United States Patent [19]

Hovorka

[11] **3,767,155**

[45] **Oct. 23, 1973**

[54] **APPARATUS FOR MOLDING LONGITUDINALLY SPACED BLOCK PORTIONS ABOUT LATERALLY SPACED PARALLEL INSERTS**

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[73] Assignee: **Western Electric Company Inc.,** New York, N.Y.

[22] Filed: **Dec. 27, 1971**

[21] Appl. No.: **212,328**

[52] **U.S. Cl.** **249/96,** 425/123

[51] **Int. Cl.** **B22d 19/00**

[58] **Field of Search** 425/122, 123, 158, 425/242, 403, 116, 289, 395, 404; 264/272, 328; 249/95, 96, 97

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Primary Examiner—J. Spencer Overholser
Assistant Examiner—John S. Brown
Attorney—W. M. Kain et al.

[57] **ABSTRACT**

In forming a block member of a wire spring relay comb, spaced block portions are molded about parallel wires by gripping sectors of the wires on opposite sides thereof and introducing molding material into a first mold cavity for forming one of the block portions. Molding material then flows from the first mold cavity, through enlarged channels extending longitudinally between the gripped wires and parallel thereto, and into additional mold cavities for forming other block portions about the wires. The molding material in the channels subsequently forms reinforcing ribs bonded to opposed sectors of the wires and integrally connecting the molded block portions. For economy and ease in manufacture, molding dies of the apparatus are formed of pressed and sintered powdered metal of a special composition. Wire guides of special design help preclude the wires from becoming misaligned prior to a molding operation. The molded block member is symmetrical on either side of a plane containing the wires, to reduce its tendency to warp or crack during and subsequent to curing.

