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2,237,274

METHOD OF MAKING RELAY CONTACT STRUCTURES

Filed Nov. 6, 1936

2 Sheets-Sheet 1

Fig. 2.

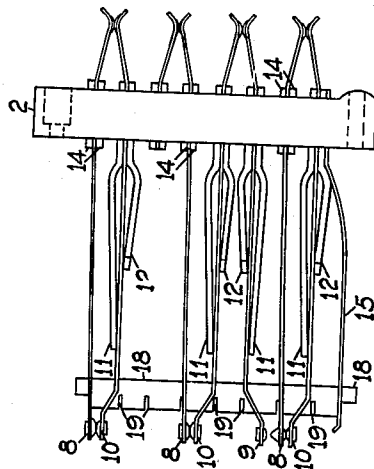
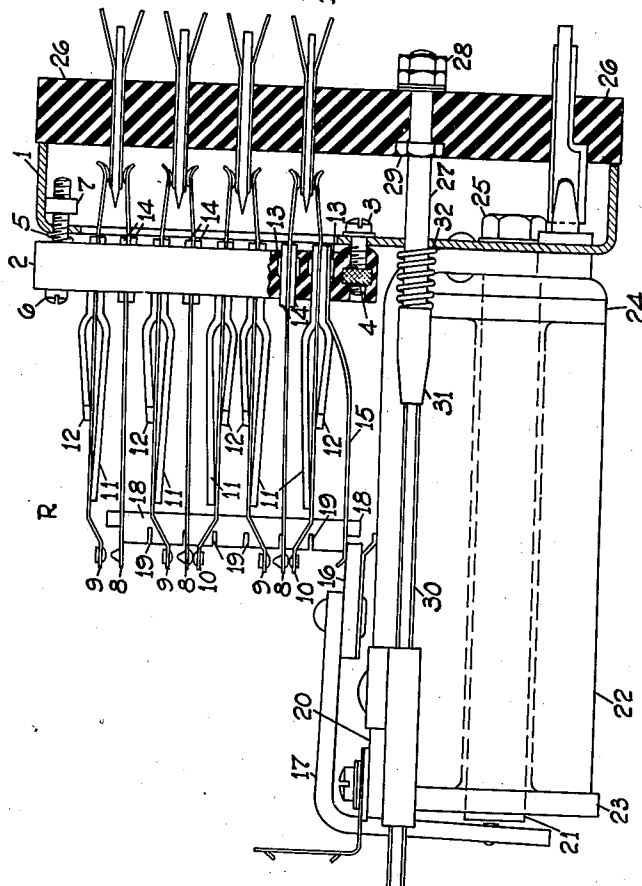


Fig. 1.



