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N. H. SAUNDERS ET AL

2,606,958

MULTICONTACT RELAYS

Filed May 9, 1946

3 Sheets-Sheet 1

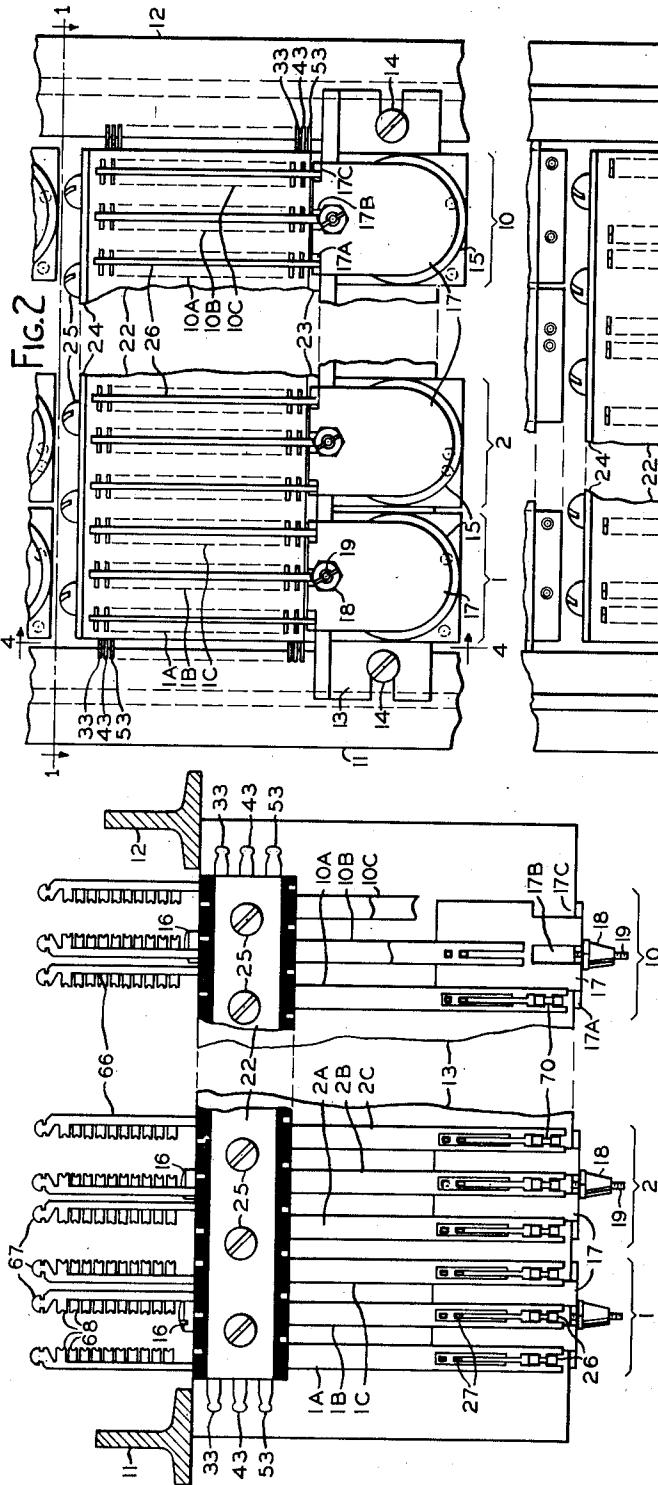


FIG. 1

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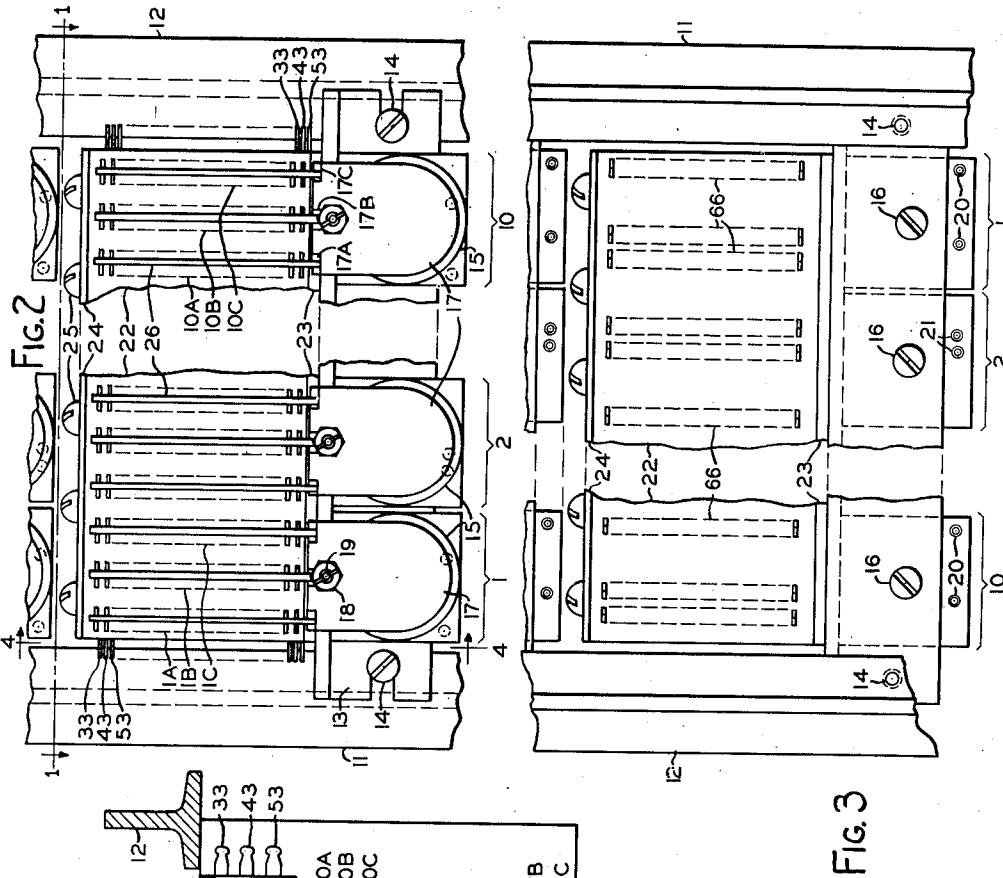