6 Claims, 8 Drawing Figures

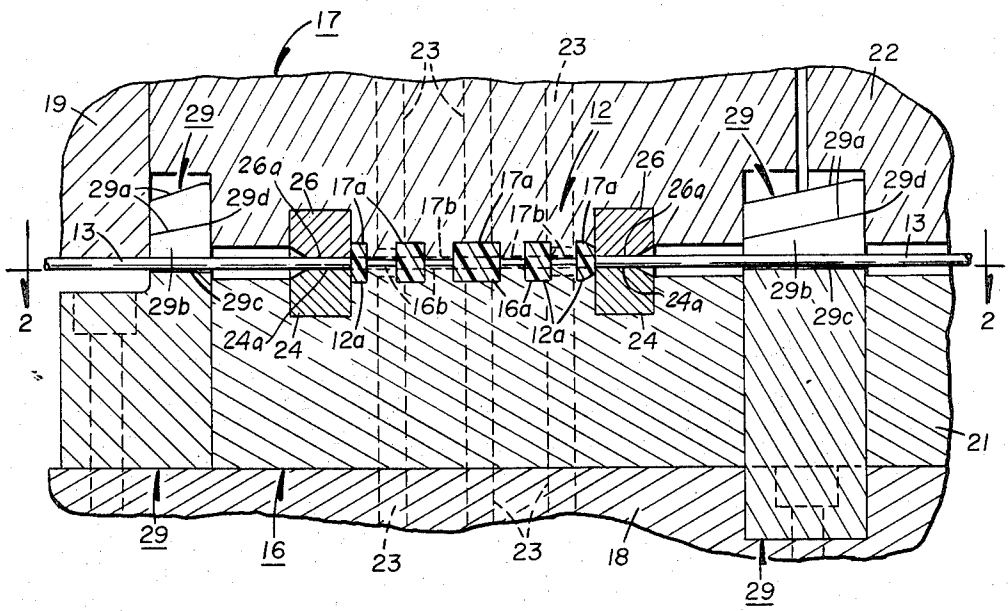

FIG. 1

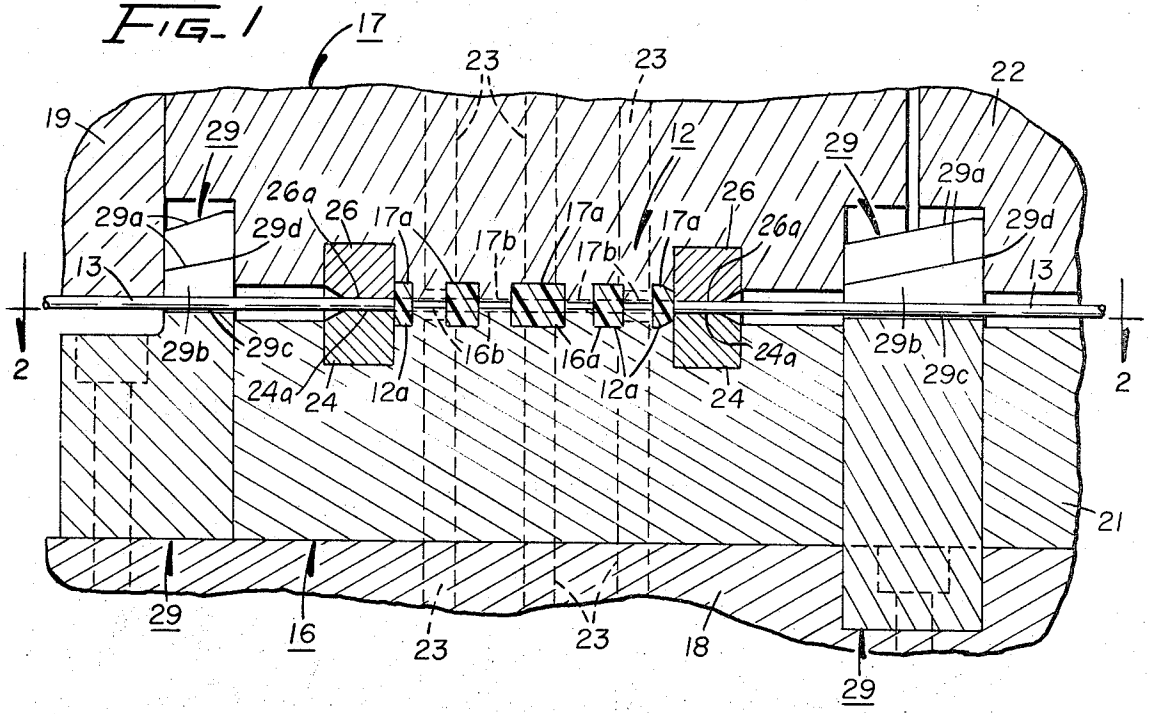
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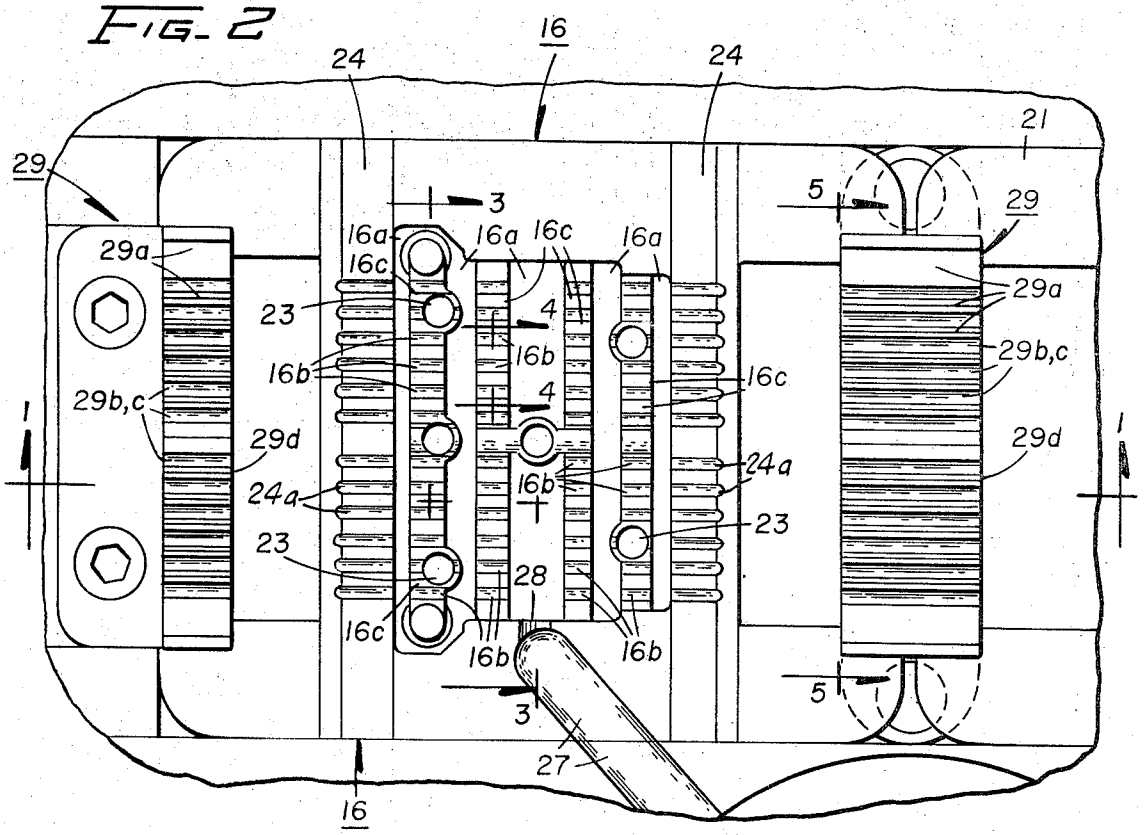
FIG. 2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29b,c
1
29d
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FIG. 3