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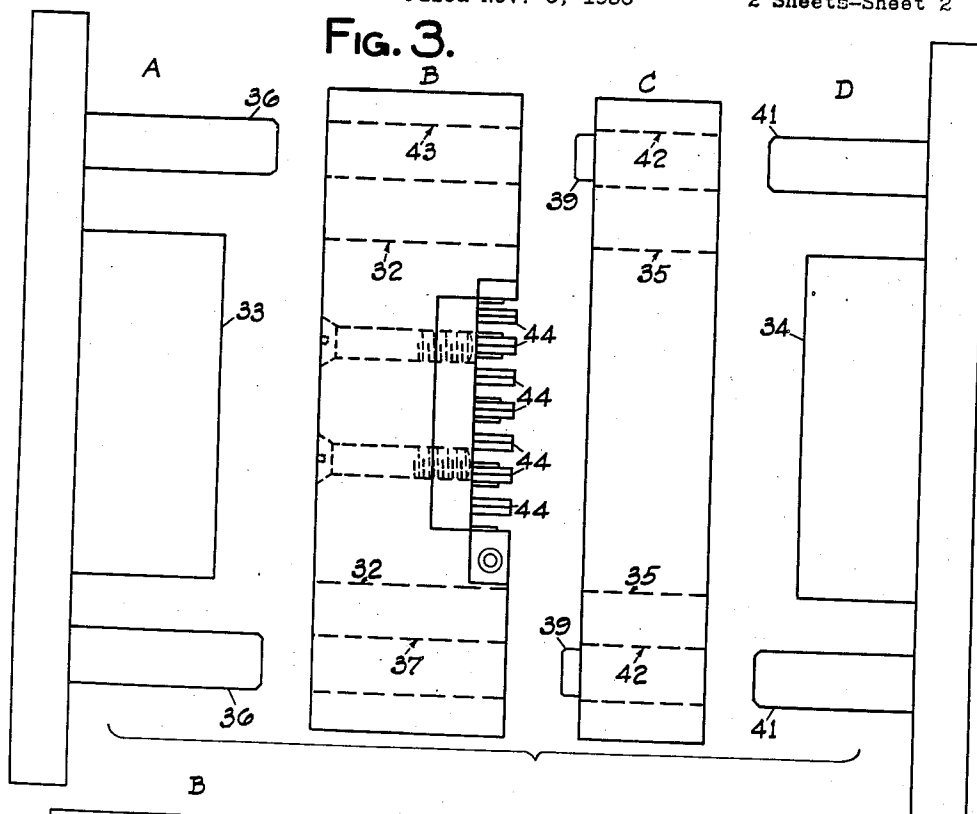
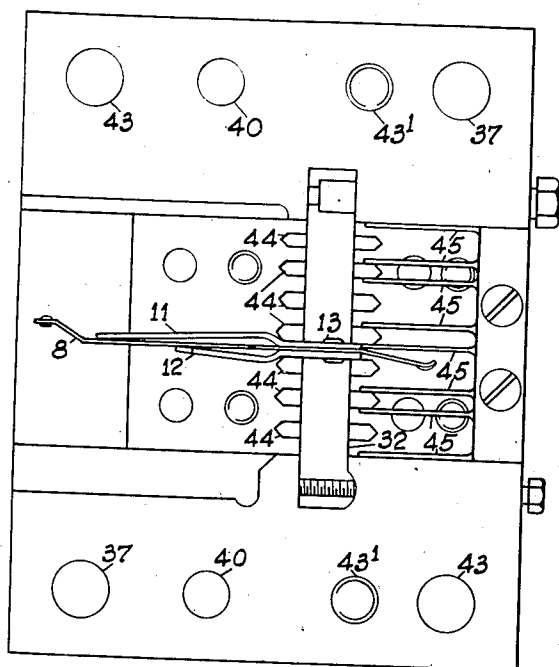
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METHOD OF MAKING RELAY CONTACT STRUCTURES

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2 Sheets-Sheet 2



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METHOD OF MAKING RELAY CONTACT STRUCTURES

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4 Claims. (Cl. 18—59)

This invention relates to electrical relays and has particular reference to relays of the type used in centralized traffic control systems for railroads.

In centralized traffic controlling systems a considerable number of relays are employed to affect the selection and control of the various controlling devices along the trackway, and these systems require relays having a great many different contact combinations. It has been found from experience that the molded type of contact block is well adapted for centralized traffic control relays or the ordinary telephone type relay as the various details that comprise a contact group are held securely in their proper operating positions and can be easily assembled in the mold. However, if it is necessary to employ a separate mold for each different contact combination desired, it is not economical to use the molded type of contact block.

The object of this invention is to provide means whereby a standard mold may be employed for any desired combination or arrangement of contact fingers or, in other words, to provide means whereby either a front, back or armature contact assembly may be placed in any level of the mold without changing the design of the mold.

Another object of this invention is to permit the individual characteristics of the contact fingers to be varied without changing the fixed dimension of the contact fingers at the points where they enter the mold. This invention is an improvement over the molded contact block as disclosed in the prior application of J. F. Merkel, Ser. No. 608,037, dated April 28, 1932.

Other objects, purposes and characteristic features of the present invention will appear as the description thereof progresses during which reference will be made to the accompanying drawings in which like reference characters designate the same parts throughout the several views. The accompanying drawings show, in a manner to make the invention readily understood rather than with the view of showing the particular construction preferable employed in practice, one form of the invention. In the drawings:

Fig. 1 is a side view of a relay with the contact group of the relay shown in accordance with the present invention and with part of the molded block broken away to more clearly show the construction.

Fig. 2 is a side view of a contact group similar to the contact group in Fig. 1 showing another possible arrangement of the contact assemblies.

Fig. 3 is a side view of the four sections A, B,

C and D of a mold suitable for making a contact block as described in this invention.

Fig. 4 is a top view of the intermediate section B of the mold.