FIG. 2

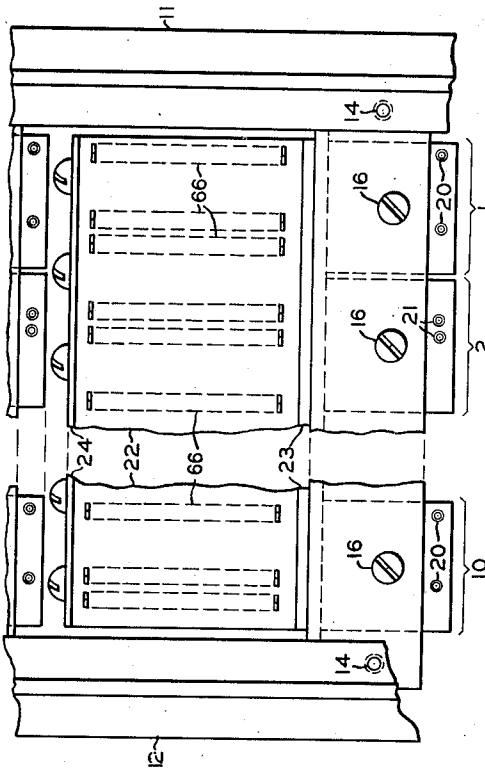


FIG. 3

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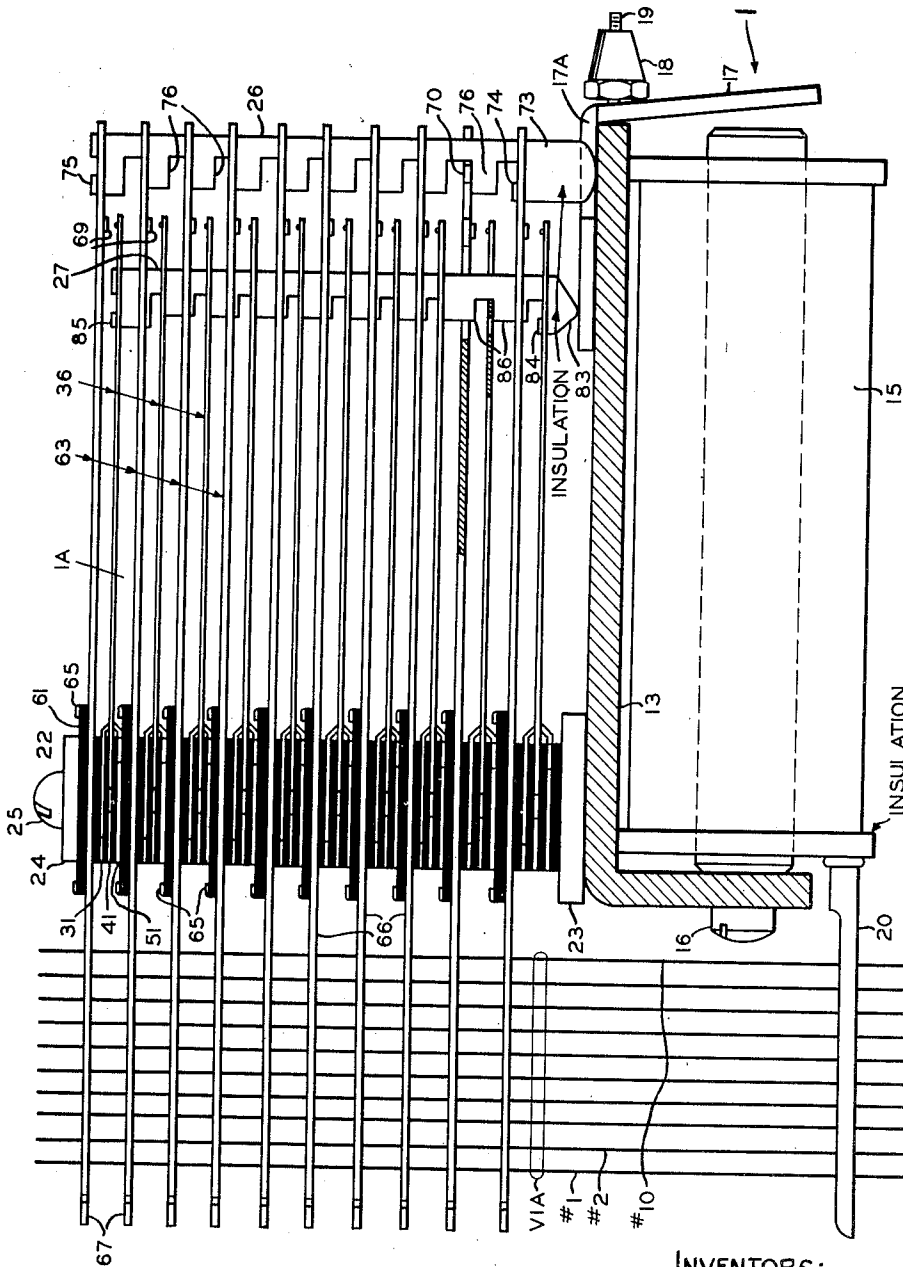