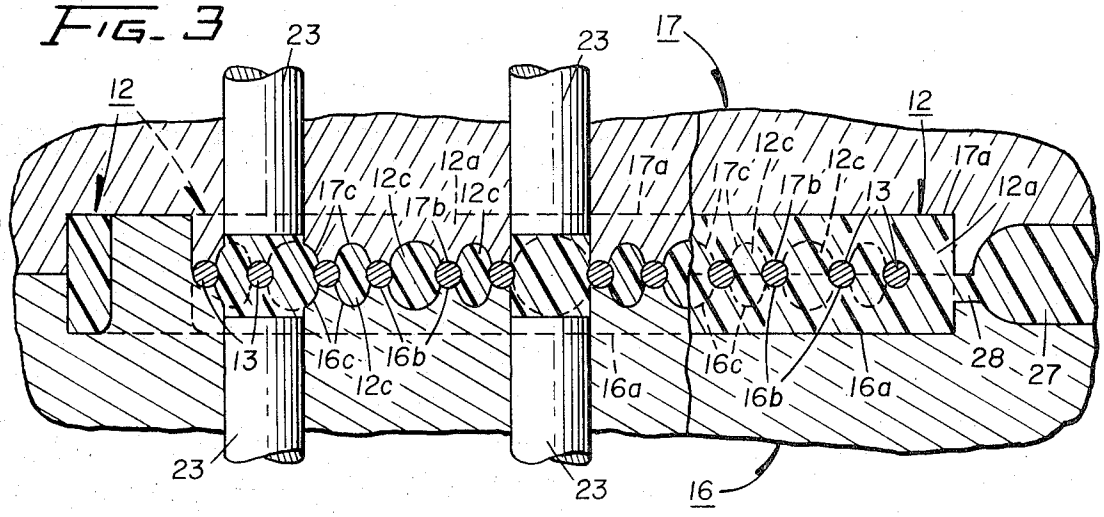


FIG. 4

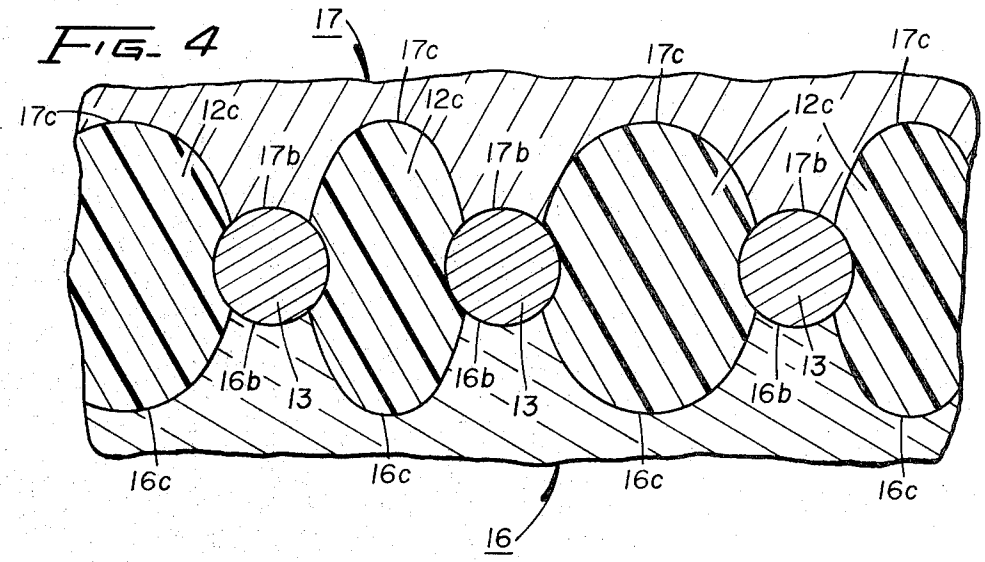


FIG. 5

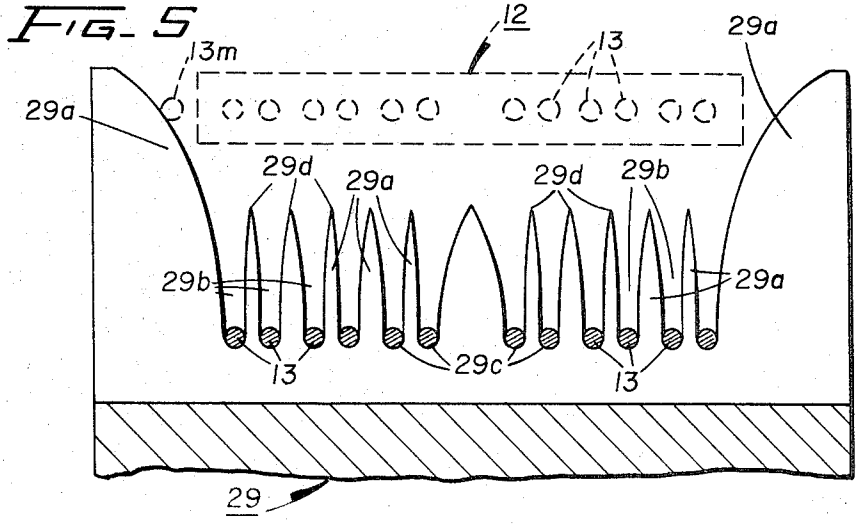


FIG. 6

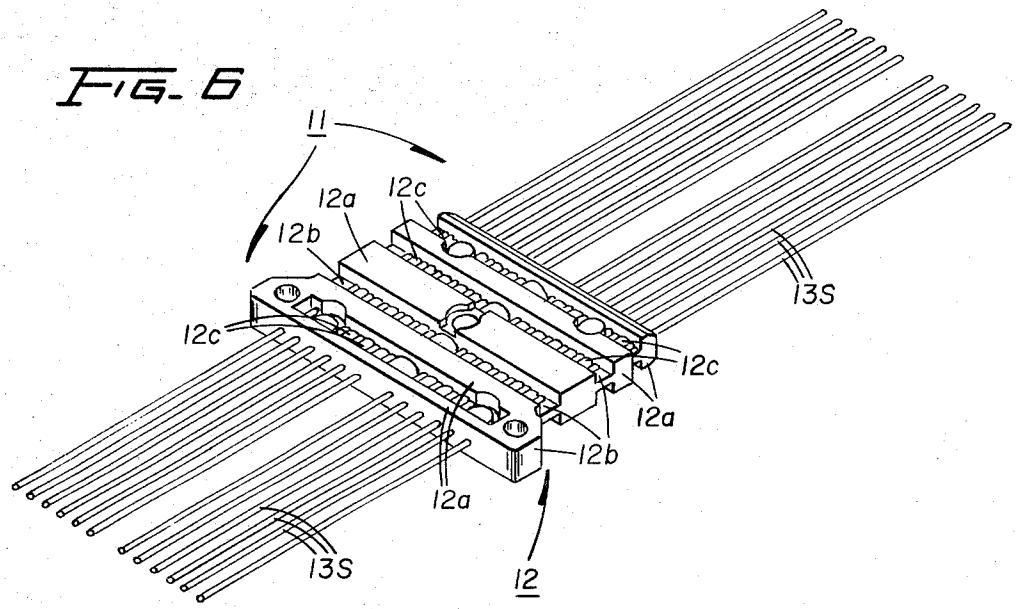


FIG. 7A

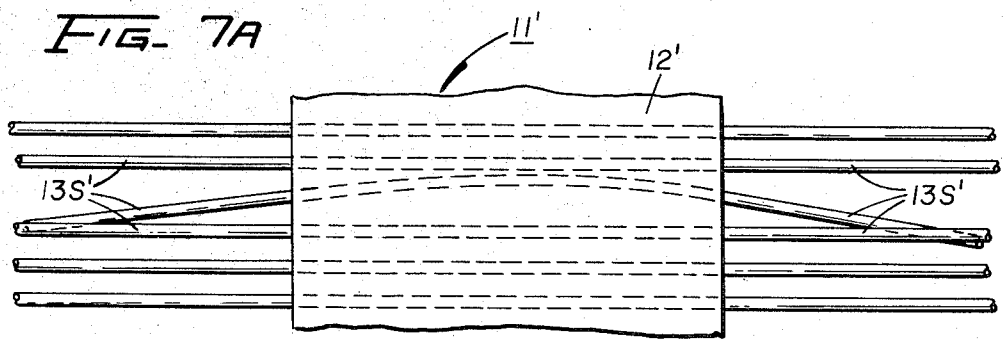
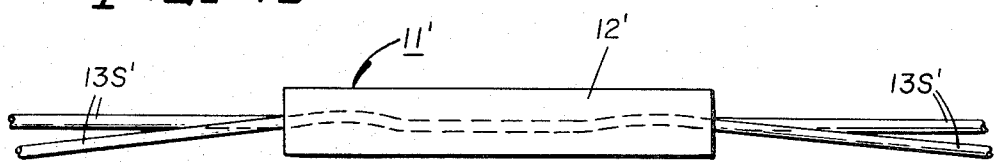


FIG. 7B



APPARATUS FOR MOLDING LONGITUDINALLY SPACED BLOCK PORTIONS ABOUT LATERALLY SPACED PARALLEL INSERTS

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to apparatus for molding longitudinally spaced block portions about laterally spaced parallel inserts, and more particularly to apparatus for molding a block member about a plurality of elongated parallel resilient wires, such as in the manufacture of wire combs for wire spring relays.

2. Description of the Prior Art

In the manufacture of wire spring relay combs, it is standard practice to advance a plurality of parallel and closely spaced, continuous wires in step-by-step fashion through molding apparatus for forming block members about the wires at spaced intervals. Subsequently, the wires are severed between the block members to form the wire spring relay combs. Molding apparatus of this general type is disclosed in the U.S. Pat. No. 2,794,211 to R. W. Brown et al.

In the manufacture of these wire spring relay combs, one of the most prevalent problems has been the prevention of what has become known in the art as "wild wires," a condition in which the projecting wire portions of a comb extend from the block member of the comb in non-parallel relationship. These wires then must be straightened before the relay comb can be used, or, if the wire misalignment is excessive, the comb must be scrapped.

This "wild wire" condition normally is the result of the molding material, which is injected into the mold cavity under relatively high pressure, causing shifting of the wires in the cavity during a molding operation, thereby creating inherent bending stresses in the wires. Then, when the wires are subsequently cut between the molded block members to form the wire spring relay combs, the portions of the wires within the molded block member of each relay comb are held fixed in position by the block member, while the portions of the wires projecting from the block member try to assume an unstressed state. As a result, the projecting portions of the wires tend to spring into non-parallel positions with respect to one another, creating a "wild wire" condition.

