

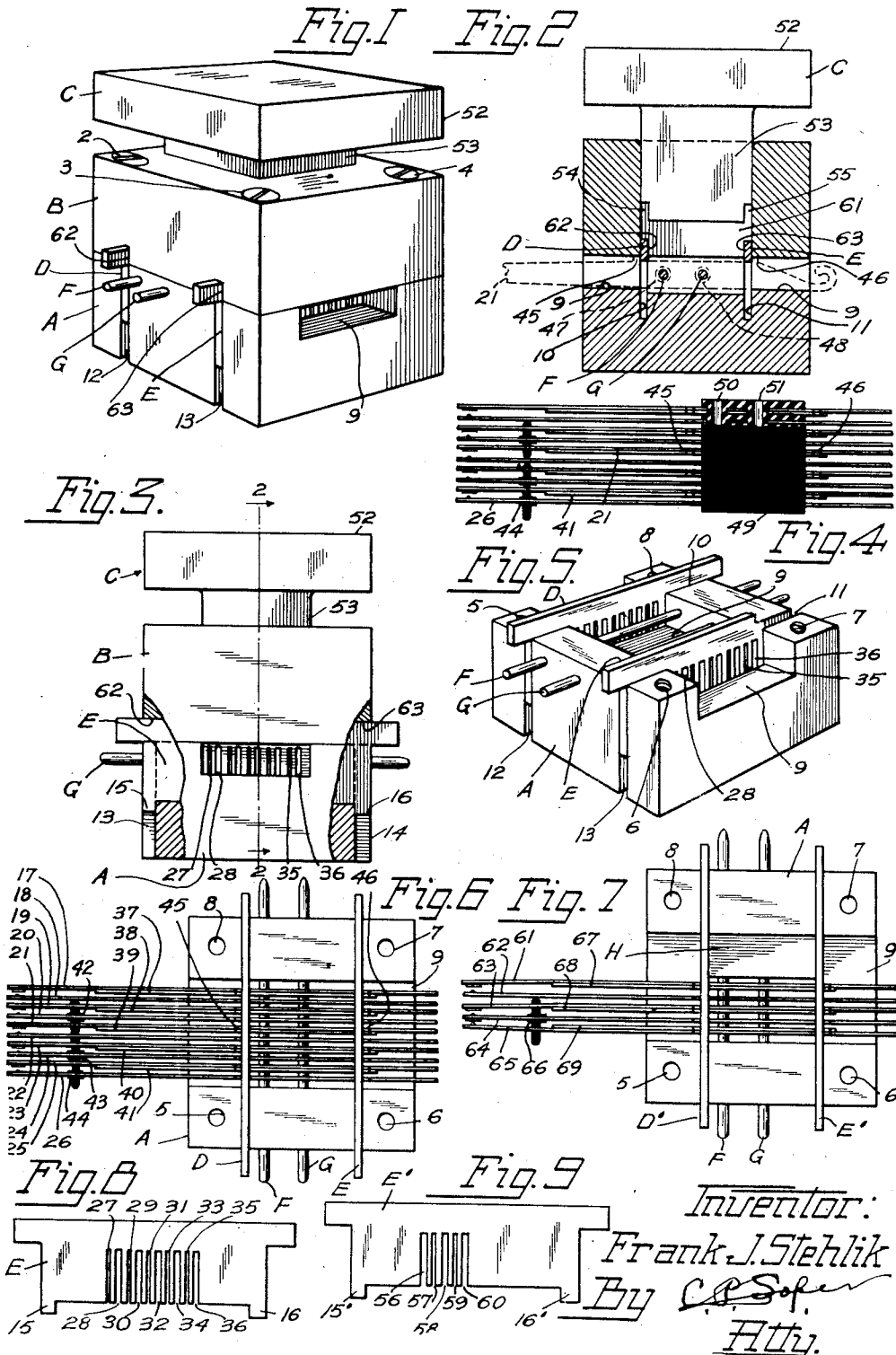
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CONTACT SPRING STACKUP

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CONTACT-SPRING STACK-UP

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This invention relates to contact-spring stack-ups.

One object of the invention is the production of a contact-spring stackup comprising contact springs and a support block of molded insulation into which the springs are embedded in the molding operation.

A further object is the production of a mold capable of molding the insulating support block of the improved stackup around any one of a number of specifically different combinations or arrangements of contact springs.