FIG. 4

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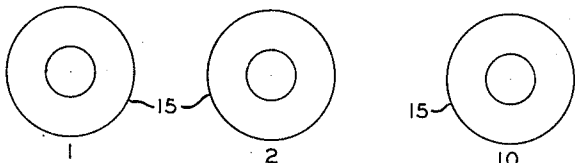
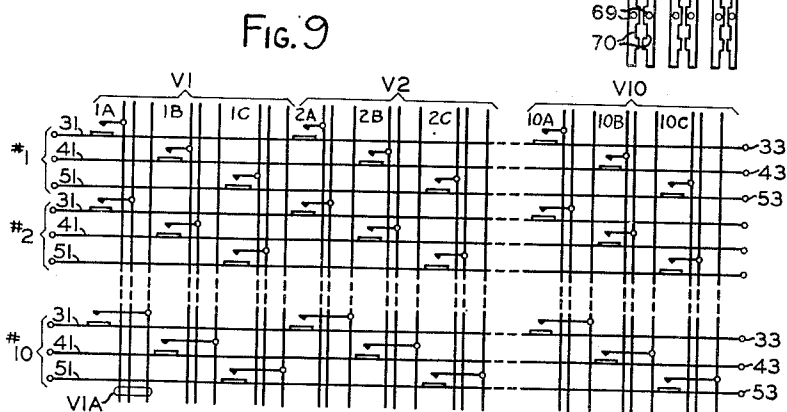
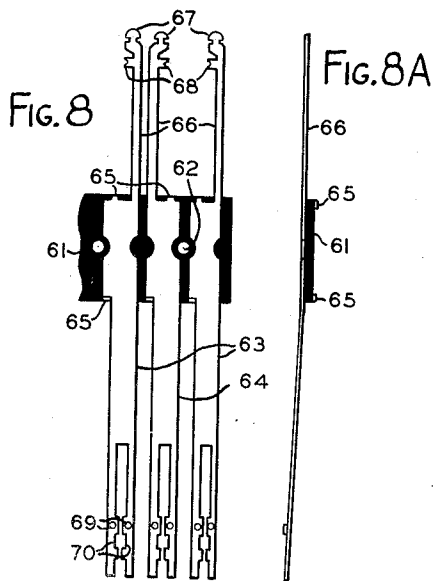
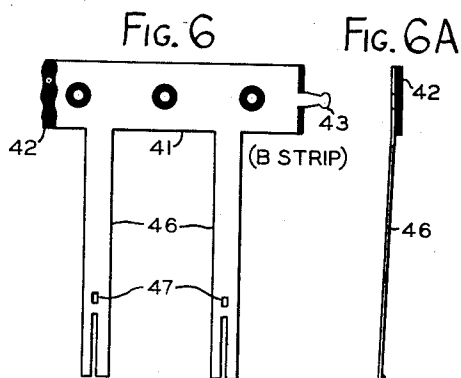
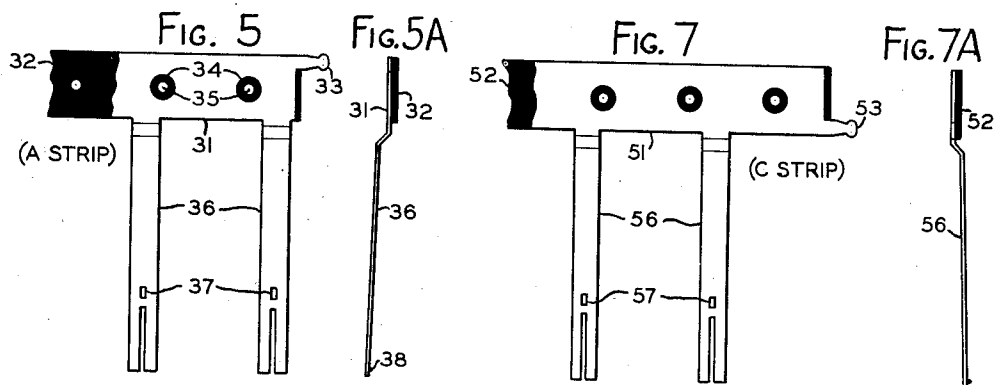
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3 Sheets-Sheet 3



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2,606,958

MULTICONTACT RELAYS

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7 Claims. (Cl. 175—320)

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This invention relates to multi-contact relays. One object is to provide an improved form of multi-contact relay which utilizes mounting space more efficiently than heretofore, and which permits the relays to be mounted in rows and columns with economical intermultiplying between concerned contacts of relays in the same row, as well as between concerned contacts of relays in the same column.

Another object is to provide suitable means for so locating and controlling the contact-carrying members of the relays that they require a minimum of adjustment after assembly.

An important feature of the invention resides in the arrangement for economically multiplying corresponding contacts of all relays in the same row, while permitting each relay to have a plurality of columns of contact members arranged side by side thereon to utilize the full width of the electromagnet. In carrying out this feature of the invention, a contact bank is provided at the rear of the row containing thin lateral conducting strips, with which the movable blades of the contact pairs are integrally formed, and appear in staggered relationship, whereby each column of contacts of any relay of the row is served by a separate group of bladed conducting strips interspersed with the bladed conducting strips serving the other columns of contacts.

According to a further feature of the invention, the movable blades of any contact column are controlled by a rack resting on the armature, while the stationary blades are fixedly positioned by a rack resting on a fixed portion of the structure. Both the movable blades and the stationary blades have a bifurcate form, and the racks lie between the arms of the bifurcate portion. This construction minimizes adjustment requirements, and leaves the space between adjacent contact columns free to permit ready inspection and adjustment.

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

The accompanying drawings, comprising Figs. 1 to 9, show the construction and arrangement of relays embodying the principles of the invention.

Fig. 1, taken along line I—I of Fig. 2, shows a top view of the relay gang shown in full in Fig. 2.