Referring to Fig. 1 a centralized traffic control relay of the quick detachable type is shown, which is designated as a whole by the reference character R, the relay proper being assembled on a rigid back plate 1 formed of sheet metal with the outside edges pressed at right angles thereto to add to its rigidity. The molded contact blocks 2, only one of which is shown, are shaped at the ends for mounting vertically side by side on the back plate 1. The lower end of each of these contact blocks is shaped with a slight vertical arc resting against the plate 1, and attached thereto by a screw 3 threaded into an insert 4 embedded in the molded material, the upper end of each contact block is held against back plate 1 by a compression spring 5 resting in a recess (not shown), in the block 2, and a bolt 6 and a nut 7 are arranged to clamp this top end against the back plate 1.

The spring contact fingers that are molded in the block 2 comprise the movable armature fingers 8 and the front and back contact fingers 9 and 10 respectively. The front contact fingers 9 and the back contact fingers 10 are provided with relatively long rigid stop plates 11 fixed on the side thereof adjacent the movable armature fingers 8, with relatively short rigid pressure plates 12 being fixed to the opposite sides of the associated fingers by through rivets 13 within the molded block 2. The movable armature fingers 8 are reinforced within the molded block 2 by holding plates 14 attached to each side thereof by similar rivets 13. Assembled with the lower back contact finger assembly is a finger operating arm or idler 15 which extends beneath the finger with its movable end resting on a transverse strip 16 attached to armature 17.

This finger operating arm 15 is connected with the movable armature fingers 8 by an insulated pusher 18 which passes through elongated clearance holes in both the front contact fingers 9 and the back contact fingers 10 and is operably connected to the movable armature fingers 8 by notches 19 therein. The movable armature fingers 8 are each provided with a rectangular hole to allow the pusher to be inserted end-wise and when in place the pusher is moved forward toward the front of the contact fingers so that the notches 19 receive a portion of the armature fingers 8 similar to the arrangement shown and disclosed in the W. K. Howe application Ser. No.

736,260, filed July 20, 1934. It will be noted that sufficient notches have been provided to take care of any desired arrangement of contact assemblies.

The electro-magnetic structure of the relay R comprises a magnetic top yoke 20 which is spot welded to the back plate 1 and a magnetic core 21 carrying an operating coil 22 wound thereon between insulating end washers 23 and 24. One end of the core 21 is drilled and tapped, and secured to the top yoke 20 by means of a bolt 25. The armature 17 is arranged to operate between the extending end of top yoke 20 and the free end of the magnetic core 21.

The relay R is mounted on an insulating panel 26 by bolts 27 (only one of which is shown) secured to the panel 26 by nuts 28 and 29 which bolts have elongated bodies extending through holes in the back plate 1 with a long hexagonal nut or rod 30 having a threaded sleeve 31 bearing against a compression spring 32.

Referring to Fig. 2, the molded contact block 2 and its associated contact finger assemblies are of the same construction as the contact block and contact finger assemblies shown in Fig. 1, but the contact assemblies differ in number and occupy different levels in the molded block.

As previously pointed out, in order to avoid the use of different molds for each different contact assembly arrangement, it must be possible to place an armature contact assembly, a back contact assembly or a front contact assembly in any level of the mold. Likewise in order to use a standard mold, each of the individual contact assemblies must have the same cross sectional dimension at the point where it enters the mold. To show the necessity for holding the various contact assemblies to fixed dimensions at the points where they enter the mold, a brief description of the molding process will be given.

In Fig. 3 there is shown the four sections A, B, C and D of a mold suitable for molding the contact block 2 shown in Figs. 1 and 2, in which A is the base of the mold, B the body, C the filler and D the top section.

Considering the mold more in detail, these members are assembled, as indicated, B on A, C on B, and D on C, to constitute the closed mold. An opening 32 in B, snugly receives the projecting member 33 on A, so as to form a bottom for the mold cavity, and likewise, a projecting member 34 on D is snugly received in opening 35 of C, to form the top of the mold cavity. In fitting the members together, two pins 36 on A, are received in openings 37 in B. The filler member C has 2 pins, 39 received in openings 40 in B, while the top member D has two pins, 41 passing entirely through openings 42 in C and received in openings 43 in B. As shown in Fig. 4 two threaded openings 43¹ in B, match with openings (not shown) on C, to receive screws (not shown) to securely hold B and C in their assembled position.

