

[54] **MULTIPLE CONTACT ELECTRICAL CONNECTOR**

[75] Inventors: **Kent G. Blackman**, Sycamore;
Eugene R. Hrdlicka, Elmwood Park,
both of Ill.

[73] Assignee: **GTE Automatic Electric
Laboratories, Inc.**, Northlake, Ill.

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[58] Field of Search **339/92 M, 174, 176 M,
339/176 MP, 220, 221, 195 M; 29/629**

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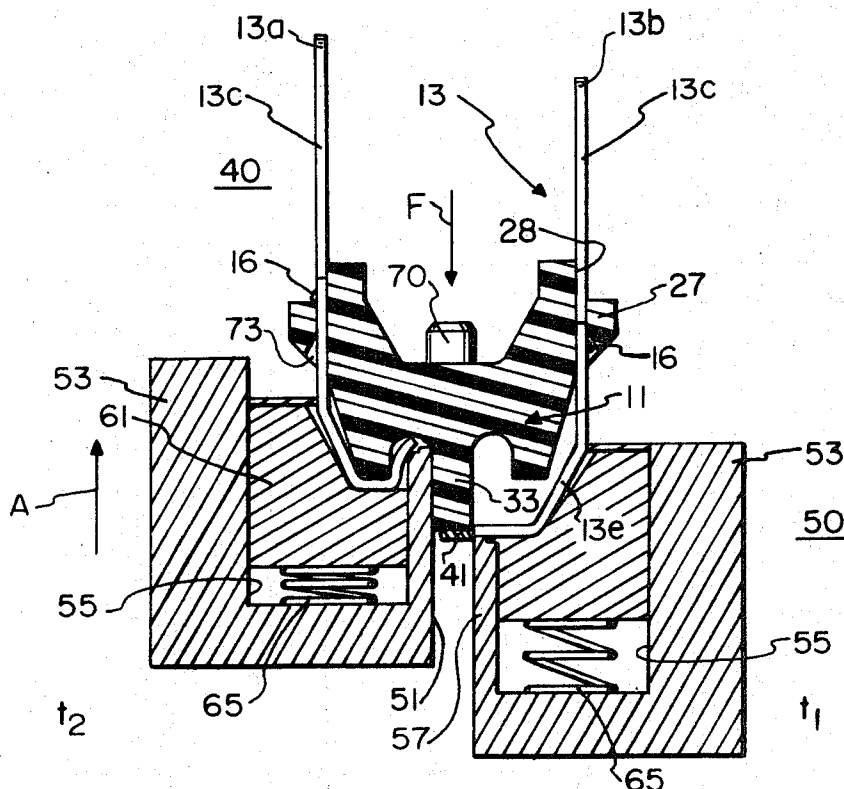
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Primary Examiner—Marvin A. Champion
Assistant Examiner—Lawrence J. Staab
Attorney—K. Mullerheim, Lester N. Arnold et al.