Fig. 2 is a front view of a section of a switchboard having a number of similar gangs of multi-contact relays mounted in a column, one such gang being shown in full.

Fig. 3 is a rear view of the apparatus of Figs. 1 and 2.

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Fig. 4 is an enlarged view of the apparatus of Figs. 1 to 3 as seen from the left generally along line 4—4 of Fig. 2.

Figs. 5 to 7 are bottom views of the three specifically different forms of movable-blade strips employed in the apparatus of Figs. 1 to 4, while Figs. 5A to 7A are end views thereof.

Figs. 8 and 8A are a bottom view and an end view of one of the stationary-blade strips employed in the apparatus of Figs. 1 to 4.

Fig. 9 is a circuit diagram showing the vertical and horizontal interconnections between contact blades of the relays.

Figs. 1 to 3 show a section of a switchboard on which the relay gangs are adapted to be mounted. This switchboard includes a row of upright bars between which relay gangs and other associated units of apparatus may be mounted in columns. Of these upright bars, only bars 11 and 12 are shown, as switchboard construction of this type is quite common.

Between bars 11 and 12, any desired number of relay gangs constructed according to the invention can be mounted in a column. One such relay gang is shown in full front view in Fig. 2, together with a fragmentary portion of the relay gang immediately overlying it in the column. Any such relay gang includes apparatus mounted on common plate 13, of angular construction. The vertical web of plate 13 is notched at the ends, as shown best in Fig. 2, to receive a pair of screws 14 through which it is attached to uprights 11 and 12.

Plate 13 is made of magnetic material to serve as a common return path for the several relays mounted in gang assembly thereon. In the illustrated embodiment, ten multi-contact relays 1 to 10 comprise a gang mounted on the common plate 13. Of these, relays 3 to 9 are omitted from the drawings to conserve drawing space.

Each of the ten relays comprising a gang includes an electromagnet 15 of the usual construction, attached at the rear to the vertical portion of plate 13 by a screw 16. Each relay is further provided with an angular armature 17, held pivotally in position by nut 18, threaded onto stud 19, which is attached to mounting plate 13.

Each of the relays of the gang is provided with three columns of contact blades, A, B, and C. Those for relay 1 are shown at 1A, 1B, and 1C; those for relay 2 are shown at 2A, 2B, and 2C; and those for relay 10 are shown at 10A, 10B, and 10C.

The contact columns 1A to 10C comprise thirty

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laterally spaced columns of contact-carrying blades supported at the rear in the composite bank 22, and extending forwardly therefrom. It will be observed that electromagnets 15 are mounted along common plate 13 very nearly in contact with each other. The slight space between them is substantially that required for mass-production manufacturing tolerance. The length of the assembly is therefore dictated substantially by the electromagnets. The three columns of contact blades for any relay are mounted directly above the electromagnet thereof, and are spaced uniformly about as close together as considerations of inspection and adjustment will permit. Since the contact columns on the several relays are of uniform height, the arrangement under discussion is apparently as economical of space on the face of the switchboard as any arrangement which can be devised.

One of the major features of the invention is that multi-contact relays having their columns of contact members disposed in the disclosed space-saving arrangement are nevertheless interconnected according to the usual requirements of multi-contact relays. That is, one blade of each contact-blade pair of any relay is connected to the corresponding blade of each other relay of the group, or gang.

Contact bank 22 is attached to mounting plate 13 by fifteen mounting screws 25 (one for each two columns of contact blades) which pass vertically through the bank and enter threaded openings (not shown) in plate 13. Contact bank 22 comprises a pile of transverse contact-blade strips held in place between base plate 23 and cap plate 24. These strips are shown individually in end view in Fig. 4, but are not shown individually in Figs. 2 and 3 to avoid undue crowding of lines.

It has been chosen to illustrate the relay gang as made up of thirty-point relays; that is, of relays each of which closes thirty circuit points on operation. Accordingly, since the previously discussed considerations of space economy dictate that each relay (for the chosen width and lateral spacing of contact blades) has three columns of contact blades, each column must contain ten pairs of contact blades, as is shown in Fig. 4 for column 1A, the first column of relay 1 of the gang of ten.