General description

The invention is especially applicable to stack-ups of flat contact springs used on what is called the telephone type of relay. Telephone relays are required to be produced with a wide variety of stackups of parallel, oppositely disposed contact springs. These stackups range, for example, from a simple one containing a single pair or set of coacting contact springs (either a "make" pair or a "break" pair) to stackups containing several sets of contact springs, any one of which may be a pair of make springs, a pair of break springs, or three springs coacting in what is referred to as a "break-make" combination. For practical considerations, relay contact springs are required to be variously spaced from spring to spring of any set in a stackup and also from the final spring of one set to the adjacent spring of the next set of the stackup. Additionally, the springs, when not made of a gauge of material varying from spring to spring according to varying duties, are assembled, some with, and some without, an adjacent underlying or overlying backstop strip, which also must be retained in position by the insulating block.

For all of the above considerations, prior to this invention, a mold suitable for molding the supporting insulation block around the support section of the contact springs of a specific spring stackup has been unsuited for molding the block of supporting insulation around the contact springs of a specifically different spring stackup. As stated, this unsuitability results from the variations from stackup to stackup of the spacing between the individual contact springs; from thickness variations amongst contact springs; from the presence or absence of a backstop or stiffener strip adjacent a spring; and/or from a variation in the number of contact springs from stackup to stackup.

An important feature of this invention is that the same mold can be used for molding the in-

sulation block about any one of a number of specifically different assemblies of contact springs by providing that the end portions of the mold, through which the contact springs pass from the outside to the inside of the mold cavity, are removable. Such removable portions of the mold disclosed herein are referred to as "combs." A separate pair of such combs may be provided for each specifically different stackup of springs around which an insulating block is to be molded. Any pair of such combs may thus have the correct number and spacing of slots therein to exactly accommodate the specific stackup of contact springs for which it is produced, and any such pair of combs can be inserted into the mold as the occasion may demand.

A further feature of the invention is that the height of the molded block of insulation may be reduced any desired amount by providing spacing blocks of various thicknesses, any one of which can be placed into the mold cavity to reduce the maximum height of the molded insulation block to that required for the particular stackup of springs currently being accommodated by the mold.

A further feature is that the block of insulation molded around a stackup of contact springs has a pair of mounting holes therethrough produced by the molding operation, which mounting holes pass through larger openings in each of the contact springs, whereby the mounting screws passing through the mounting holes are separated by unbroken molded insulation from the contact springs through which the screws pass.

A still further feature of the invention is that it greatly facilitates manufacture in that the assembling of contact springs into stackups preparatory to molding may be carried out under more favorable conditions away from the molds.

Other objects and features of the invention will appear as the description progresses.

The drawing

Referring now to the accompanying drawing, comprising Figs. 1 to 9, they show sufficient views of a single-cavity mold constructed in accordance with the principles of the invention and of the molded product to enable the invention to be understood.

Fig. 1 is a perspective view of the improved mold in assembled relationship, with the plunger portion slightly withdrawn;

Fig. 2 is a side view partly in section taken along the section line 2—2 of Fig. 3 in the direction indicated by the arrowheads;

Fig. 3 is a front view of the mold with the lower corner portions broken away;

Fig. 4 is a view of a spring stackup with insulation block 49 having been molded therearound in the mold as shown in Figs. 1 to 3, 5, and 6;

Fig. 5 is a perspective view of the mold with the parts B and C removed;

Fig. 6 is a plan view of the portion of the mold shown in Fig. 5, with an assembly of contact springs 17 to 26, together with backstop strips 37 to 41 assembled therein preparatory to the molding operation;

Fig. 7 is a plan view of the same portion of the mold, but adapted to mold an insulation support block about a specifically different stackup of contact springs;

Fig. 8 is a side elevation of the comb E of Figs. 1 to 3, 5, and 6; and

Fig. 9 is a side elevation of the comb E' of Fig. 7.

The invention having been described generally, a detailed description will now be given.

Detailed description

Figs. 1 to 3 show the mold assembled as for a molding operation, but the stackup of contact springs around which a block of insulation is to be molded has been omitted to enable the details of the mold to be more clearly shown.

The mold includes the base or cavity portion A, filler portion B, and ram portion C. As shown best in Figs. 1 and 5, base A has the channel 9 extending thereacross, the intermediate portion of which forms the mold cavity, defined at the ends by combs D and E. Comb D is a duplicate of comb E, shown in profile in Fig. 8.