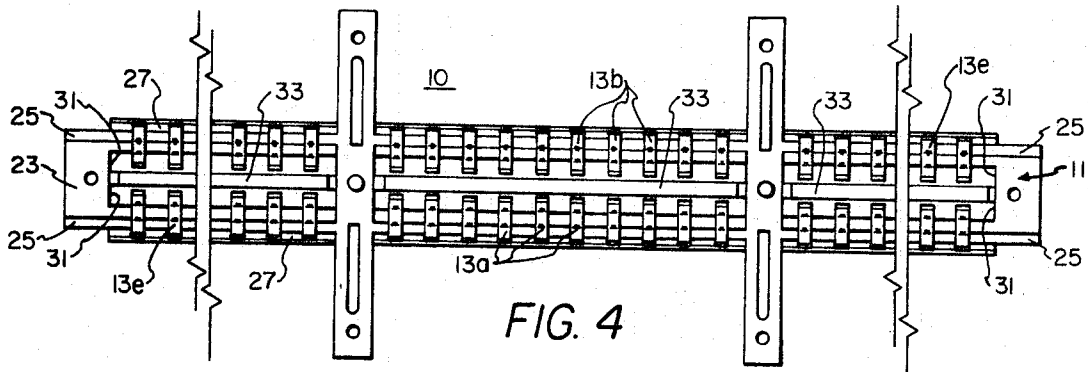
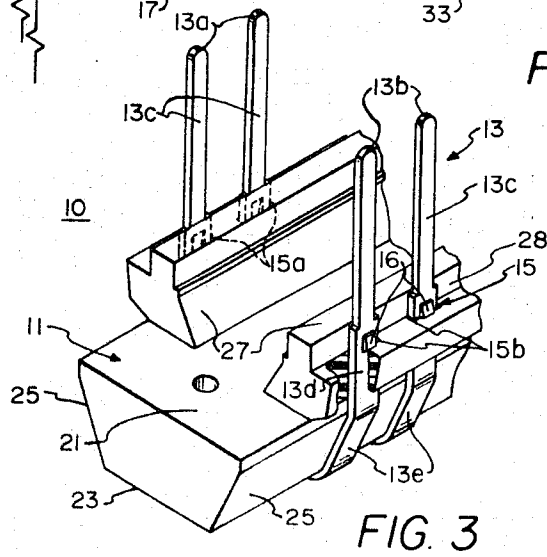
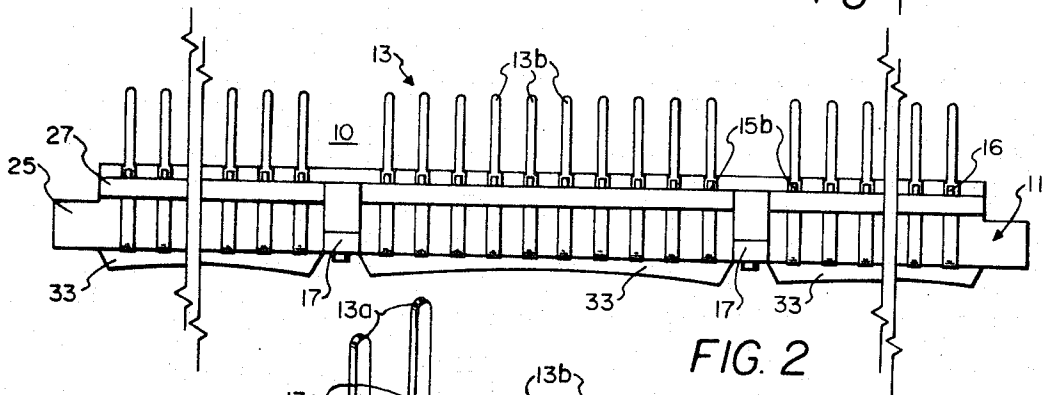
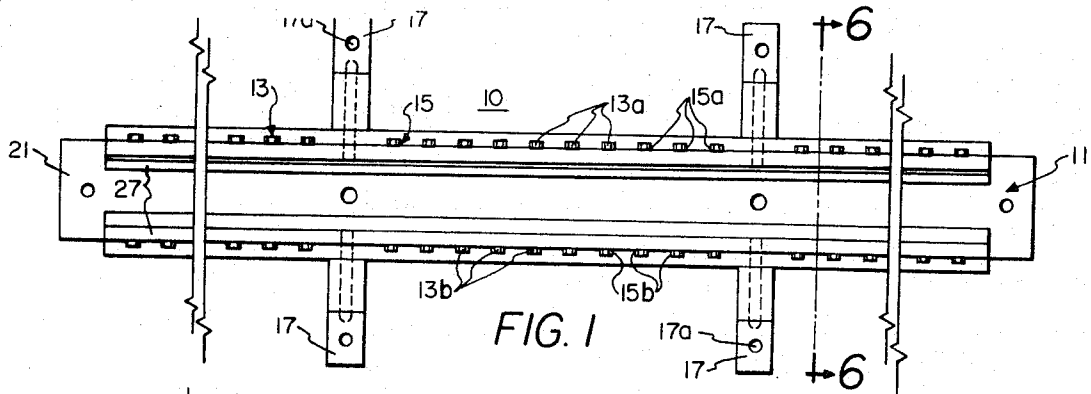
[57] **ABSTRACT**