Referring to Figs. 4, 8, and 8A, the top contact-blade strip in bank 22 (immediately underlying cap plate 24) comprises an insulation strip 61 having thirty contact blades on the underside thereof, clipped thereto as by bent-over tabs 65, passing through locating notches in the front and rear edges thereof. These contact blades comprise fifteen blades 63 for the odd columns of the assembly, and fifteen blades 64 for the even columns. The blades 63 and 64 are similar except that the rear terminal extensions 66 thereof are oppositely located to provide common working spaces (one for each pair of columns of contact blades) for the attachment, as by soldering, of vertical multiplying conductors such as group VIA (Figs. 4 and 9). The thirty contact blades 63 and 64 carried underneath strip 61 provide one fixed blade for each of the thirty columns of the relay gang.

The topmost contact strip 61 is underlaid by three contact strips 31, 41, and 51 detailed respectively in Figs. 5, 6, and 7.

Strip 31 is referred to as an A strip in that the ten contact blades 36 fixed therewith are so located along the strip as to appear only in the A columns, 1A, 2A, and so forth, a single appear-

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ance along the strip for each relay; strip 41 is referred to as a B strip in that the contact blades 46 attached thereto appear only in columns, 1B, 2B, and so forth; and strip 51 is referred to as a C strip in that the contact blades 56 fixed therewith are so located as to appear only in the C columns, 1C, 2C, and so forth. The staggered arrangement of the contact blades on these strips is diagrammatically shown in Fig. 9.

Insulation strips 32, 42, and 52 are laid on and fixed with strips 31, 41, and 51, respectively to keep them out of contact with each other and with the blades 63 and 64, and to hold them in alignment in the bank with respect to mounting screws 25. For example, each such insulation strip and its underlying conducting strip may be fixed with each other as by being pressed together after one or the other of the parts has been coated with a suitable adhesive material.

Holes, such as 35 in insulation strip 32, rather snugly receive the bank screws 25, while holes, such as 34, in the underlying conducting strip are substantially larger to avoid undesired contact with the bank screws. End lugs 33, 43, and 53 permit external connection to be made at either end of conducting strips 31, 41, and 51.

Contact blades 36 carried on strip 31 are offset downwardly to the level of the non-offset contact blades 46 carried by a strip 41, while contact blades 56 carried by C strip 51 are offset upwardly to the said level, bringing the contact blades on the three strips overlying each other, as a level group, into horizontal alignment and in fixed uniform relationship to their immediately overlying fixed blades mounted on strip 61.

It will appear from the foregoing that the three contact blades carried by the topmost strip 61 for any one of the ten relays overlie, respectively, a contact blade 36 secured to strip 31, a contact blade 46 secured to strip 41, and a contact blade 56 secured to a strip 51, whereby closure of the topmost contact pair of each of the three columns of any one of the ten relays closes three separate circuit connections not multiplied with each other, while closure of the corresponding contacts of any other relay connects the same horizontal strips 31, 41, and 51 to such conductors as are attached to the cooperating stationary contacts thereof, fixed with the uppermost strip 61.

The described arrangement, including the uppermost fixed-blade strip 61 and the immediately underlying movable-blade strips 31, 41, and 51, provides the three uppermost contact points for each of the ten relays. This arrangement is repeated below for each of the remaining nine contact points in any column of any relay in the gang. The lowermost contact strip 51 in the bank is underlaid by an insulating strip to keep it out of contact with base plate 23.

Preferably, each of the stationary blades 63 and 64, and each of the movable blades 36, 46 and 56, is so preformed as to slope downwardly toward the front of the relay when not supported, so as to provide the required normal tension when the positioning racks are installed. That is, the contact blades shown in Fig. 4 are approximately straight merely because of the front-end support afforded by racks 26 and 27.

Each of the thirty columns of contact blades has a movable rack 27 (see Figs. 1 and 4) having a vertical body portion lying between the arms of the bifurcate forward end portion of the contact blades. Rack 27 has rearwardly extending lifting portions 26 which underlie the movable blade, respectively. The rack is held in position by an

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upstanding top portion 85 and an upstanding bottom portion 84 which enter openings 37, 47, or 57 (Figs. 5 to 7) depending upon whether the rack is serving an A column, a B column, or a C column. Foot portion 83 of rack 27 provides a bearing location on the top of the concerned armature 17, directly underneath the point at which the movable blades are lifted.

The rack 27 is prevented from rotating substantially about its own axis by being confined between the arms of the movable blades through which it passes.