As seen best in Fig. 5, combs D and E lie respectively in the transverse comb slots 10 and 11. Each of these slots extends substantially below the floor of cavity recess 9 to afford lateral support for the free ends of the teeth of the combs during a molding operation, when internal pressure is applied. Additionally, the base A has four end slots enabling combs D and E to be keyed in position against endwise movement during the molding operation. One of the end slots 12 for the comb D is shown in Figs. 1 and 5, wherein the corresponding end slot 13 for the comb E is shown. Fig. 3, at the lower broken-away corner portions, shows end slots 13 and 14 for the comb E, into which the key portions 15 and 16 of the comb E fit to key the comb against endwise movement.

Filler portion B has filler channel 61 therethrough, as best seen in Fig. 2. This channel is of a size to accommodate the plunger 53 of ram portion C. Filler portion B also has a pair of transverse slots 62 and 63 which receive the back portions of combs D and E to further support the combs against outward lateral pressure during the molding operation.

When the mold is assembled as shown in Figs. 1 to 3, parts A and B are held together by four countersunk screws, the head portions of screws 2 to 4 of which are shown in Fig. 1. These screws pass through openings in filler portion B and are received within the threaded openings 5 to 8 in base portion A.

The ram portion C comprises head 52 and plunger 53. The plunger 53 is recessed at 54 and 55 (Fig. 2) to allow it to pass alongside the backs of combs D and E.

Fig. 6 shows a stackup of contact springs pre-assembled in combs D and E and placed in the base or cavity portion A of the mold in readi-

ness for the molding of a contact block of insulation around the support portion of the stackup, such as contact block 49 (Fig. 4), subject to the completion of the mold assembly by fastening filler block B in place as shown in Fig. 1 by the screws such as 2, 3, and 4.

The spring-contact stackup, shown before molding in Fig. 6 and after molding in Fig. 4, includes five "make" pairs of contact springs 17 to 26. The lower spring of each such pair is the one designated the armature spring, the armature spring of a pair being the one which receives the thrust from the relay armature when the contact springs are actuated thereby. It is to be noted that the armature springs of the stackup are interlinked by a series of insulating control pins 42 to 44. Control pin 44, for example, passes through and is secured in the lowermost armature spring 26. It has a depending portion to be engaged by the relay armature when the spring stackup is to be actuated, and it has an upwardly extending portion which contacts the bottom of pin 43 to bring about actuation of the armature springs lying above it in the stackup. Pin 43 is secured in armature spring 24 and has an upwardly extending portion contacting armature spring 22. Pin 42 is secured in armature spring 20. It has a depending portion which engages the upper surface of armature spring 22, and an upwardly extending portion which engages the lower surface of armature spring 18. Therefore, an upward thrust imparted to the depending portion of pin 44 causes an upward movement of pins 42 to 44, along with armature springs 18, 20, 22, 24, and 26. It will be understood, of course, that the remaining contact springs of the assembly (termed "make" springs) have suitable clearance openings therethrough for the actuating pins to pass without directly controlling such springs. In practice, the upward movement of the armature springs is sufficient to cause each to contact its associated make spring and move it a substantial distance to thereby acquire the requisite contact pressure.

Each of the make springs (17, 19, 21, 23, 25) is preferably provided with what may be termed trapped pressure. This condition is secured by tensioning each such spring so that the free end thereof would normally stand in a lower position than illustrated and by providing such springs respectively with the illustrated underlying backstop strips, or stiffeners, 37 to 41. These stiffening blades hold the make springs in the illustrated position to thereby give the required normal contact separation. Yet, when the armature spring assembly is moved upward through the medium of the control pins 44 to 42 substantial contact pressure is encountered as soon as contact is made and the contact springs begin to be moved.

It will be observed that each of the backstop blades or stiffeners 37 to 41 extends from a point close to the location of the contact pins 42 to 44 back into and through the molding zone lying between the combs D and E. These stiffeners thus appear on both sides of the finished block of insulation 49 (Fig. 4), and are held securely in the illustrated position along with the contact springs of the stackup.

The outline of one of the contact springs (make spring 21, Figs. 4 and 6) is indicated in dotted outline in Fig. 2. The outline of all the other contact springs and of the backstop blades 37 to

41 is similar within and adjacent the molding zone.