In the prior known mold arrangement for preventing this "wild wire" condition, as disclosed in the U.S. Pat. No. 2,876,499 to F. A. Schultz, the closely spaced wires are received in transversely extending rows of full-depth recesses or seats in a mold cavity portion of a lower mold member. The wires also are engaged and held down from above by several depending, flat-surfaced bar portions in a mold cavity portion of an upper mold member, the bar portions being offset relative to one another and the majority of the seats in the lower mold member. Molding material then is introduced into the upper mold cavity portion above the wires and the upper mold cavity portion, being relatively open and unobstructed, becomes filled with molding material. Next, as the pressure in the upper mold cavity portion increases, the molding material is forced downward between the closely spaced wires to fill the lower mold cavity portion. The molding material is introduced into the mold cavity in this manner so that flow of the molding material against the wires in a horizontal plane, which could cause lateral shifting of the wires, is substantially eliminated.

While generally effective, this prior known arrangement has not proven entirely satisfactory in preventing "wild wire" conditions from occurring. One of the reasons for this is attributed to the fact that the upper mold member does not positively hold the wires against movement out of the seats of the lower mold member during a molding operation. Thus, as a result of the extremely high pressure under which the molding material is injected into the mold cavity, the molding material tends to flow between the wires and the seats, thereby causing upward, and possibly even horizontal, displacement of the wires. This is particularly true where a wire may not be initially seated properly and is already slightly spaced above its seat as a result of being nicked or slightly bent.

Further, sometimes the molding material which flows between a wire and its seat subsequently adheres to and remains in the seat, instead of being removed from the mold with the wire. If then becomes impossible for a subsequent wire to seat properly and the wire is out of alignment even before injection of the molding material has begun. Since the wire hold-down bar portions of the upper mold member are offset relative to the majority of the seats, downward bending of this wire by one of these bar portions also may occur as the mold closes, thereby further aggravating the resultant "wild wire" condition. Eventually, if the accumulation of material in the seat is repeated on subsequent shots the "wild wire" condition caused thereby may become aggravated to the point that the apparatus must be shut down so that the mold can be cleaned.