A dielectric contact support body including a plurality of separate contact blades conveniently arranged in two opposite and spaced rows and mounted on the support body through reception within associated apertures and through wedge fitting reception thereof within associated recesses of the support body. In a preferred method of manufacture, the support body is formed with a pair of recesses separated by a shoulder member and the contact blades are formed into a U-shaped matrix having a linking web portion disposed in the bight section thereof. The contact blade matrix is driven in a controlled manner onto the support body so as to insert the leg sections of the matrix through their associated apertures and to sever the linking web portion through its engagement with the shoulder member of the support body. The severed end portions of the blades are then force fitted into their associated recesses.

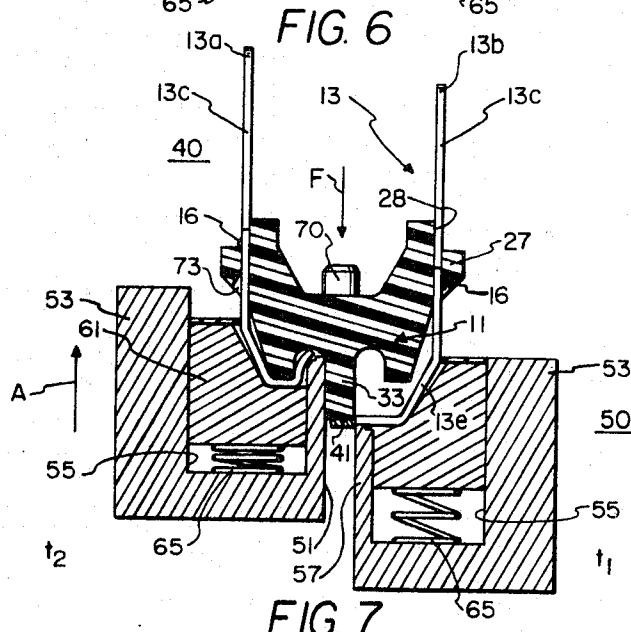
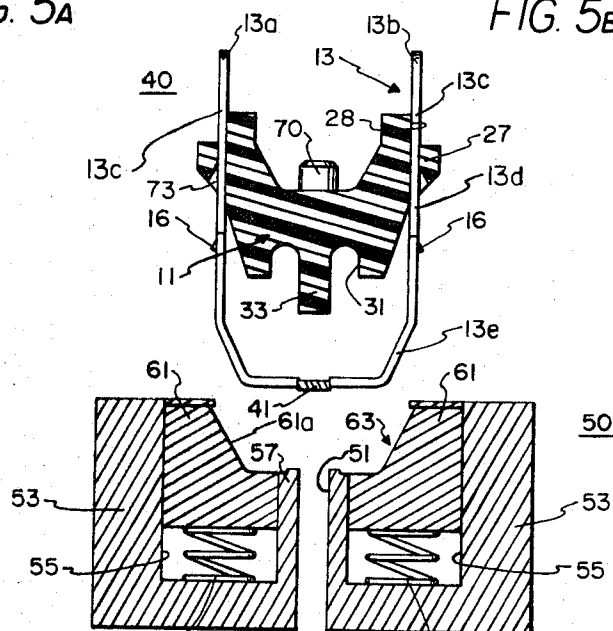
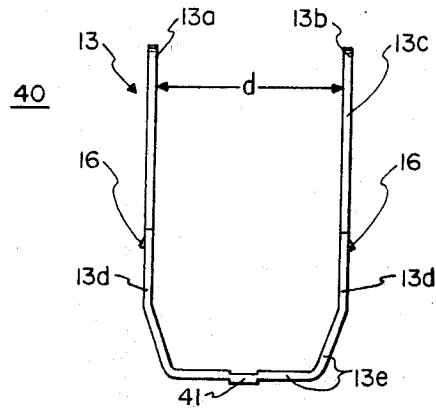
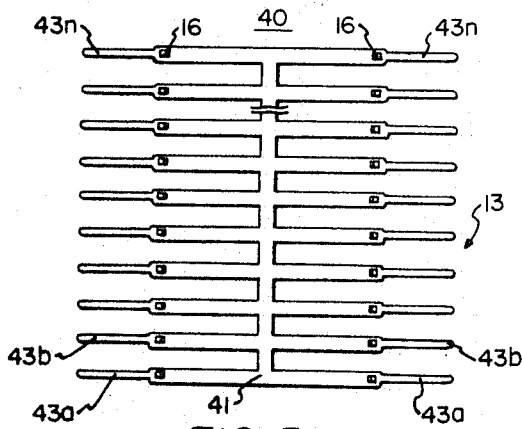
1 Claim, 8 Drawing Figures