In Fig. 4 there is shown a top view of body section B of the mold and also the position that a back contact assembly comprising parts 8, 11, 12 and 13 would occupy when properly located in the mold. The various contact assemblies are placed in section B of the mold in openings formed by guides 44 with stops 45 serving as a means for locating the various contact fingers in their proper positions in the mold. The sections A, B, and C are assembled as described above and a measured amount of "Bakelite" or some similar insulating material is then poured

into the mold through the opening 35 in section C. After the top section D has been assembled in place the mold is subjected to a high pressure at a temperature of approximately 300 degrees F.

As the insulating material of which the block is composed is in a fine powder form before being molded, it is apparent that unless the contact assemblies fit snugly between the guides 44 and thus fill all the mold, openings will be present which will allow the powder to escape when it is poured into the mold. Also, the heavy pressure on the mold during the heat treatment will squeeze more material through the openings, thus defeating the molding process.

The characteristics of the movable armature fingers 8 and the stationary front and back fingers 9 and 10 respectively are necessarily different, and this difference is frequently obtained by the use of different gauges of finger material or by the use of a stop, as required, by each particular finger to obtain the desired characteristics obviously changes the thickness of the metal at the point where the finger assembly is held in the contact block and is therefore unsuitable for a standard molded type of block.

In this invention means have been provided for varying the individual characteristics of the contact fingers without changing the fixed dimension of the finger assemblies at the point where they enter the mold.

Contact fingers of suitable width and thickness are chosen, fingers with sufficient strength to cover the range of pressures encountered in practice and if trapped pressure is desired these fingers may be preformed in a suitable fixture so as to exert the proper pressure against their stop plates and, in the case of the armature fingers 8, if the fundamental pressure is more than desired, the pressure may be reduced by notching so as to produce a neck section (not shown) between the support and the contact end of the finger. The armature fingers 8 are provided with holding plates 14, top and bottom, which act as a mechanical grip of uniform dimension for holding the armature fingers during the molding process.

Each front contact finger 9 is provided with a pressure plate 12 and a stop plate 11 assembled as previously described which plates likewise act as a mechanical grip for holding the front contact fingers during the molding process. The back contact fingers 10 are assembled in a similar manner except that the pressure plates 12 are located below the fingers and the stop plates 11 are located above the fingers. In the case of the front and back contact fingers the use of pressure plates 12 make it possible to obtain several degrees of finger stiffness by choice of a suitable length of pressure plate. Stated another way by substituting a longer pressure plate the characteristics of a much stiffer finger are obtained without having to change the gauge of the finger itself.

Thus, the pressure plate 12 gives the results obtainable by using a thicker contact finger and the stop plate 11 insures a definite position of the contact finger when the contact finger is disengaged and the complete unit comprising a pressure plate, a contact finger and a stop plate has a definite and fixed dimension at the point where it must fit the mold. Furthermore, this dimension is the same as that of an armature finger with its two holding plates and therefore, the two types of fingers can be assembled in the various mold levels or slots as may be required to obtain

the desired contact combination of dependent or independent, front or back, contacts.

During molding operations contact fingers have a tendency to become distorted when they are placed in the mold without support other than their own stiffness. This tendency is overcome in the present invention by the grip exerted on the fingers by the various plates at the point where they enter the mold. Freedom from distortion during molding is essential to the successful use of performing in contact fingers and the savings obtained thereby.

Several other advantages are obtained by using pressure plates and stop plates with the front and back contact fingers as shown in Figs. 1 and 2 of the accompanying drawings.

To one skilled in the art, it is a well known fact that the torque developed by the tractive type relay builds up very gradually at the start and much more rapidly at the end of the armature travel and reaches a maximum amount just before the armature contacts the pole piece. Therefore, one advantage is the ability to choose and proportion the contact load of a relay by properly adjusting the stop and pressure plates so as to more nearly fit the characteristic torque or pull curve of the magnetic structure and thereby provide a more economical relay and also a relay of more desirable operating characteristics than is possible if the load curve does not fit the torque curve.

Another advantage is the ability to use a contact adjustment which employs trapped pressure, or one in which the contact pressure is built up entirely by the contact finger movement with no complication other than to adjust the contact finger and pressure plate in accordance with the desired results. This makes it possible when using contact pressures generated by spring movement to substitute an electrical test for the customary operation of measuring each contact with a gram gauge to be certain of sufficient contact pressure.