Another disadvantage of the above discussed prior known apparatus is that the block members which are molded about the wires are of unsymmetrical construction, whereby a block member sometimes warps or cracks during or subsequent to curing, as the result of unequal internal stresses therein, making the resultant relay comb unsuitable for use. In addition, in view of the fact that the mold cavity must be of relatively small height and the wires must be in closely spaced relationship, the mold cavity may not always become completely filled, thus producing a block member having voids therein.

SUMMARY OF THE INVENTION

In accordance with this invention, a pair of longitudinally spaced block portions are molded about a plurality of laterally spaced parallel inserts by gripping sectors of the inserts on opposite sides thereof, between the portions of the inserts which are to be enclosed by the block portions, such that substantially no molding material can flow into engagement with the gripped sectors. Molding material then is injected into a first mold cavity for forming one of the block portions. Next, molding material flows from the first mold cavity, through channels extending longitudinally between opposed sectors of the inserts and parallel to the inserts, into a second mold cavity for forming the second block portion about the inserts. The molding material in the channels subsequently forms reinforcing ribs which are bonded to the opposed sectors of the inserts and which integrally connect the molded block portions.

Preferably, the channels are enlarged relative to the inserts to produce reinforcing ribs of relatively strong construction. Further, the molded block portions and

the ribs are formed so that they are symmetrical on either side of a plane containing the inserts, to reduce warping or cracking of the molded material during or subsequent to curing. Wire guides of special design also are provided to help preclude the wires from becoming misaligned prior to a molding operation. In addition, for economy and ease in manufacture, molding dies of the apparatus preferably are formed of a pressed and sintered metal powder of a special composition.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a cross-sectional view of molding apparatus in accordance with the invention, taken substantially along its vertical centerline, as indicated by the line 1—1 of FIG. 2;

FIG. 2 is a plan view of a lower molding die of the molding apparatus as seen along a parting line defined by the line 2—2 in FIG. 1;

FIG. 3 is an enlarged cross-sectional view of the molding apparatus, taken along the line 3—3 in FIG. 2;

FIG. 4 is a further enlarged cross-sectional view of a portion of the molding apparatus, similar to FIG. 3, taken along the line 4—4 in FIG. 2;

FIG. 5 is an enlarged view of a wire guide for the molding apparatus, as seen along the line 5—5 in FIG. 2;

FIG. 6 is an isometric view of a wire spring relay comb formed by the molding apparatus of FIGS. 1–5;

FIG. 7A is a plan view of a portion of a wire spring relay comb, illustrating a "wild wire" condition; and

FIG. 7B is a side view of a portion of a wire spring relay comb, illustrating another "wild wire" condition.

DETAILED DESCRIPTION

Referring to FIG. 6, apparatus is disclosed for molding an article 11, such as a wire spring comb of the type used in wire spring relays, wherein the comb includes a block member 12 which is molded about a plurality of parallel resilient wires or inserts 13S of electrically conducting material, the wires having portions projecting from the opposite ends of the block member. In accordance with this invention, the molded block member 12 is symmetrical on both sides of a plane containing the wires13S. More specifically, the molded block member 12 includes a plurality of transversely extending rectangular block portions 12*a* which enclose the wires 13S and which are integrally interconnected to one another adjacent their opposite ends by rectangular shaped ribs 12*b* and intermediate their ends by elliptically shaped ribs 12*c* (best shown in FIG. 4) disposed between the wires and bonded thereto.

For one of the combs 11 to be acceptable for additional processing and subsequent use in a wire spring relay, the projecting portions of the wires 13S must extend substantially parallel to one another, as shown in FIG. 6. However, referring to FIGS. 7A and 7B, occasionally a "wild wire" condition occurs, in which certain wires 13S′ of a comb 11′ extend from its block member 12′ in non-parallel relationship and may even criss-cross (FIG. 7A). The misaligned projecting portions of the wires 13S′ then must be straightened, if possible, before the comb 11′ is subjected to additional processing, and a primary purpose of the subject invention is to reduce the occurrence of these "wild wire" conditions to a minimum.

The molding apparatus disclosed in FIGS. 1–5 is intended for use in apparatus of the general type disclosed in the U.S. Pat. No. 2,794,211 to R. W. Brown et al, and capable of molding the block members 12 about a plurality of continuous parallel and horizontally disposed wires 13 at spaced intervals as the wires are intermittently advanced therethrough. In this connection, when the molding apparatus is in an open position, the wires 13 are advanced therethrough from left to right in FIG. 1, by a reciprocating feed mechanism (not shown) and under suitable back tension which tends to keep the wires in parallel alignment. Subsequently, the wires 13 are severed between adjacent ones of the molded block members 12 to form the wire spring relay combs 11, having the projecting wires 13S, as shown in FIG. 6.

More specifically, referring to FIG. 1, the disclosed apparatus includes opposed lower and upper molding dies 16 and 17 for molding one of the block members 12 about the wires 13. The lower molding die 16 is mounted on a lower fixed platen 18 and the upper molding die 17 is mounted on an upper platen 19 which is movable perpendicular to a parting line of the apparatus as defined by the line 2—2 in FIG. 1, and relative to the lower platen between an open position (not shown) and a closed molding position as shown in FIG. 1. To the right of the molding dies 16 and 17, as viewed in FIG. 1, and in alignment therewith, the lower and upper platen 18 and 19 carry another set of molding dies 21 and 22, identical to the molding dies 16 and 17, whereby the disclosed apparatus is capable of molding two block members 12 about the wires 13 simultaneously. When the apparatus is opened after each molding operation, the molded block members 12 and the wires 13 are ejected from the molding dies 16, 17 and 21, 22 by suitable ejector pins 23 in a well known manner. The wires 13 then are advanced to move the molded block members 12 out of molding position, and to position new portions of the wires in molding position.