SHEET 1 OF 2



SHEET 2 OF 2



MULTIPLE CONTACT ELECTRICAL CONNECTOR

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates generally to multiple contact electrical connectors, and more particularly relates to the manner in which the securement of separate contact blades to a dielectric support body is obtained and to a method for manufacturing such connectors.

2. Description of the Prior Art

It is important to construct multiple contact connectors or terminals so as to achieve uniform spacing and alignment of individual contact blades. Also contact blades must be tightly secured to the insulating terminal block so as to provide the integrity of electrical connections to the contact surfaces thereof. It is also important to provide means for attaching the contact blades whereby an individual blade may be easily and rapidly replaced in the shop or in the field with a minimum use of tools and expenditure of time. Heretofore, it has been conventional to employ fastening devices of various types, such as screws, rivets and/or clamps, to secure the contact blades to the terminal block. The terminal blocks were required to be provided with numerous taps and holes to accommodate these various types of fastening devices, and to have the surfaces upon which the contact blades were to be mounted constructed with very close tolerances for providing a secure fit of the contact blades thereon. It is now possible with the present invention to secure certain advantages in both the configuration of the multiple contact connector itself and the method of manufacture therefor.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide a dielectric contact support body or terminal block on which a large number of separate contact blades are easily maintained in proper spacing and alignment and which can be firmly mounted without the use of discrete fastening devices.

It is another object of the invention to provide a contact support body relatively simple in its structural features and which supports the contact blades in a manner so as to present maximum access to the electrical contact surface areas thereof.

It is still another object of the invention to provide a method for manufacturing multiple contact connectors having large numbers of individual contact blades mounted thereon through utilizing a number of such blades arranged in a self-supporting matrix to be mounted onto the support body through the interaction of a single assembly tool with the support body, thus reducing the number of and complexity of the processing steps required to construct a completed connector.

In a preferred embodiment, a multiple contact electrical connector is comprised of a dielectric contact support body and a plurality of separate electrical contact blades conveniently mounted on the support body in at least two parallel spaced rows. The dielectric support body includes at least two rows of spaced apertures for accommodating the passage therethrough of the two rows of contact blades and a raised shoulder member on one surface of the support body intermediately disposed with respect to the rows of apertures. Further, the support body includes contact shaping re-

cesses at least two of which are generally separated by the shoulder portion. The contact blades of each row have free end portions extending outwardly from the support body in one direction, respectively, and intermediate portions extending through the associated apertures in the support body. Further, opposite end portions of the contact blades extend along an exterior surface of the support body in a direction generally opposite from the one direction. The extreme end portions of the opposite end portions of the contact blades are positioned with a force fit into at least one of the contact shaping recesses to tightly secure each of the contact blades to the support body. Further, the intermediate portions of the contact blades include protruding tabs thereon which are drawn into engagement with the sides of the support body which define the apertures when the contact blades are forced into the associated recesses.