This comes about because visual inspection is sufficient to show that the contact finger is in contact with the stop plate and also the pressure plate, when not engaged with the armature finger. It has been found from test that if a front or back contact finger is moved the required distance when the relay is operated the required minimum contact pressure will be generated. The contact pressure may be more but not less than the minimum amount desired and since additional contact pressure is desirable rather than objectionable, provided the relay will operate at the prescribed values, it becomes practicable to rely on electrical tests to show the need for adjustment of contact fingers to obtain proper contact pressures.

The above procedure coupled with a visual inspection to check that the armature fingers fully compress the back contacts avoids the need for the inconvenient and unsatisfactory gram gauging operation except to detect abnormally high pressures so great that the electrical values exceed the specified tolerances.

The contact block in Figs. 1 and 2 show the finger operating arm 15 assembled with the bottom back contact assembly. This arrangement makes it necessary that the lower slot in the mold be slightly larger than the slots at the other levels. It is not necessary to adhere to this arrangement as a mold can be designed with slots the same size at all levels and the armature operating arm assembled with the holding plates

14, without departing from the scope of the invention, as the armature operating arm is the same thickness as the contact fingers.

From the foregoing description it is apparent that a molded contact block for relays has been provided and is easily and economically constructed. Furthermore, contact blocks with any desired contact arrangement may be made from a standard mold and the contact fingers can be easily assembled in their proper operating positions in the mold.

The above rather detailed description of one form of the applicant's invention is given solely by way of illustration, and is not intended, in any manner whatsoever, in a limiting sense. Obviously, the invention can assume many physical forms and is susceptible to numerous modifications, all such forms and modifications are intended to be embraced by this invention as come within the scope of the appended claims.

What I claim is:

1. In a "Bakelite" or like molding process, the method of molding a plurality of devices formed from the same gauge sheet material and of different sizes and shapes into an integral block of "Bakelite," comprising, forming a mold having an inner cavity connected to the outside by a plurality of separate openings of identical size and shape, locally building up the cross section of the devices, having a cross section smaller than the mold openings, on the flat faces thereof so that each exactly fills an opening at the point where it enters the mold cavity, placing each in an opening of the mold to extend into the cavity and then molding "Bakelite" about them, under pressure.

2. The method of molding a plurality of different kinds of relay contact finger assemblies in a single piece of "Bakelite" or the like in a hollow mold having a plurality of identical separate openings connecting the inside of the mold with the outside, comprising, forming each finger from a long flat thin piece of spring metal, fastening to it, at one end, two rigid plates, one on each flat side, and differing in lengths with the different kinds of fingers, the cross sections of all the spring pieces, and of all the plates, being respectively, the same, and the cross section of each combined finger and plates being the same as the cross section of the openings in the mold, inserting the plate end of each finger into the mold and through an opening, and forming the molding material around the inserted finger ends, under pressure; the rigid plates projecting out from the mold to prevent distortion of the spring metal during the molding operation.

3. The method of molding relay contact finger assemblies of different kinds in a mold having an interior cavity and a plurality of identical separate openings leading into the cavity, in a single piece of "Bakelite" or the like, comprising, forming a plurality of contact finger assemblies including front and back contact fingers and armature contact fingers, each including a thin flat piece of spring metal, and a rigid plate of material on each flat side, at one end, the plates on each front and back contact finger assembly extending a considerable distance toward the other end, to form stop, and pressure plates; the plates on the armature fingers extending only enough to protrude from the mold in which they are to be inserted, keeping all the spring pieces of identical cross section, and all the plates of identical cross section and such that each finger, at its plate end, has a cross section identical with

that of a said separate opening, inserting the plate end of each assembly into one, respectively, of said openings, to extend from the outside into the interior cavity in the mold, and forming the molding material around the assemblies in the cavity and under pressure, whereby front and back finger assemblies, and armature assemblies, can be equally well placed in the separate mold openings in different relative arrangements to lend flexibility of operation to, and economy in, the molding operation.

4. The method of molding a plurality of different kinds of relay contact finger assemblies in a single piece of "Bakelite" or the like in a hollow mold having a plurality of identical separate openings connecting the inside of the mold with

the outside, comprising, forming each finger from a long flat thin piece of spring metal, fastening to it, at one end, two rigid plates, one on each flat side, and differing in lengths with the different kinds of fingers, the cross section of each of the combined spring pieces and plates being the same, and the same as the cross section of the mold openings, inserting the plate end of each finger into the mold and through an opening, and forming the molding material around the inserted finger ends, under pressure; the rigid plates projecting out from the mold to prevent distortion of the spring metal during the molding operation.

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