Each of the thirty columns of contact blades is provided with a stationary rack 26 for supporting the forward end of the fixed blade 63 or 64 in fixed relationship to mounting plate 13. Rack 26 is generally similar to rack 27 except that it has a foot portion 73 appropriately longer than the foot portion 83, and is made from material having approximately twice the thickness of the material from which rack 27 was made.

As seen best in Figs. 1, 2, 4, each armature 17 is cut away at 17A, 17B, and 17C to accommodate the foot portion 73 of the three associated stationary racks 26.

The reason for the greater thickness of fixed racks 26 is that the bifurcations in both the movable-contact blades and the fixed-contact blades must be wide enough to permit rack 27 to be inserted first, followed by rack 26. As is shown best in Fig. 3, each of the fixed blades 63 and 64 is provided with a pair of inward extensions 70 which are far enough apart to permit rack 27 to pass between them, but are close enough together to permit both arms of the fixed blade to lie on top of the concerned support members 76 fixed with rack 26. This construction of racks and contact blades permits the contact bank and attachment blades to be completely assembled without racks 26 and 27, followed by the successive insertions of movable racks 27 and fixed racks 26. Since these racks can be inserted with the assembly otherwise intact, it is obviously unnecessary to take the assembly apart to replace any rack 26 or 27 which may become broken or otherwise defective.

After the assembly of Figs. 1 to 4 is installed between upright bars 11 and 12, along with the associated assemblies in the same column, and in adjoining columns if desired, external connections can be made to the horizontal conductors represented by horizontal conducting strips 31, 41, and 51, through terminal lugs 33, 43, and 53 on either end thereof.

The stationary blades of the relays of the several installed relay gangs in the same column may next be suitably connected in multiple through vertical conductors such as groups VI, V2, and V10 of Fig. 9, comprising ten groups such as VIA of Fig. 4, there being one such group of ten vertical conductors for each of the thirty contact columns carried by any assembly. These vertical conductors can be conveniently attached to the staggered side lugs 68 (see Fig. 1 and 8) and may comprise bare wires soldered thereto.

Finally, external conductors may be joined, as desired, to the rear terminal tabs 67 of one or more of the relay gangs multiply connected in the same column.

Referring now particularly to Figs. 3 and 4, it will be observed that each electromagnet 15 assigned to an odd-numbered relay on the assembly has a pair of coil terminals 20 so located as to underlie the first and second columns of

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rear terminal arms 66 of such relay, whereby the vertical bare wires (such as VIA, Fig. 4) do not come into contact therewith, while each electromagnet assigned to an even-numbered relay has its coil terminals 21 located in a different position thereon, so as to underlie the first and second columns of rearwardly extending members 66 in their different location with respect to the even-numbered relays.

Operation

When, for example, relay 1 of the relay gang of Figs. 1 to 4, and 9 is to be operated, the electromagnet 15 thereof energized, by passing current through the winding thereof through its rear terminals 20, causing it to attract the depending portion of its armature 17. This causes the horizontal portion of the armature to rise, lifting each of its three movable racks 27 a sufficient distance to carry the associated movable blades into engagement with their respective overlying fixed blades. Preferably, the stroke of armature 17 is sufficient to lift rack 27 slightly higher than is necessary to make contact, causing the bifurcate arms of the movable springs to be slightly bent under the applied force. With a given thickness of material in the movable blades, the amount of bending with the contacts engaged is directly indicative of the contact pressure applied.

As illustrated in Fig. 4, the fixed blades are somewhat thicker than the movable blades, whereby they bend less readily under the applied contact pressure. Additionally, the downward tension in the fixed-contact blades (governed by the amount of out-of-line forming as indicated in Fig. 8A) is sufficient that the fixed blades remain firmly in engagement with their rack 26 with the relay in operated condition. Operation of the relay 1 connects each of the 30 horizontal conductors (represented by ten sets of strips 31, 41, and 51, Figs. 5 to 7, and 9) to a separate one of the thirty vertical conductors VI.

When the operated relay is to be restored, de-energization of the electromagnet 15 thereof permits its armature 17 to be returned to normal position under the influence of the downwardly tensioned movable blades supported by movable racks 27.