Since the molding dies 21 and 22 are identical in construction and function to the molding dies 16 and 17, only the molding dies 16 and 17 have been disclosed in detail and will be described. As is best shown in FIGS. 1 and 2, in accordance with this invention the lower molding die 16 includes a series of horizontally disposed cavity portions 16*a* which are longitudinally spaced and which extend transversely relative to the wires 13. Similarly, the upper molding die 17 includes cavity portions 17*a* which are opposed and identical to their respective cavity portions 16*a*. In this regard, an outer wall of each end mold cavity portion 16*a* is formed by a replaceable die insert 24 having a row of semi-circular wire receiving and aligning grooves 24*a* formed therein and provided with suitable seals (not shown) to prevent flashing along the wires 13 during a molding operation. An outer wall of each end mold cavity portion 17*a* also is formed by a similar replaceable die insert 26 having a row of wire receiving and aligning grooves 26*a* in opposed relationship to the grooves 24*a*. The die inserts 24 and 26 are removably secured in elongated horizontal slots in the molding dies 16 and 17 in any suitable manner. When the apparatus is closed, the mold cavity portions 16*a* and 17*a* cooperate to form a series of substantially separate mold cavities 16*a*–17*a* for forming respective ones of the block portions 12*a* of the wire spring relay comb 11.

Referring to FIG. 2, between the mold cavity portions 16*a*, the lower molding die 16 includes horizontally extending rows of upwardly concave arcuate seats 16*b* for receiving lower sectors of the wires 13 in mating engagement in a molding operation. Similarily, referring to FIGS. 3 and 4, the upper mold member 17 also includes rows of downwardly concave arcuate seats 17*b*, which are opposed to respective ones of the arcuate seats 16*b* and which engage upper sectors of the wires 13 in mating engagement during a molding operation. Thus, when the apparatus is closed the opposed arcuate seats 16*b* and 17*b* cooperate to captivate the wires 13 securely therebetween to prevent shifting of the wires during a molding operation and to preclude molding material from flowing between the wires and the engaged sectors of the seats.

Intermediate each opposed pair of the arcuate seats 16*b* and 17*b*, the lower and upper molding dies 16 and 17 have opposed arcuate surface portions or slots 16*c* and 17*c* which form channels 16*c*–17*c* for interconnecting the mold cavities 16*a*–17*a* when the molding apparatus is closed, and for forming the elliptically shaped interconnecting ribs 12*c* the respective surface portions and seats intersecting in opposed spaced relationship so that the ribs are formed in bonded engagement with opposed sectors of the wires 13, as shown in FIGS. 3 and 4. The channels 16*c*–17*c* are enlarged relative to the wires to facilitate the flow of molding material through the channels and so that the ribs 12*c* will be formed of a substantial amount of molding material and thus be of relatively strong construction. As is best shown in FIGS. 2 and 3, the molding dies 16 and 17 and the platen 18 and 19 also include a runner system 27 which extends to a gate 28 in the lower molding die 16, the gate opening into the centermost one of the mold cavity portions 16a of the lower molding die at one side thereof and at the parting line of the apparatus.

From the above description, it is seen that the lower and upper molding dies 16 and 17 are of symmetrical construction about the parting line of the apparatus, whereby each of the wire spring relay combs 11 is symmetrical about the plane containing the wires 13 of the comb, as noted above and as shown in FIG. 6. As a result, the tendency for uneven stress or shrinkage to occur in the block members 12 during curing, which could cause the block members to warp (bow) or crack during or subsequent to curing, is substantially reduced.

Referring to FIGS. 1, 2 and 5, adjacent the wire entrance and exit ends of the molding dies 16 and 17, wire guide combs 29 are suitably secured to the lower platen 18 and are receivable in suitable recesses in the upper mold members 17 and 22 when the apparatus is closed. Each wire guide comb 29 includes a plurality of laterally spaced upwardly projecting teeth 29*a*, with the outermost teeth extending substantially above the teeth therebetween. Curved opposed sides of the teeth 29*a* are progressively tapered from adjacent their upper ends, as shown in FIG. 5, to define wire guide slots 29*b* which are wide at the top and which merge into upwardly concave wire conforming seats 29*c* at their lower ends, for receiving the wires 13 and locating them in proper alignment with the arcuate seats 16*b* and 17*b* of the molding dies 16 and 17, and the wire receiving grooves 24*a* and 26*a* of the molding die inserts 24 and 26, as the molding apparatus is closed. Further, as is shown in FIG. 1, top edges of the teeth 29*a* are tapered in a direction parallel to the wires 13 and thus the upper extremities of the intermediate teeth define pointed wire locating portions 29*d*.

Preferably, for economy and ease of manufacture, the molding dies 16 and 17 are formed of a pressed and sintered metal powder composition. In this connection, favorable results have been achieved utilizing a composition containing iron on the order of 94.5 ± 4.0 percent, carbon on the order of 0.50 ± 0.25 percent, nickel on the order of 2.0 ± 1.0 percent, and one or more suitable bonding metals, such as molybdenum, manganese or niobium, up to a combined maximum of 2 percent. The nickel is added to make the molding dies 16 and 17 "resilient" in the sense that they will not be brittle and subject to cracking. In this regard, the composition should not include any copper since it has been found that this metal tends to cause deformation of the molding dies 16 and 17 during heat treating and to make them brittle in nature. In manufacturing the molding dies 16 and 17 in this manner they may be press-formed directly to the configuration as shown in the drawing, or certain parts thereof, such as the slots for the die inserts 24 and 26, may subsequently be formed by machining, as desired.