These and other objects of the invention will become immediately apparent and obvious to those skilled in the pertinent art upon referring to the following description in connection with the accompanying drawings, of which:

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a top plan view of a multiple contact connector constructed in accordance with the principles of the present invention and showing two opposed and spaced rows of contacts mounted upon a suitable support body of insulating material broken near its end portions for reducing its length;

FIG. 2 is a side plan view of the multiple contact connector of FIG. 1;

FIG. 3 is a top perspective view of an end portion of the multiple contact connector of FIGS. 1 and 2;

FIG. 4 is a bottom plan view of the multiple contact connector of FIG. 1 and 2;

FIG. 5A is a top plan view of a planar configuration of a matrix of electrical contact blades suitable for mounting on the multiple contact connector of the present invention;

FIG. 5B is an end view of the matrix of electrical contact blades of FIG. 5A subsequent to their formation in a desired U-shaped pattern;

FIG. 6 is a combined cross-sectional view showing the contact support body of FIG. 1 taken generally along the line 6—6 thereof; the contact blade matrix of FIG. 5B partially inserted thereon; and a punch device useful in the assembly of the contact blades onto the support body; and

FIG. 7 is a cross-sectional view similar to FIG. 6 but showing the parts in different stages of their engaged position.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Now referring generally to FIGS. 1-4 of the drawing, there is shown a multiple contact electrical connector 10 comprised of a dielectric support body 11 and a plurality of electrical contact blades 13 mounted to the support body 11 in a convenient arrangement of two opposed and spaced rows 13a and 13b. The support body 11 is provided in a relatively elongated configuration which is convenient to accommodate the two rows of contact blades 13a and 13b. It is quite possible to provide more than a single row of contact blades on each side of the longitudinal axis of the support body

11 as for example double or triple rows of contact blades could be provided on each side of the longitudinal axis in various patterns of alignment. However, the principles and advantages of the invention can be well understood with reference to the displayed embodiment of the connector 10.

The support body 11 is typically comprised of any suitable dielectric or insulating material that is commonly used in constructing electrical connector bodies and includes a plurality of apertures 15 corresponding to the number of contact blades 13. These apertures 15 are also conveniently arranged in two opposed and spaced rows 15a and 15b by virtue of their having the contact blades 13 insertedly received therethrough in mounting the contact blades to the support body 11. In order to provide a convenient means by which to mount the support body 11 to any selected panel board or other substrate (not shown), the support body 11 is provided with a number of mounting posts 17 arranged in pairs as shown in FIGS. 1-2 and 4. The posts 17 are then provided with suitable openings 17a in their outer extremities through which standard fastening devices could be inserted into an adjacent panel board. Other suitable mounting means could be provided and such features do not constitute a pertinent part of this invention.

It can be seen in FIGS. 1-4 that the contact blades 13 of the two rows of contact blades 13a and 13b are aligned so as to present a number of pairs of opposed and spaced contact blades 13. Each pair of contact blades 13 lies in a plane transverse to the longitudinal axis of the support body 11 and is uniformly spaced from adjacent pairs of contact blades 13. It is to be noted that the particular alignment of contact blades 13 and their uniform spacing are largely design choices and serve the purpose of enhancing the economy of manufacturing the connector 10 because of the adaptability of the design to automatic wiring apparatus and methods.

The overall design of the connector 10 is guided by the particular application of the connector which is to form a part of a well known connector jack assembly used in telecommunication networks. The connector assembly employs a mating connector socket (not shown) to receive the support body 11 in a plug-in fashion while permitting the contact blades 13 to extend freely for the attachment of wire leads thereto. In a popular design for the plug-in portion of such connectors, the connector 10 utilizes a bar-shaped or four-sided support body 11 having a top wall or surface 21, a bottom wall or surface 23 and two opposed side walls or surfaces 25 when considering the orientation of the support body 11 in FIG. 3.