We claim:

1. In an electrical contacting device, elongated movable conducting members disposed generally opposite each other and generally parallel to each other in columns forming a row transverse to the members, means behind the row supporting the rear end of each member while leaving the front end thereof free to be moved, said supporting means including means maintaining any said member insulated from the adjacent said members, relatively fixed conducting members corresponding respectively to the movable members, means supporting each fixed member adjacent to its corresponding movable member, the last said supporting means including means maintaining any said fixed conducting member insulated from any adjacent one of the said members, the columns being divided into similar successive groups of adjacent columns, superposed conducting strips extending laterally of the groups at the rear of the movable members connecting each movable members of any group to the corresponding movable member of each other group, and separate means for each group for moving the movable members thereof into and out of engagement with their respective corresponding fixed members.

2. In an electrical contacting device, pairs of contact members and means supporting them in columns forming a row containing similar successive groups of adjacent columns, said supporting means including means for insulating each contact member from each adjacent contact member, superposed conducting strips, extending laterally between the groups, connecting one member of each pair of any group to the corresponding member of each other group, and separate means for each group of columns for closing and opening the pairs of contact members thereof.

3. In an electrical contacting device, pairs of contact members and means supporting them in a row containing similar successive groups of adjacent pairs, said supporting means including means for insulating each contact member from each adjacent contact member, superposed conducting strips extending along the row corresponding respectively to the pairs of contact members in any group, each such strip being joined directly to one contact member of each pair to which it corresponds, and separate means for each group for opening and closing the respective pairs of contact members thereof.

4. In an electrical contacting device, pairs of contact members and means supporting them in rows and columns intersecting each other, the columns comprising similar groups of adjacent columns, said supporting means including means for insulating each contact member from each adjacent contact member, superposed groups of conducting strips extending along the rows and corresponding respectively thereto, the strips in any group of strips corresponding respectively to the pairs of contacts disposed in the corresponding row in any said group of columns, each such strip being connected directly to one contact member of each pair to which it corresponds, and separate means for each group of columns for opening and closing the respective pairs of contact members thereof.

5. In a gang of multi-contact relays, a mounting plate, relays including respective operating elements mounted in a row on one side of the plate closely adjacent to each other, pairs of contact members and means mounting them on the opposite side of the plate in rows extending along the row of relays and in columns intersecting such rows, similar groups of such columns appearing opposite the operating elements respectively and forming a part of the respective relays, said operating elements comprising independent electrically controlled means for opening and closing the pairs of contact members of their respective relays, conducting strips included in the means for mounting the contact pairs, such strips corresponding respectively to the contact pairs of any relay, each strip being joined electrically to one contact of the pair to which it corresponds in each relay, and insulating means included in said mounting means and interspersed between the conducting strips to maintain each contact member insulated from each other contact member to which it is not connected by a said conducting strip.

6. A contact bank built up of similar successive groups of flat strips laid upon each other and fastened together, each said group of strips including an insulating strip having a row of individual transverse contact elements fixed over-

lappingly therewith comprising similar groups of contact elements succeeding each other along the strip, each such element having a terminal portion extending rearwardly from the bank and a contact portion extending forwardly from the bank, each said group of strips including conducting strips corresponding respectively to the individual contact elements in any said group thereof, each conducting strip having multiplied contact members fixed thereto and extending forwardly therefrom into operative relationship to the respective corresponding individual contact elements carried by the said insulating strip of its group of strips, the said contact members fixed with any said conducting strip being equal in number to the number of said groups of individual elements on a strip thereof, the contact members on the conducting strips in any said group of strips being staggered in location from strip to strip in accordance with the different correspondence at the conducting strips to the individual contact elements along a strip thereof, and insulating separator strips interspersed with the foregoing strips for maintaining the conducting strips insulated from each other and from the individual members carried by the insulating strips.

7. In a contact bank, superposed flat strips comprising successive groups of strips, each said group including a strip having a row of individual transverse contact elements fixed overlappingly therewith and extending forwardly from the bank, the individual members comprising similar groups of contact elements succeeding each other along the strip, each said group of strips including conducting strips corresponding respectively to the individual elements in any said group thereof on a strip, each conducting strip having multiplied contact members fixed thereto and extending forwardly therefrom into operative relationship to the respective corresponding individual elements carried by the insulating strip of its group of strips, the multiplied members in any group of strips being staggered in location from strip to strip in accordance with the different correspondence of the conducting strips to the individual strips, and means included in the bank for maintaining the conducting strips insulated from each other and from the individual members carried by the insulating strips.

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