United States Patent

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[54] **ELECTRICAL WIRING CONNECTOR BLOCK**
10 Claims, 5 Drawing Figs.

[52] **U.S. Cl.** **339/176,** 339/49, 339/91, 339/276
[51] **Int. Cl.** **H01r 25/04,** H01r 13/54, H01r 5/08
[50] **Field of Search** ..... 339/17 LC, 17 LM, 17 L, 176 MP, 176 MF, 198, 198.1, 198.2, 206 P, 207 S, 210 M, 211, 217 S, 276 C, 276 T, 278 C, 75 M, 75 MP, 91, 49 R

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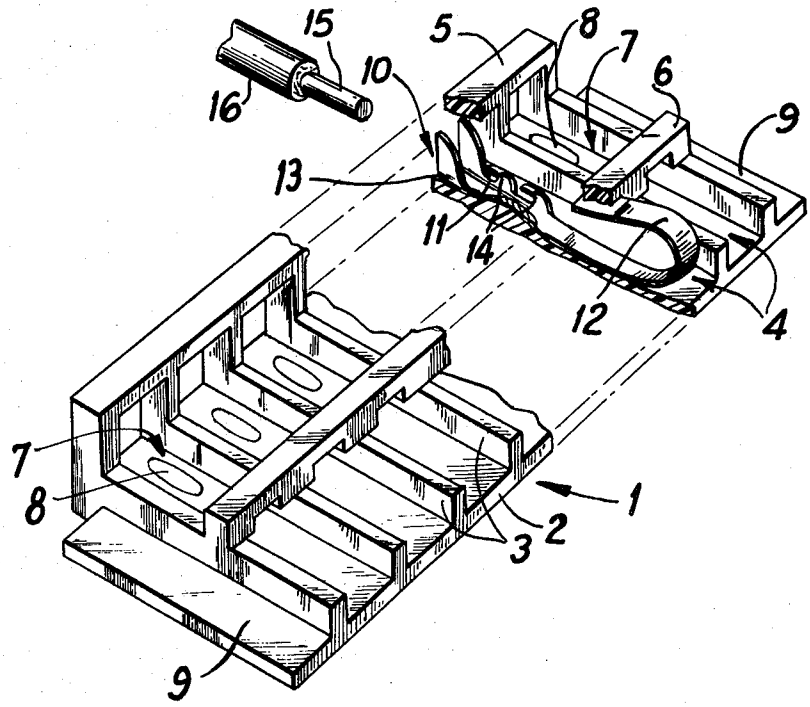
ABSTRACT: An improved electrical wiring connector block in which the terminal lugs are preassembled at the factory, the blocks having knoblike protrusions formed thereon shaped and located to serve as anvils for crimping the lug ends on electrical conductors inserted therein, one or more connector blocks then being inserted into an associated housing wherein matching lug contacts of the blocks are aligned for electrical contact with each other, with contact strips in the housing, or with terminal strips of a printed circuit board inserted in the housing.