Since each of the contact blades 13 are required to provide two electrical connections, i.e., one to a corresponding contact in the mating connector socket and one to a wire lead, the contact blades 13 must provide maximum surface area for electrical contact. It is therefore particularly advantageous to provide two opposed and opposite ledge or shoulder portions 27 extending laterally along the outer edge portions of the top wall 21 of the support body 11. The ledges 27 include the multiple apertures 15, leaving approximately the entire side walls 25 unencumbered by structure which would prevent access to the contact blades 13. The ledges 27 further include wall faces 28, respectively, which are positioned adjacent the openings of the apertures 15 of

each of the rows of apertures 15a and 15b. The wall faces 28 provide additional support for the contact blades 13 through engagement with a surface portion of each of the blades.

Now considering the configuration of the contact blades 13, it can be seen that an individual contact blade is generally elongated and includes a free or first end portion 13c, an intermediate or central portion 13d and a second end portion 13e (FIG. 3). The second end portions 13e of the mounted contact blades 13 can be seen to extend along an associated side wall 25 and onto the bottom wall 23 of the support body 11 (FIG. 4). It is common to provide for the side walls 25 to converge at a selected slope toward the bottom wall 23 to facilitate the insertion of the connector 10 into spring-like contact jaws or outwardly diverging contact jaws of the mating connector socket. This pattern can be observed in FIG. 3 and greatly improves the electrical access to the contact blades 13 wherein the second end portions 13e comprise electrical contact surfaces or areas in addition to the free end portions 13c which also comprise electrical contact surfaces or areas suitable to permit multiple wire wraps or turns of separate wire leads (not shown) to be attached to each free end portion 13c.

In the manner of mounting the contact blades 13 to the support body 11, the contact blades are provided with protruding spring-like tabs 16, respectively, (most clearly seen in FIGS. 3, 5A and 5B) and the support body 11 is provided with a pair of contact shaping trough-like grooves or recesses 31 in the bottom wall 23. The recesses 31 extend at least the full length of an associated group of contact blades and receive the second end portions of an associated row of the contact blades 13 therein, respectively, in a wedge fitting fashion for capturing the contact blades 13 therein. The bottom wall 23 further includes a generally raised ridge or shoulder member 33 disposed laterally along the full length of the recesses 31 for electrically isolating the opposed rows of contacts 13a and 13b from each other. The raised shoulder member 33 also serves a novel purpose in the manufacture of the connector 10 as will be described more fully hereinafter.

It can be readily observed that the contact blades 13 are securely mounted on the support body 11 through the cooperation of the following several features. The contact blades 13 are initially positioned with respect to the support body 11 and to each other by their insertion through the apertures 15. Thereafter, the contact blades 13 are positioned within the apertures 15, respectively, through engagement of their tabs 16 with the sides of the ledges 27 which define the apertures 15 and the wedge fit of the blades within the recesses 31. It is apparent that the wedge fitting operates to tighten the tabs 16 against the sides of the apertures 15 opposite from the recesses 31. In this manner, the contact blades 13 are secured to the support body 11 of the connector 10 without the need of using separate fastening devices such as screws, rivets and/or clamps.

In a preferred method for manufacturing the connector 10, the contact support body 11 is suitably formed in the configuration previously discussed. In addition thereto, the raised shoulder member 33 is formed to present a relatively flat uppermost surface, as shown in FIG. 4, which is inclined slightly toward its central portion in an outward concave pattern, as clearly shown in FIG. 2. Next, a single group 40 of contact blades 13 is

formed, typically by a stamping operation from flat metal stock, in a coplanar matrix of a plurality of blades 13 extending oppositely from a common or linking web portion 41. in order to form the opposite and aligned pairs of contact blades 13 of FIGS. 1-4, the oppositely extending blades 13 in the matrix group 40 are also aligned in coaxial pairs of blades as is indicated by adjacent and parallel contact blade pairs 43a-43n in FIG. 5A, wherein the suffix *n* is representative of the selected number of blade pairs in a given matrix group. During the stamping operation, it is convenient to provide the contact blades 13 with the tabs 16 as well as to provide the particular geometry desired for the contact blades 13.

Next, the matrix group 40 of contact blades 13 has each of its blade pairs 43a-43n formed into a generally U-shaped pattern or configuration having the web portion 41 thereof disposed in the bight section of the configured matrix group 40. As is apparent from the drawing, the opening between the leg sections of the blade pairs 43a-43n, as indicated by reference character *d* of FIG. 5B, is determined by the distance between opposed pairs of apertures 15 on the support body 11. Additionally during the stamping operation, the linking web portion 41 is partially severed in its connection to the blade pairs 43a-43n for serving to lessen the amount of shearing force required to completely sever or disconnect the blade pairs 43a-43n during a subsequent step. This condition is indicated in FIG. 5B by the offset configuration of web portion 41. Also, obviously, the concave configuration of the shoulder member 33 serves to lessen the amount of shearing force required at any given time to sever the contact blades 13 from the web portion 41, i.e., to distribute the total shearing force with respect to time.

In FIGS. 6 and 7, there is shown a punch device 50 useful in the assembly of the contact blades 13 onto the support body 11 which device is shown in cross-section only and thus would appear to be two separate reverse or mirror-image pieces of structure due to a central opening 51 contained axially thereof a substantial portion of the length of the device 50. However, the punch device 50 can be thought of as comprising a single unit structure having two exterior supporting walls 53, two internal grooves or channels 55, and two opposed interior supporting walls 57 which define the opening 51 in the device 50.

Additionally, the punch device 50 is provided with two movable channel members 61 insertedly received in the channels 55, respectively, and which have inclined or beveled surfaces 61a along an upper interior portion thereof. The surfaces 61a of one channel member 61 are likewise the reverse or mirror-image of those of the other channel member and cooperate to form a trough 63 within which to complementarily receive the bight section of the configured matrix group 40. The channel members 61 are movably or slidably mounted within the channels 55 on coil springs 65, respectively, which springs are compressible under force of the intended engagement between the channel members 61 with the configured matrix group 40 and the support body 11.

In accordance with the preferred method for manufacturing the connector 10, the support body 11, the configured matrix group 40 of contact blades 13, and the punch device 50 are formed into the respective configurations heretofore described. Next, a single ma-

trix group 40 (or, a number of matrix groups 40 depending upon the longitudinal length of the support body 11 and the punch device 50) is selectively positioned with respect to the support body 11 so as to accept the support body 11 within the opening of the U-pattern and with the leg sections of the contact blades 13 aligned for reception through the apertures 15 of the support body 11.

Similarly, the matrix group 40 is aligned with respect to the punch device 50 to permit the bight section of the U-pattern to be received within the trough 63. This positioning will by virtue of the symmetry of parts align the web portion 41 to be engaged by the raised shoulder member 33, and further will align the web portion 41 to overlie the opening 51 in the punch device 50.

It is a suggested technique for which alternatives can be readily substituted to achieve the proper positioning of the matrix group 40 by initially inserting the free end portions 13c of the contact blades 13 through the respective apertures 15 much in the manner as indicated in FIG. 6. This would decrease the likelihood of damage to the contact blades 13 caused by some blades being bent due to misalignment with their associated apertures 15, as well as lessen the criticality of aligning the respective parts prior to the driving step now to be set forth.

Next, the support body 11, the punch device 50 and the configured matrix group 40 of contact blades 13 are driven into respective engagement as by applying a force *F* (FIG. 7) to a drive post 70 on the support body 11 when supporting the punch device 50 on a non-yielding base. Alternatively, the post 70 could be used to hold the support body 11 stationary while the punch device is moved in the direction of the arrow *A* in FIG. 7. The resulting engagement of parts is similar to that shown in FIG. 7 with the exception that the movement between the respective parts is shown in two different stages of its completion. On the right-half side of FIG. 7, the engagement is shown at a time *t*₁ wherein the web portion 41 has instantaneously engaged the shoulder member 33 of the support body 11 and the second end portions 13e of the contact blades 13 are received within the trough 63. Likewise, the spring-like tabs 16 are just before being inserted through the apertures 15. Desirably, the underside entrances to the apertures 15 can be tapered in an outwardly diverging pattern as indicated at 73 in FIG. 7 in order to depress and guide the respective tabs 16 more evenly into the apertures 15.

Now on the left-hand side of FIG. 7, the engagement of parts is shown at a subsequent time *t*₂ wherein the second end portions 13e of the contact blades 13 have now been severed from the web portion 41 by the insertion of the shoulder member 33 into the opening 51 of the punch device 50. Also, the two interior support walls 57 have been received into the contact shaping recesses 31 by virtue of the movement of the channel members 61 into their compressed position to expose the uppermost portions of the interior support walls 57. These uppermost portions of the walls 57 comprise in effect protuberant members when the channel members 61 are depressed and must therefore be shaped of a complementary nature to the recesses 31 in order to permit their reception within the same.

At time *t*₂, the tabs 16 have cleared their travel through the apertures 15 wherein they were temporarily compressed, and have returned to their original protruding position with respect to the plane of the associ-

ated row of contact blades 13a or 13b. This protrusion is designed to prevent the return of the contact blades 13 in a direction opposite to the direction of the arrow A of FIG. 7. Approximately simultaneous with the clearing of the tabs 16 through the apertures 15, the severed second end portions 13e of the contact blades are being inserted into the recesses 31. The recesses 31 are designed so as to tightly receive the contact end portions 3e in a wedge fitting fashion, thus drawing the contact blades 13 tightly across the side walls 25 of the support body 11 against the anchor point formed by the tabs 16 being pulled against the sides of the ledges 27 defining the apertures 15.

Therefore, with the withdrawal of the support body 11 and contact blades 13 from engagement with the punch device 50, the web portion 41 has been severed from the matrix group 40 to yield a plurality of individual and separate contact blades 13. Also, these contact blades have been securely mounted to the specially designed support body 11 through cooperation between the tabs 16 and wedge fit of the contact blades 13 within the recesses 31. It is to be noted that the punch device 50 has been configured to accomplish the functions of inserting the contact blades 13 through the apertures 15, severing the blades 13 from their matrix group 40 and wedge fitting the blades 13 into the recesses 31. However, these functions can also be accomplished by other configurations of tool devices, e.g., the contact matrix group 40 could be mounted in the field with a pair of common needle-nose pliers, and the Applicants do not intend for the scope or application of the invention to be limited to the displayed configuration of the punch device 50.

Further, this invention has been described with reference to a preferred embodiment and various other equivalent and equally useful configurations could no doubt be readily substituted by the skilled practitioner after becoming knowledgeable of the principles and rudiments of the present invention. It is therefore the intent of the Applicants to cover these alternative embodiments through the following claims, to wit:

We claim:

1. An electrical connector structure of the multiple contact type comprising an elongated dielectric contact support body having a top wall, bottom wall and a pair of sidewalls and including a pair of contact shaping recesses extending lengthwise of said bottom wall and two rows of oppositely disposed electrical contact blades positioned on said contact support body generally perpendicular to said elongated dimension thereof, said contact blades including first end portions protruding outwardly from said support body and second end portions secured within said pair of recesses, respectively, the improvement comprising a raised shoulder member disposed intermediately of said pair of recesses and including a pair of edge portions disposed substantially adjacent to said pair of recesses for use in severing said contact blades to an appropriate length, said raised shoulder member further having a relatively flat lowermost surface area being slightly concave toward its central portion when viewed in a direction perpendicular to one of said sidewalls for use in distributing the shear forces present during a substantially simultaneous severing of a plurality of said contact blades.

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