The assembled contact springs 17 to 26 in Fig. 6, together with stiffener blades 37 to 41, pass through the slots 27 to 36 of the comb E (see Fig. 8), as well as through the corresponding slots of the duplicate comb D. In the illustrated stackup construction, the contact springs may be all punched from the same gauge of sheet material. Nevertheless, alternate slots 28, 30, 32, 34, and 36 are of extra width, for each such slot must accommodate one of the backstop blades 37 to 41, in addition to a contact spring. On the other hand, slots 27, 29, 31, 33, and 35 are comparatively narrow, each of them being just of sufficient width to accommodate one of the armature springs, in connection with which backstops are unnecessary, and are moreover undesirable as their presence would require a greater height in the stackup and in the molded block 49, Fig. 4.

As indicated in Fig. 2, each of the contact springs and stiffener blades, or backstops, lies on the floor of cavity channel 9 in base A outside of the mold cavity defined at the ends by the combs D and E. Inside the mold cavity, the floor of channel 9 is lowered a sufficient amount to allow insulating material during the molding operation to pass beneath the spring and stiffener blades.

When the combs D and E are in their illustrated molding position they hold the contact springs and stiffener blades down firmly because the upper level of the notches (such as 27 to 36, Fig. 8) in the combs is then slightly below the top surface of base A, in contact with the upper surface of the contact springs and stiffener blades. Endwise movement in the mold of the contact springs and stiffener blades is prevented by a pair of notches on each. The notches are aligned and lie immediately outside of the combs. These notches on the spring 21 are shown in profile at 45 and 46 in Fig. 2. In Fig. 6 these notches may be seen in alignment with corresponding notches on the other blades of the assembly.

Following the assembly together of the contact springs and back stop blades with combs D and E and the placing of this preassembly into base portion A as shown in Fig. 6, the lateral pins F and G are inserted. The filler portion B is next assembled in the position shown in Figs. 1 to 3 and held there by screws such as 2 to 4, the slots 62 and 63 receiving the backs of combs D and E. The assembly is thus held rigidly together.

The molding operation may now take place, during which a predetermined amount of molding material is introduced into the opening 61 in filler portion B, following which the plunger 53 of ram C is introduced into the opening in the filler block. Heat and pressure may then be applied. As a result of the pressure, ram C is forced down until the back portions of combs D and E are received within the recesses 54 and 55 (Fig. 2) in plunger 53, and the bottom face of the plunger 53 is flush with the top surface of base A.

It is to be noted that the upper line of the portion of spring 21 (Fig. 2) within the mold cavity (and the same is true for the other contact spring and for the backstop blades of the assembled stackup) is substantially below the upper face of base A, whereby the molded insulating material also forms itself above the inserted blades, and thus entirely surrounds each.

As shown in Fig. 2, contact spring 21 has a pair of comparatively large holes 47 and 48 there-through, through which the pins F and G are concentrically passed, after the other parts have

been assembled as shown in Fig. 6. The pins F and G pass concentrically through similar openings in the other blades of the assembly. The pins F and G are substantially smaller than the openings such as 47 and 48. As a result, an unbroken wall of insulating material flows entirely around the pins F and G to define the openings 50 and 51 (Fig. 4) through which mounting screws may be passed.

After the block of insulation 49, formed around the blades of the stackup by the above-described molding operation, has had time to set, the mold is taken apart—pins F and G are withdrawn; combs D and E are removed; and the molded stackup is removed complete, having the form shown in Fig. 4.

Molding other stackups

When it is desired to use the illustrated mold to mold contact blocks around specifically different stackups of contact springs, the combs D and E may be replaced by other combs having the required location and thickness of spaces, such as 27 to 35 (Fig. 8).

Unless the width of the mold cavity is changed, the block of insulation molded around the set of contact springs is of the height shown at 49 in Fig. 4. When it is desired to reduce the height of the molded block of insulation (as when the assembled spring stackup contains only a comparatively few contact springs), a filler block H (Fig. 7) may be used. This filler block is of the same length and thickness as the mold cavity and is of a height to close off any desired amount thereof to thereby reduce the height of the molded block of insulation. The block H has horizontal openings therethrough through which the pins F and G pass, such openings being aligned with those in the base A.