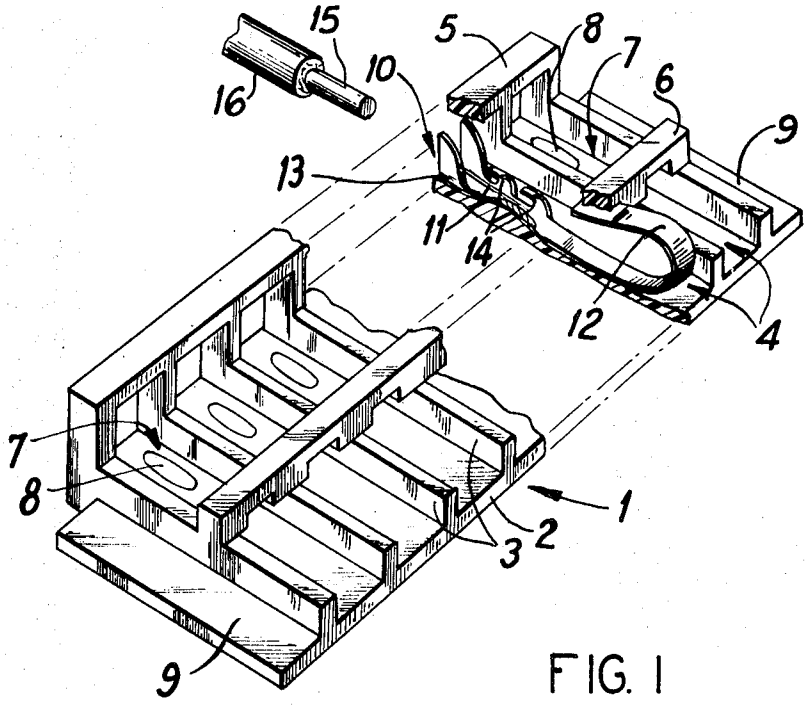


FIG. 1

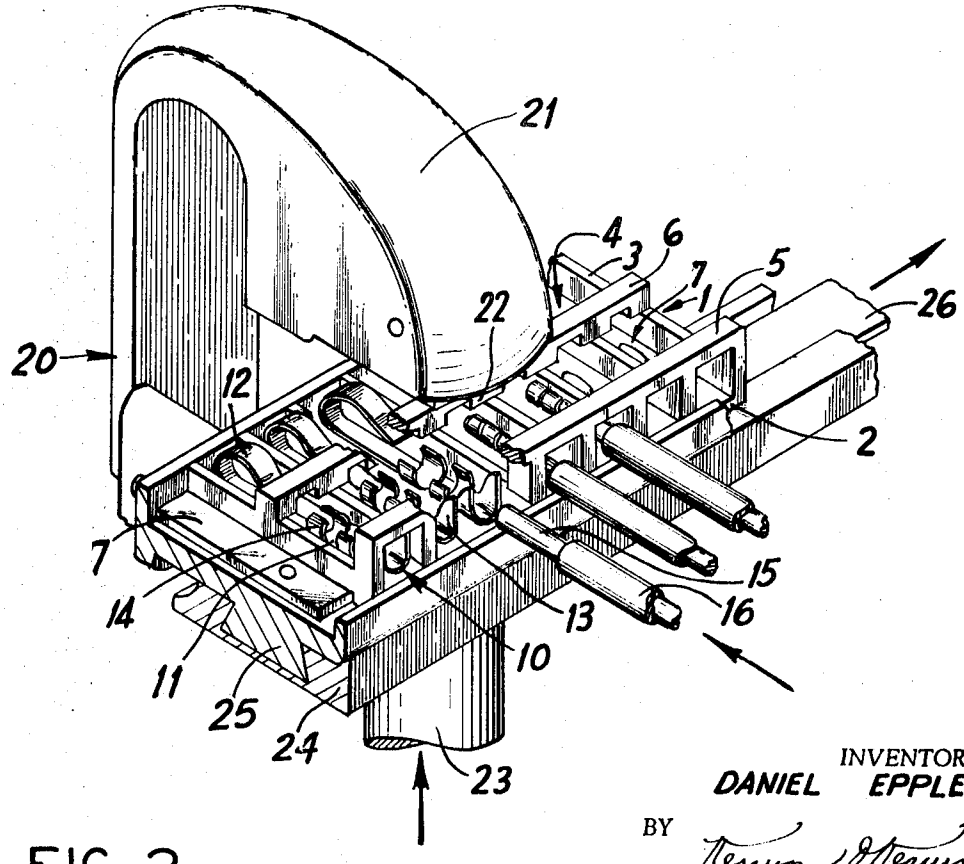


FIG. 2

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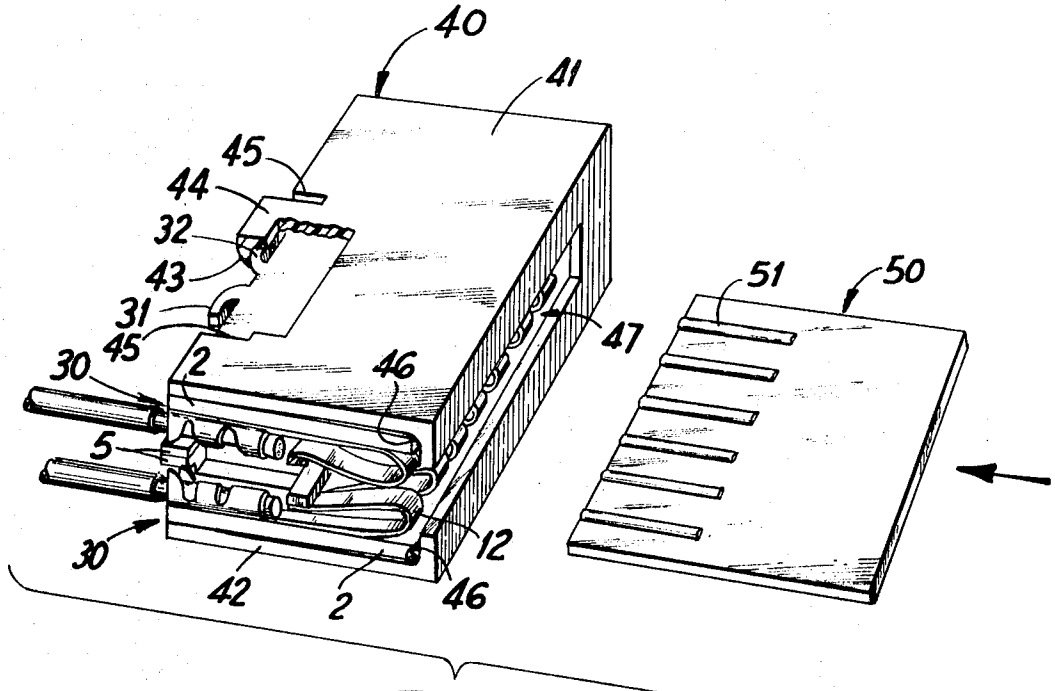