As the molding dies 16 and 17 have been formed in a press from a powdered metal composition as above described, they are heat treated by carburizing at 1,525° F in a 20–23 dew point atmosphere, quenched in oil and drawn (heat treated) for 1 hour at 300° F. Finally, the surfaces of the molding dies 16 and 17 are vacuum-impregnated with high temperature plastic (600° F) in a conventional manner.

OPERATION

In operation, after the molding apparatus has been opened after each molding cycle the wires 13 generally extend through the apparatus, under tension, at an intermediate level between the lower and upper platen 18 and 19 and above the intermediate teeth 29*a* of the wire guide combs 29, as illustrated by the dashed lines in FIG. 5, so that the molded block members 12 and the wires can be advanced through the apparatus. In certain instances, however, the wires 13 may have shifted horizontally out of alignment with the wire guide slots 29*b*, such as to the left, as illustrated by the single dotted line circle 13*m* in FIG. 5. Then, as the upper platen 19 subsequently begins to move downward to its closed molding position, as shown in FIG. 1, the left-hand outermost wire 13 will initially engage the adjacent relatively tall outermost tooth 29*a* and be cammed inward to the right. Since the wires 13 are interconnected by previously molded ones of the block members 12 and are under tension, this camming action causes all of the wires to be shifted laterally as a unit. Thus, the outermost teeth 29*a* insure that the wires 13 will always be in vertical alignment with the upper portions of their respective guide slots 29*b*, as defined by the upper pointed extremities 29*d* of the intermediate teeth 29*a*, as the molding apparatus begins to close. The upper pointed extremities 29*d* of the intermediate teeth 29*a* then pass between the downwardly moving wires 13 and the wires continue to be moved downward into the seats 29*c*, thereby locating the wires substantially in alignment with the arcuate seats 16*b* and 17*b* of the molding dies 16 and 17 and the wire receiving grooves 24*a* and 26*a* in the die inserts 24 and 26.

Referring to FIGS. 3 and 4, as the molding apparatus closes for a molding operation the opposed arcuate seats 16*b* and 17*b* of the molding dies 16 and 17 receive their associated sectors of the wires 13 in mating engagement and captivate the wires securely therebetween. This seating and captivating of the wires 13 is accomplished even though the wires may be nicked or slightly bent, as the result of the inherent camming ability of the opposed arcuate seats 16*b* and 17*b* and the high pressure which they are capable of exerting on such wires as the apparatus reaches its closed position. The opposed seats 16*b* and 17*b*, in effect, also form seals about the engaged sectors of the wires 13, such that molding material cannot flow between the seats and the wires to form deposits or accummulations in the seats which could subsequently interfere with the molding apparatus closing and operating in a proper manner.

After the molding apparatus has been closed, molding material is introduced into the central mold cavity 16*a*–17*a* through the runner system 27 and the molding gate 28, to begin filling this cavity. As the pressure in the central mold cavity 16*a*–17*a* builds up, the molding material also begins to flow through the channels 16*c*–17*c*, and thus longitudinally between the wires 13, into the remaining mold cavities 16*a*–17*a* in succession. This flow of the molding material continues until all of the mold cavities 16*a*–17*a* and channels 16*c*–17*c* have been filled, thereby forming one of the block members 12 composed of the block portions 12*a* interconnected by the elliptically shaped ribs 12*c*, with the ribs also being bonded to opposed sectors of the wires 13 in the channels.

During the initial filling of the central mold cavity 16*a*–17*a*, since the distance across this cavity between the adjacent arcuate seats 16*b* and 17*b* is relatively small, and since the wires 13 are firmly gripped between the arcuate seats, the molding material cannot cause shifting of the wires laterally, even though the material is flowing horizontally into the cavity and transversely with respect to the wires. For the same reasons, and because the material flows through the channels 16*c*–17*c* and into the other mold cavities 16*a*–17*a* substantially parallel to the wires 13, there is substantially no tendency for this flowing material to shift the wires laterally in these mold cavities. Thus, shifting of the wires 13 during the molding operation, so as to cause subsequent "wild wire" condition in the finished wire spring relay comb 11, as illustrated in FIGS. 7A and 7B, is substantially precluded. In addition, as a result of the channels 16*c*–17*c* being relatively large in cross-section and the molding material flowing through the channels and between the mold cavities 16*a*–17*a* in substantially straight line paths, complete filling of the mold cavities is achieved and the resultant block member 12 is free of voids.

After a suitable setting time, the molding apparatus is opened and the molded block member 12 and the wires 13 are ejected from the molding dies 16 and 17 (and the molding dies 21 and 22) by the ejector pins 23, whereupon the wires are advanced another step for the next molding operation. Subsequently, the wires 13 are severed to form the wire spring relay combs 11, composed of one of the block members 12 molded about the wires 13S, as shown in FIG. 6.

Summarizing, molding apparatus has been disclosed for the molding of the block members 12 about the wires 13, in which the wires are properly seated and captivated in the apparatus as it is closed for a molding operation, and in which subsequent shifting of the wires during the molding operation, so as to cause a "wild wire" condition in the resultant relay combs 11, as illustrated in FIGS. 7A and 7B, is substantially precluded. The construction of the apparatus is such that deposits or accummulations of molding material in the arcuate wire gripping seats 16*b* and 17*b*, which could interfere with subsequent closing or proper operation of the apparatus, cannot occur. The apparatus also is constructed so that complete filling of the mold cavities 16*a*–17*a* and the interconnecting channels 16*c* and 17*c* can be readily achieved, whereby the molded block members 12 are substantially free of voids. In addition, since the molded block members 12 are symmetrical about the parting line of the apparatus, any tendency for the creation of internal stresses within the block members, which could cause warping or stress cracking thereof during or subsequent to curing, is substantially reduced. Further, the resultant wire spring relay combs 11 are inherently of relatively strong construction, as a result of the reinforcing ribs 12*c* integrally connecting the block portions 12*a*, being bonded to the opposed sectors of the adjacent wires 13S, and being relatively large in cross section.