For the accommodation of the specifically different stackup of contact springs shown in Fig. 7, combs D' and E' are provided. The profile of the comb E' is shown in Fig. 9. The comparatively wide slot 56 accommodates break spring 65 and the overlying backstop blade 69; the comparatively narrow slot 57 accommodates the pin-carrying armature spring 64; the wide slot 58 accommodates make spring 63 and its underlying backstop blade 68; narrow slot 59 accommodates armature spring 62; and the comparatively wide slot 60 accommodates make spring 61 and its underlying backstop blade 67.

Obviously, as many sets of combs as desired may be provided, each with its own combination of inter-teeth slots to accommodate the combination of contact springs and support blades of a specifically different contact-spring stackup. It is also obvious that as many thicknesses of filler blocks H as desired may be provided.

Because of their simple construction, the pairs of combs may be provided economically in large numbers. Then, the stackups of contact springs may be preassembled into the pairs of combs by specialized assemblers at an assembly bench provided for that purpose, after which the separate preassemblies may be given to the molder. The molder molds a support block of insulation molded around each preassembly as previously described. A more efficient use of the molds is thus possible, for the molder can prepare a mold in much less time when he does not need to place the contact springs individually into the mold, but is able to insert the preassembled stackup along with the pair of combs into whose slots the contact springs have been preassembled. As

previously noted, one such preassembly is represented in Fig. 6 by contact springs 17 to 26, backstop strips 37 to 41, and combs D and E. Another preassembly is represented by combs D' and E', Fig. 7, together with the contact springs and backstop strips assembled in the notches thereof.

Application of the invention to other types of molds, such as multiple-cavity molds and injection molds, for example, may obviously be made without departing from the spirit thereof.

I claim:

1. A mold for molding a support block of insulation around an intermediate portion of the contact springs of a stackup, comprising a base member, a filler member, and a plunger adapted to be brought together to define a mold cavity with open ends through each of which the corresponding end portions of said springs protrude during the molding operation, and a pair of removable combs held in position between said base and filler members during the molding operation to define the ends of the mold cavity and consequently the ends of the support block to be molded, each of said combs having a thickness, in the direction in which the springs extend, substantially less than the distance from the molded support block to the associated end of the contact springs, and having slots therethrough of a size and spacing to accommodate the associated spring portions which extend outwardly through such comb during the molding operation.

2. A mold for molding a support block of insulation around an intermediate portion of the contact springs of a stackup, comprising members adapted to be brought together to define a mold cavity with open ends through each of which the corresponding end portions of said springs protrude during the molding operation, and a pair of removable combs held in position in said mold during the molding operation to define the ends of the mold cavity and consequently the ends of the support block to be molded, each of said combs having a thickness, in the direction in which the springs extend, substantially less than the distance from the molded support block to the associated end of the contact springs, and having slots therethrough of a size and spacing to accommodate the associated spring portions which extend outwardly through such comb during the molding operation.

3. A mold for molding a support block of insulation around a portion of a stackup compris-

ing a group of generally parallel, oppositely disposed strips, said mold comprising members adapted to be brought together to define a mold cavity with an open end through which said strips protrude during the molding operation, and a comb adapted to be held in position during the molding operation to define said end of the mold cavity and consequently the corresponding end of the support block to be molded, said comb having a thickness, longitudinally of the strips, substantially less than the distance from the molded support block to the associated end of the strips, and having slots therethrough of a size and spacing to accommodate the associated strip portions which extend outwardly through such comb during the molding operation.

4. A mold for molding a support block of insulation around a portion of a stackup comprising a group of generally parallel, oppositely disposed strips, said mold comprising members adapted to be brought together to define a mold cavity with an open end, and a comb adapted to be held in position during the molding operation to define said end of the mold cavity and consequently the corresponding end of the support block to be molded, said comb having an imperforate section which defines one portion of said open end, and having a toothed section of which the teeth define the remaining portion of the open end between the strips, protruding portions of said strips extending outwardly through said comb between the teeth thereof.

5. A mold for molding a support block of insulation around a portion of a stackup comprising a group of generally parallel, oppositely disposed strips, said mold comprising members adapted to be brought together to define a mold cavity with an open end through which said strips protrude during the molding operation, and stop members adapted to be held in position between said strips during the molding operation to define said end of the mold cavity and consequently the corresponding end of the support block to be molded, each of said stop members having a thickness, longitudinally of the strips, substantially less than the distance from the molded support block to the associated end of the strips, whereby the associated strip portions extend outwardly between and beyond such stop members during the molding operation.

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