FIG. 3

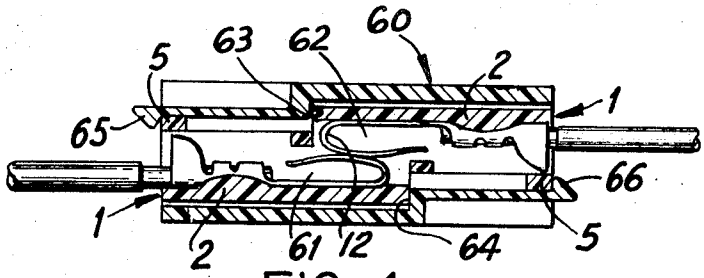

FIG. 4

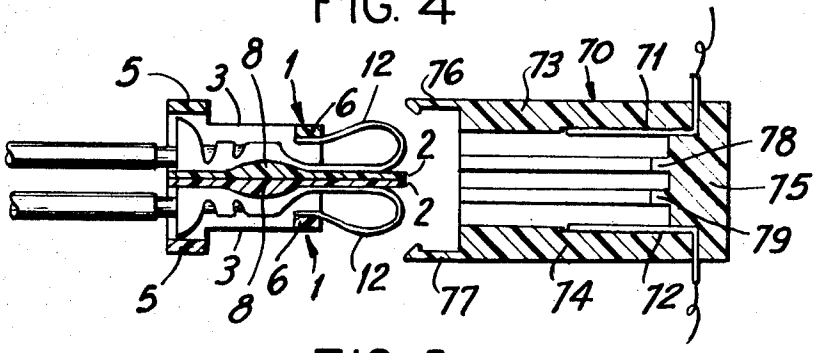

FIG. 5

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ELECTRICAL WIRING CONNECTOR BLOCK

This invention relates to improvements in electrical wiring connector blocks of the molded plastic type having a plurality of transverse cavities adapted to receive metal crimp-type terminal lugs and to molded plastic housings for holding these blocks after they have been assembled with terminal lugs and wires.

More particularly, this invention relates to connector blocks in which the terminal lugs are preassembled at the factory. These connector blocks have specially designed lug cavities which securely hold the terminal lugs in properly spaced relation, electrically insulated from each other, and also serve as novel anvil portions of lug crimping dies.

The connector blocks are adapted to be placed in a sliding tray compression tool, more fully described in my copending application, Ser. No. 814,348, filed Apr. 8, 1969, so that the lugs may be crimped about their respective electrical conductors without removal from the connector block.

Heretofore, it has been the practice to crimp each terminal lug about its conductor separately, using a plierlike crimping tool, and then to assemble it in the connector block. This procedure has several disadvantages. First, it is awkward for the operator to manipulate the lug, the wire conductor, and the crimping tool in proper relation to one another. Secondly, in holding the lug in his hand, the operator may get fingerprints on it which will subsequently cause surface corrosion with consequent increased surface resistance. This is particularly disadvantageous with spring-type terminal lugs which depend upon the pressure between mating tongues of the spring loops to provide good contact for the efficient transfer of electrical current.

A third disadvantage is that the lugs may become twisted, bent or even broken when installed in the connector block by hand. The lugs must then be removed from their conductors and replaced. More seriously, if damage to a lug is not detected, improper contact may result in later malfunction or failure of the equipment in which the connector block is installed.

Finally, the two-stage operation of first crimping each lug on its wire conductor and then installing the lug in the connector block is time consuming and requires trained operators.

By providing connector blocks preassembled with connector lugs under factory controlled conditions and which are designed for crimping the lugs on their respective conductors while mounted in the block, my invention overcomes all the aforementioned disadvantages. Factory preassembly avoids the dual problems of corrosion and damage to the lugs and, because the connector block is designed to mount in the sliding tray fixture of a plier-type manual compression tool, the operator will have his other hand free to guide the conductor wires into their proper lugs. The task of preparing a completely wired connector block is thus accomplished simply and rapidly.