What is claimed is:

1. Apparatus for molding a plurality of block portions about a plurality of laterally spaced parallel inserts, wherein the block portions are longitudinally spaced along the inserts, and the inserts extend between and project beyond the block portions in spaced parallel relationship, which comprises:

first and second molding dies movable relative to one another perpendicular to a parting line of said molding dies, between an open position and a closed molding position in which said molding dies define mold cavities spaced longitudinally relative to the inserts, for forming the block portions about the inserts;

rows of insert receiving means spaced longitudinally relative to the inserts for aligning the portions of the inserts which are to project beyond the block portions;

at least one row of opposed arcuate seats located on said first and second molding dies intermediate the rows of said longitudinally spaced insert receiving means, said arcuate seats extending between the mold cavities in alignment with respective ones of said insert receiving means and being engageable with sectors of respective ones of the inserts to captivate the inserts therebetween when the molding dies are moved to their closed molding position, so as to preclude shifting of the inserts and to preclude the flow of molding material between said seats and the sectors during a molding operation; and

opposed surface portions on said molding dies between said arcuate seats and extending between the mold cavities, said surface portions defining channels through which molding material can flow between the mold cavities and into engagement with opposed sectors of the inserts, to form reinforcing ribs bonded to the opposed sectors of the inserts and integrally connecting the block portions which are formed about the inserts in the mold cavities.

2. Apparatus for molding a plurality of block portions about a plurality of laterally spaced parallel inserts, as recited in claim 1, in which:

said first and second molding dies are substantially identical in construction, such that the molded block portions and the reinforcing ribs are symmetrical on either side of a plane containing the inserts.

3. Apparatus for molding a plurality of block portions about a plurality of laterally spaced parallel inserts, as recited in claim 1, in which:

the channels defined by said opposed surface portions of said first and second molding dies are enlarged relative to the inserts, so as to facilitate the flow of molding material through the channels and so as to form reinforcing ribs of relatively strong construction.

4. Apparatus for molding a plurality of longitudinally spaced block portions about a plurality of laterally spaced parallel inserts, which comprises:

first and second molding dies movable relative to one another between an open position and a closed molding position in which said molding dies define spaced mold cavities for forming tne block portions about the inserts, said molding dies being formed of a pressed and sintered metal powder composition containing iron on the order of 94.5 ± 4.0 percent, carbon on the order of 0.50 ± 0.25 percent, nickel on the order of 2.0 ± 1.0 percent, and substantially no copper, with any balance being one or more bonding metals up to a combined maximum of 2 percent;

opposed arcuate seats on said first and second molding dies between the mold cavities, said arcuate seats being engageable with sectors of respective ones of the inserts to captivate the inserts therebetween when the molding dies are moved to their closed molding position, so as to preclude shifting of the inserts and to preclude the flow of molding material between said seats and the sectors during a molding operation; and

opposed surface portions on said molding dies between said arcuate seats, said surface portions defining channels through which molding material can flow between the mold cavities and into engagement with opposed sectors of the inserts, to form reinforcing ribs bonded to the opposed sectors of the inserts and integrally connecting the block portions which are formed about the inserts in the mold cavities.

5. Apparatus for molding a plurality of longitudinally spaced block portions about a plurality of laterally spaced parallel wires, in which the block portions are molded at preselected intervals along the wires and the wires are advanced in successive increments through the apparatus, which comprises:

first and second molding dies movable relative to one another between an open position and a closed molding position in which said molding dies define spaced mold cavities for forming the block portions about the wires;

opposed arcuate seats on said molding dies between the mold cavities, said arcuate seats being engageable with sectors of respective ones of the wires to captivate the wires therebetween when the molding dies are moved to their closed molding position, so as to preclude shifting of the wires and to preclude the flow of molding material between said seats and the wires during a molding operation;

opposed surface portions on said molding dies between said arcuate seats, said surface portions defining channels through which molding material can flow between the mold cavities and into engagement with opposed sectors of the wires, to form reinforcing ribs bonded to the opposed sectors of the wires and integrally connecting the block portions which are formed about the wires in the mold cavities; and

first and second sets of wire guides mounted adjacent the entrance and exit ends of said molding dies in fixed positions relative to one of said molding dies, said wire guides tapering both longitudinally and transversely of the wires to form transversely spaced, pointed wire locating extremities on the wire guides, and said wire guides tapering transversely of the wires and toward one another to define wire guide slots merging into arcuate wire receiving seats in alignment with said opposed arcuate seats on said molding dies, with the outermost wire guides of each set of wire guides projecting substantially beyond the wire guides therebetween and beyond the normal positions of the wires in the apparatus when the apparatus is in its open position.

6. Apparatus for molding a plurality of block portions about a plurality of laterally spaced inserts, as recited in claim 3, in which:

said surface portions and said arcuate seats intersect in spaced relationship to the parting line of said molding dies, and said surface portions, intermediate said arcuate seats, are elliptically shaped and spaced from the parting line of said molding dies.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,767,155 Dated October 23, 1973

Inventor(s) J. J. Hovorka

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 2, line 21, "If" should read --It--. Column 6, line 25, "As" should read --After--.

Signed and sealed this 16th day of April 1974.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents