

[54] **CONNECTOR BLOCK AND METHOD OF MAKING THE SAME**

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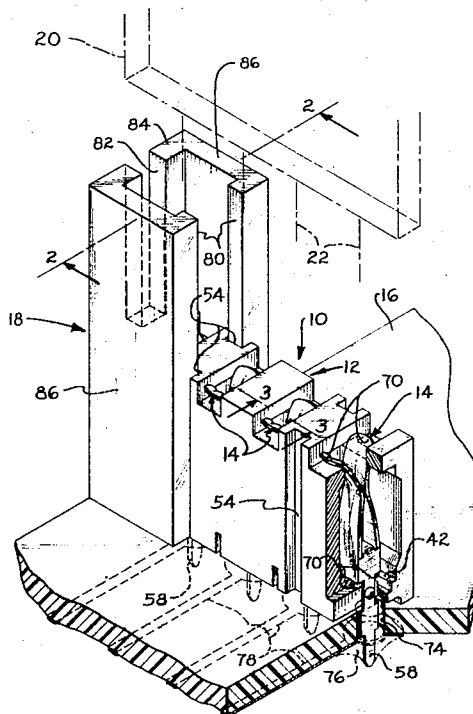
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[57]

ABSTRACT

A connector block formed from an extruded hollow insulating body of uniform cross section having grooves in the sides of the body at selected locations along its length and terminals inserted into the body through certain of the grooves. Contacts are inserted through grooves to establish electrical connections with the terminals in the body and portions of the terminals extend from the body for establishing electrical connections with circuitry on the board.

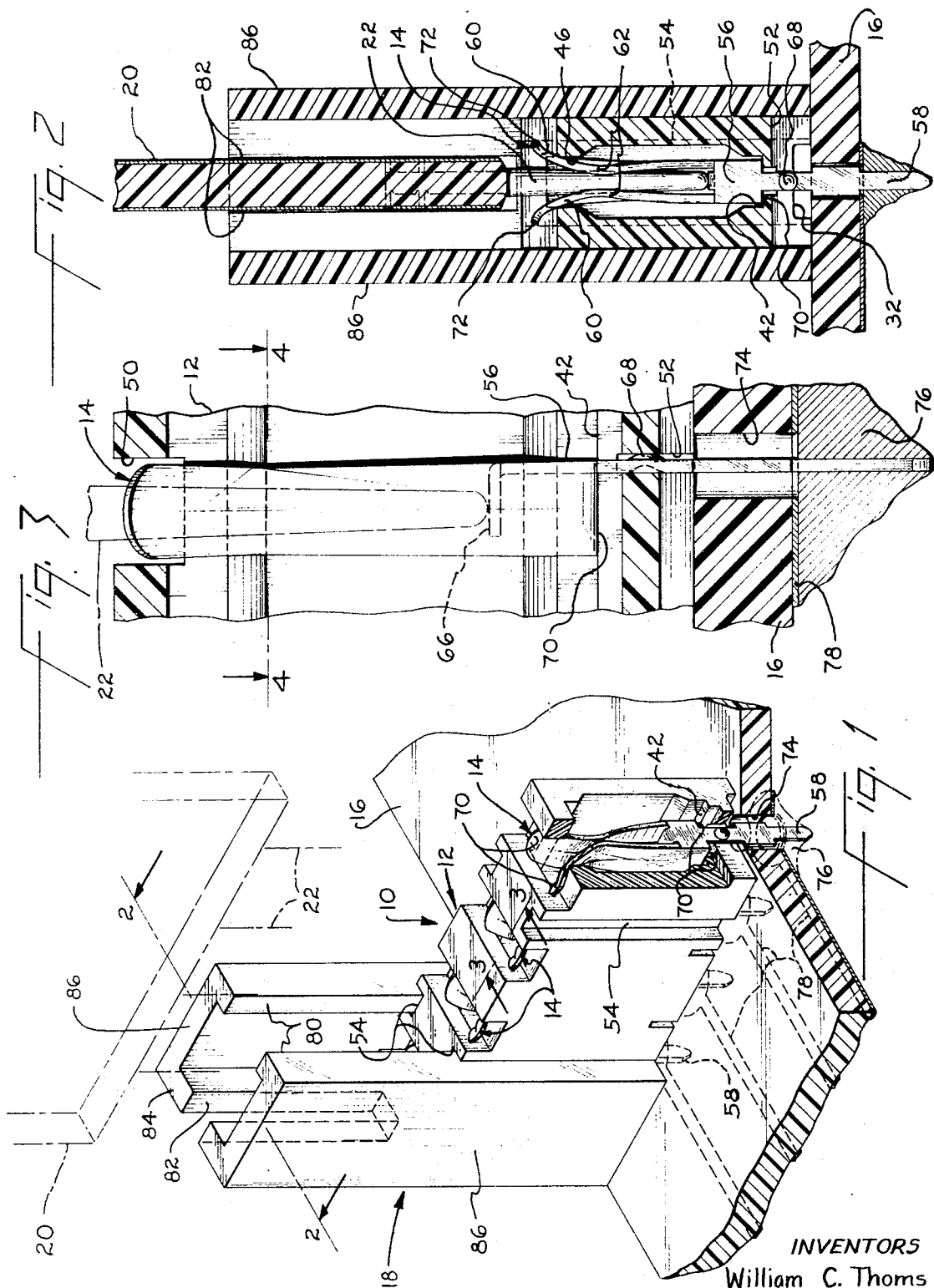
10 Claims, 7 Drawing Figures



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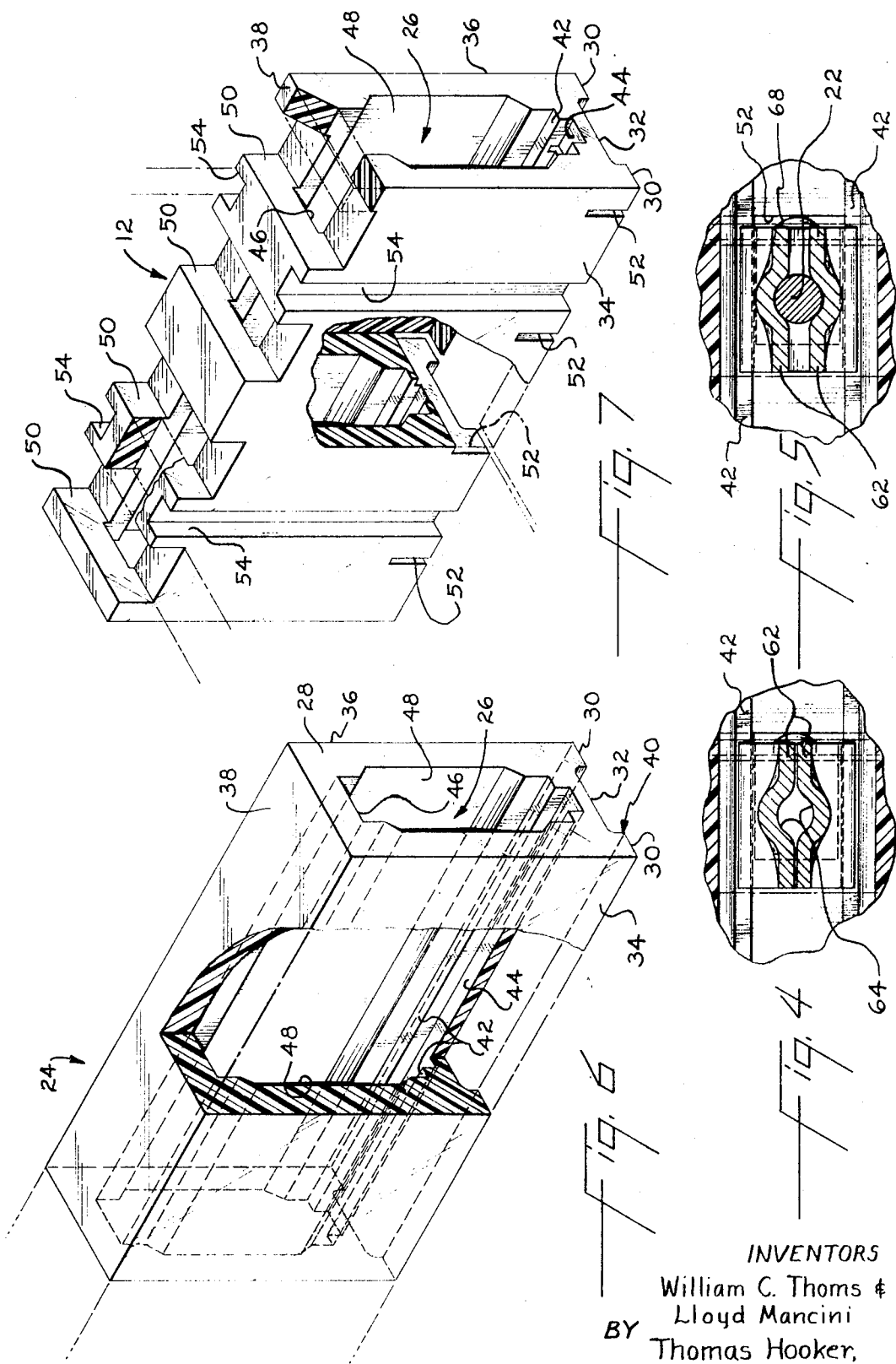


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CONNECTOR BLOCK AND METHOD OF MAKING THE SAME

Conventional connector blocks utilize molded plastic bodies for supporting the terminals. This type of insulating body is expensive since it requires that a separate mold be made for each connector block. It is not feasible to modify a mold so that it may be used to make a modification of the connector block for which it was originally intended. In addition to the cost of the conventional connector block mold, the preparation of the mold is time consuming so that it is not possible to start up production upon the decision to make a connector block of a given type.

The invention relates to an improved connector block and the method of making the same in which the plastic insulating body is formed from a segment of an indefinite length of hollow extruded plastic of uniform cross section. The plastic extrusion is cut into segments of the proper length required for a specific connector block and an appropriate number of grooves are formed in the sides of the segments to permit the insertion of terminals into the segments at the desired spacing along the length of the segments.

By the use of this type of connector block and method for making the same, it is possible to provide a stock connector block insulator from which a variety of connector blocks may be formed having different lengths and different terminal spacings. Because the extruded plastic material is uniform in cross section, the longitudinal spacing of the terminal is determined by the location at which the terminal related grooves are formed in the side walls of the plastic. The terminals may be spaced as close together or as far apart as is required by the particular application. The extruded plastic connector body enables the manufacturer to make up connector blocks having any given number of terminals from a common stock of extruded plastic.

Because of the flexibility of block length and terminal spacing afforded by the disclosed connector block and method, the manufacturer can rapidly and with minimum expense design and manufacture a connector block to the customer's specifications using the common extruded plastic body. This flexibility of manufacture represents a marked decrease in expense, time and preparation over the conventional molded plastic connector block. The extruded plastic stock may be shipped to manufacturing facilities away from the extrusion facility, thereby reducing over head and increasing manufacturing flexibility. While the invention is particularly useful in the manufacture of relatively low volume connector block orders, it may be used in high volume manufacture.

Other objects and features of the invention will become apparent as the description proceeds, especially when taken in conjunction with the accompanying drawings illustrating the invention, of which there are two sheets.

IN THE DRAWINGS

FIG. 1 is a partially broken away perspective view of a connector block according to the invention;

FIG. 2 is a sectional view taken along line 2—2 of FIG. 1;

FIG. 3 is a sectional view taken along line 3—3 of FIG. 1;

FIG. 4 is a sectional view taken along line 4—4 of FIG. 3;

FIG. 5 is a view like that of FIG. 4 illustrating a contact inserted between the terminal contacts;

FIG. 6 is a perspective view of a segment of an indefinite length of extruded plastic body stock; and

FIG. 7 is a perspective view like that of FIG. 6 illustrating the segment after grooves have been formed in it and prior to the insertion of terminals.

Connector block 10 illustrated in FIG. 1 includes an elongate insulating body 12 with a number of terminals 14 confined therein at spaced locations along the length of the body. The block rests upon the top of a circuit board support 16 with portions of the terminals extending through holes in the circuit board for the establishment of solder connections with printed circuitry on the bottom of the board. A daughter board guide and support 18 may be provided at each end of block 10 in

order to align daughter board 20 during movement of the daughter board toward block 10 to position contacts 22 in the block in electrical connection with terminals 14. Only one support 18 is illustrated.

The insulating body 12 is formed from a segment or tube 24 of an indefinite length of extruded plastic material or stock as illustrated in FIG. 6. The segment is hollow having an interior opening 26 which extends along its longitudinal axis. As illustrated in FIG. 6, all cross sections of segment 24 taken in planes perpendicular to the longitudinal axis are identical. The extrusion is provided with a pair of legs 30 on the side thereof which rests on circuit board 16 to define a relieved longitudinal channel 32. Generally the extruded segment is rectangular in cross section having a pair of opposite parallel sides 34 and 36, a top face 38 and a bottom face 40 defined by legs 30 and channel 32.

Interior opening or recess 26 is symmetrical to either side of a center line extending between faces 38 and 40 and includes a pair of stop surfaces 42 which extend longitudinally along the length of the segment 24. A channel 44 is provided between surfaces 42. Another channel 46 is provided at the top of recess 26 adjacent top 38. Recess side walls 48 extend between the top and bottom of the segment parallel to side walls 34 and 36.

As previously mentioned, segment 24 may be formed by an extrusion process in which case an indefinite length of plastic or other insulating material is formed having a cross section identical to that of segment 24. To form a connector block 10 having a given number of terminals located therein along the length of the block and a known overall length, a segment 24 of desired length is severed from the indefinite length of extruded material. The manufacture of the segment is completed by the formation of a number of grooves in the segment at desired locations along its length followed by the insertion of terminals 14 into the block. FIG. 7 illustrates segment 24 after the grooves have been formed in it. If it is desired, the grooves may be formed in a segment of extruded material prior to severing the segment from the length. It is obvious that the invention is not dependent upon whether or not the grooves are formed in the connector block segment prior to or after severing of the segment from the extruded length.

The connector block 10 illustrated in FIG. 1 is provided with four terminals 14 along the length thereof. The insulating body 12, shown in FIG. 7, is formed from segment 24 by providing a number of grooves in the segment body as hereinafter described. A pair of grooves 50 and 52 are formed in body 12 at each terminal location along the length of the body. Each groove 50 is formed in top face 38, extends between side walls 34 and 36 and has sufficient depth so that it intersects longitudinal channel 46 of recess 26. Grooves 50 are sufficiently wide so as to permit the insertion of terminals 14 therethrough into the interior 26 of the body.

Grooves 52 are formed in bottom surface 40 of block 12 and also extend between side walls 34 and 36. These grooves are narrower than grooves 50 and intersect longitudinal channel 44 below stop surfaces 42 as illustrated best in FIG. 7.

A pair of grooves 54 is formed in side walls 34 and 36 between the terminal grooves 50 and 52 nearest each end of the body. Grooves 54 extend from top surface 38 to bottom surface 40 and do not intersect recess 26. These grooves are used to mount the daughter board guide supports 18 to the connector block. If required, the ends of the body 12 may be formed to a desired shape.

All of the grooves 50, 52 and 54 which are formed in segment 24 in order to make body 12 may be formed by milling, broaching or other conventional means. In some applications it is contemplated that the body 12 may be formed from a segment 24 by drilling openings in the segment at desired locations rather than by forming grooves in the segment. Likewise, other methods may be utilized in order to provide the desired openings in the sides of the segment 24 in order to form a connector body 12, and it is not necessary that the openings be grooves as disclosed and described herein.

Terminals 14, as illustrated best in FIGS. 2 and 3, are preferably formed from sheet metal stock and include a flat body portion 56 having a prong or tail 58 extending away therefrom. A pair of leaf contacts or springs 60 are bent at a 90° angle to portion 56 and extend therefrom in a direction opposite to that of tail 58. Springs 60 include inwardly bent contact portions 62 which are recessed at 64, as illustrated in FIG. 4, in order to receive a contact 22 and form an electrical connection therewith. A contact stop 66 extends from portion 56 between springs 60 so as to prevent over-insertion of contact 22 into the block 10. A dimple 68 is formed in tail 58 to form a friction fit in groove 52. Shoulders 70, defined by the ends of springs 60 adjacent portion 56, abut stops 42 when the terminal is fully inserted into body 12. This relationship is best illustrated in FIGS. 1 and 2.

The terminals 14 are mounted in body 12 by insertion through the openings in terminal recess 26 defined by grooves 50. Each terminal is inserted through such an opening with the offset tail portion 58 extending through the adjacent narrow groove 52 in the opposite side of the body. As the terminal is pushed into the recess 26, shoulders 70 are brought into abutment with stops 42 and dimple 68 is wedged into the groove 52 to retain the terminal in the body by forming a tight friction fit with the groove. When fully inserted the divergent upper ends 72 of springs 60 extend into groove 50 but do not project outwardly of body 12. Ends 72 provide a lead in to facilitate insertion of contact 22 into the connector block 10.

After the terminals have been inserted into the body 12, the assembled connector block is mounted on the top surface of board 16 with the terminal tails 58 projecting through holes 74 formed through the board. The lower surface of board 16 is then soldered, typically by a wave soldering operation, so that reliable solder connections 76 are formed between tails 58 and printed circuitry 78 on the bottom of board 16. The channel 32 spaces bottom surface 40 above circuit board hole 74 so as to prevent the possibility of solder wicking between terminals during soldering.

Elongate generally U-shaped daughter board supports and guides 18 may be mounted on each end of connector block 10 on circuit board 16. Inwardly facing lips 80 on each guide 18 are fitted into the grooves 54 adjacent the ends of the block so that each guide surrounds an endmost terminal 14 in the block. An orientation slot 82 is formed in the guide side wall 84 between legs 86.

As the daughter board 20 carrying contacts 22 is moved toward connector block 10, the edges of the board are first inserted in the slots 82 of guides 18 so as to orient the daughter board relative to the connector block with each contact 22 positioned above its respective terminal 14 in the block. The daughter board is then moved toward the block so that contacts 22 are forced between springs 60 to spread the same and form electrical connections with contact receiving grooves 64 at contact area 62. This relationship is illustrated in FIG. 5. During insertion of the contacts 22 the upper ends 72 of springs 60 bottom on the side walls of channel 46 thereby assuring a desirable high contact pressure connection between the terminals and the contacts.

The fit between the terminals 14 and grooves 50 and 52 is open so that there is free circulation of air through the grooves and past the terminals. In this way heat generated by the flow of electricity between the terminals and the contacts 22 is freely dissipated. Circulation is also improved because air is free to circulate between adjacent terminals in the interior cavity 26 of the block. In the case where only one guide 18 is used, or where guides 18 are not used, air is also free to circulate through the open ends of the cavity.

While in the disclosed embodiment of the invention the terminals 14 are inserted into body 12 through the same opening in the body through which the contacts are inserted for mating with the terminals, it is not intended that the invention be limited to such a construction. The terminals may be inserted into the connector block through the opening for the terminal tail or even through a different opening in the block. It is in-

tended specifically that the invention include a connector block in which terminals are bottom loaded, that is one where the terminals are inserted through an opening in the bottom of the connector block and in which the daughter board contacts are inserted for mating with the terminals through an opening in the top of the connector block.

While a friction type connection is disclosed herein between the terminal and the connector block, obviously a conventional spring lance or other means may be used to confine a terminal in the connector block. The lance or detent may be formed in either the plastic body or in the terminal. In the case of a bottom loading connector block it will be useful to provide means to secure the connector block on the terminals after soldering of the terminal to the circuit board. Retention of the terminal in the connector block is not a problem in the disclosed block since the body 12 is positively held between terminal shoulders 70 and circuit board 16. In the case of the bottom loading connector block, however, the body is not positively confined between the board and part of the terminal so that a spring lance, detent or other means may be used to hold the block on the soldered terminals and thus prevent accidental removal of the block from the terminals.

In the disclosed connector block each opening in the block is associated with a single terminal. This need not be so, and obviously a single longitudinal slot may be formed in the insulating body in place of either of the slots 50 or 52.

While we have illustrated and described a preferred embodiment of our invention, it is understood that this is capable of modification, and we therefore do not wish to be limited to the precise details set forth, but desire to avail ourselves of such changes and alterations as fall within the purview of the following claims.

What we claim as our invention is:

1. The method of making a connector block comprising the steps of extruding an elongate plastic tube of indefinite length having a hollow interior extending the length thereof and a uniform generally rectangular cross section, severing a connector block body of desired longitudinal extent from said extruded tube, forming pairs of openings through the body at selected locations along the length of the body with each pair of openings including a contact receiving opening and a terminal opening, and inserting a terminal through one of each pair of openings into the interior of the body with a terminal disconnect contact portion aligned with a contact receiving opening for disconnect engagement with a contact lead inserted through such opening and a terminal connection portion extending outwardly of the body through the terminal opening.

2. The method of claim 1 including the step of inserting each terminal into the interior of the body through a contact receiving opening.

3. The method of claim 1 including the step of forming at least one of each pair of openings by providing grooves extending laterally across one longitudinally extending side wall of the body, the groove extending into the adjacent side walls and having a depth greater than the thickness of said side wall.

4. The method of claim 3 including the step of locating a portion of each terminal within a slot.

5. The method of making a connector block from an elongate tubelike open ended insulating body having a hollow interior extending the length thereof and a uniform rectangular cross section along the length thereof comprising the steps of forming openings through the thickness of the body at selected locations along the length of the body and then inserting terminals through the openings and into the hollow interior of the body with a contact portion of each terminal within the body aligned for disconnect engagement with a contact element inserted into the body through an opening and a connection portion of each terminal aligned for engagement with a circuit element.

6. The method of claim 5 in which the body is formed by the steps of extruding an elongate tubelike length of rectangular hollow insulating material and then severing a portion of the material from the length of material to form said body.

7. A connector block comprising an elongate integral open ended insulating tubular body having side walls defining a hollow interior cavity extending the length thereof, a number of pairs of openings formed through the side walls of said body at spaced locations along the length thereof, said body having a uniform cross section in planes perpendicular to the longitudinal axis thereof at locations away from said openings, each pair of openings including a contact receiving opening and a terminal opening, and a terminal positioned within said cavity adjacent each of said pairs of openings and having a terminal spring contact in alignment with said contact opening for establishing a disconnect electrical connection with a male contact inserted through said contact opening and a terminal connection portion extending through said terminal opening for establishing an electrical connection with a circuit element, one opening of each pair of openings being sufficiently large to permit movement of the terminal therethrough and into the interior cavity.

8. A connector block comprising an elongate and open ended plastic extrusion forming an insulating body, said body having a generally rectangular completely enclosed cross section and a hollow interior extending the length thereof and joining the open ends, openings formed through the walls of said body at intervals along the length thereof, the body having a uniform cross section away from said openings, and terminals within said interior of the body, a number of said openings defining entrance passages through which the terminals are inserted into the interior of the body, such passages having an areal extent sufficiently large to permit free movement of the terminals therethrough, each of said terminals including a contact portion for making a disconnect electrical

connection with a contact inserted into the body through an opening and a circuit element contact means extending from the body through an opening therein for establishing an electrical connection with a circuit element outside of the body.

9. A connector block as in claim 8 wherein each terminal is associated with a pair of openings in said body with said contact portion aligned for making a disconnect electrical connection with a contact inserted through a first opening of said pair and said circuit element contact means extending from the body through the second opening of a pair of openings.

10. A connector block comprising an elongate and open ended plastic extrusion forming an insulating body, said body having a generally rectangular cross section and a hollow interior extending the length thereof and joining the open ends, openings formed through the walls of said body at intervals along the length thereof, the body having a uniform cross section away from said openings, and terminals within said interior of the body, a number of said openings defining entrance passages through which the terminals are inserted into the interior of the body, such passages comprising grooves formed in one side of the body and extending laterally there across and into the adjacent sides, said grooves intersecting the interior of the body to form apertures having an areal extent sufficiently large to permit free movement of said terminals through said side of the body, each of said terminals including a contact portion for making a disconnect electrical connection with a contact inserted into the body through an opening and a circuit element contact means extending from the body through an opening therein for establishing an electrical connection with a circuit element outside of the body.

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