After positioning one of my connector blocks in the sliding tray of such a tool, the operator merely inserts a conductor wire in the crimping end of the first lug and squeezes the handles together to effect the crimped connection. Upon release of the handles, the tray automatically steps one space over, ready to crimp the next lug. By continuing to insert conductors and squeeze the handles, the operator quickly completes the connector block wiring operation without once having to touch the lugs. As mentioned earlier, the structure and sequence of operation of such a sliding tray compression tool is more fully explained in my copending application Ser. No. 814,348, filed Apr. 8, 1969, entitled COMPRESSION TOOL FOR ELECTRICAL CONNECTORS.

Accordingly, it is an object of this invention to provide a connector block of novel design in which the connector lugs are preassembled at the factory.

It is another object of this invention to provide a connector block in which the lugs may be inserted by machine and held securely without screws or rivets, yet be capable of manual replacement in the field should the need arise.

It is further object of this invention to provide a connector block wherein the lug cavity comprises the anvil portion of a lug crimping die so that the preassembled lugs may be firmly crimped onto electrical conductors while in place in the connector block.

It is a further object of this invention to provide a connector block housing adapted to slidably receive connector blocks for effecting electrical contact between the lugs of one connector block and mating lugs of another connector block or mating contact strips positioned within the housing or fastened to the edge of a printed circuit board inserted therein.

These and other objects of the invention will become apparent from the following description taken in connection with the accompanying drawings, in which:

FIG. 1 is a cutaway perspective view of a connector block showing one lug assembled into position ready to receive a wire conductor.

FIG. 2 is a perspective view of a connector block mounted in a sliding tray compression tool.

FIG. 3 is a cutaway perspective view of a connector block housing adapted for use with a printed circuit board.

FIG. 4 is a sectional end view of an alternate form of connector block housing.

FIG. 5 is a sectional end view of another alternate form of connector block housing.

In these figures the same parts are identified by the same reference numeral in each figure.

Referring to FIG. 1, the connector block, designated generally by numeral 1, is an elongated, generally rectangular one-piece plastic molding. The plastic should be relatively hard and strong with good electrical insulating properties. I prefer ABS plastic or glass-filled plastic, but suitable equivalents may also be used.

Connector block 1 has a flat rectangular base 2 on which is mounted a plurality of transverse, equally spaced partitions 3 to form transverse lug-receiving cavities 4. A side yoke 5 and a center yoke 6 extend longitudinally across the tops of transverse partitions 3 along one side and generally down the center, respectively, of the connector block. The portion of each lug receiving cavity 4 between the two yokes 5 and 6, is designated the crimping cavity 7.

Important features of the invention are convex knoblike protrusions 8, integrally molded on base 1 within each crimping cavity 7. These protrusions serve the dual functions of locking the lugs in place against lateral forces tending to slide them out of lug cavities 4 and of providing a crimping anvil to permit crimping the lugs on their respective electrical conductors, as will be more fully explained below. If the blocks are molded of ABS plastic or glass-filled plastic, protrusions 8 will be hard enough to serve satisfactorily as anvils in the lug crimping process. Alternatively, a softer plastic may be used and the knob surfaces hardened by metallic plating.

At each end of connector block 1, extensions of base 2 act as locating shoulders 9 for properly positioning the block in a connector block housing.

A terminal lug 10 is shown in position in one of the lug cavities 4, it being understood that the connector block is supplied from the factory with lugs preassembled in every lug cavity. The lugs are formed from a strip of malleable conductive metal, such as copper, and normally have a bright finish to provide good electrical contact. Each lug has a crimping portion 11 and a spring contact portion 12. At the other end of the crimping portion are two upstanding ears 13 which serve to hold the lug securely within the opening formed by partitions 3 and side yoke 5. Next to upstanding ears 13 are crimping ears 14 located on that part of the lug which is positioned over protrusion 8. As is shown by the cutaway section of FIGURE 1, the crimping portion of lug 10 is bent upwardly to conform to the shape of protrusion 8.

Spring contact portion 12 of the lug consists of a flat recurving tongue, the end of which fits under and presses up against center yoke 6. The recurving tongue acts as a leaf spring; so it

can be depressed to allow insertion of the lug, first under side yoke 5 and then under center yoke 6. When the lug is fully inserted in cavity 4, the spring action of the recurving tongue pressing against yoke 6 together with upstanding ears 13 pressing against yoke 5 combine with protrusion 8 to provide a detent effect which locks the lug against forces tending to push it further through the cavity or to pull it back out. In this manner, the lug is held firmly within the cavity without screws or rivets; yet it can be easily removed, if necessary, by depressing the spring contact portion 12 and pulling the lug out under center yoke 6 and side yoke 5.

The preferred form of protrusions 8 is a convex oval shape, as is indicated in FIG. 1. Such a form may be described as one portion of an ellipsoid which has been divided by a plane parallel to its axis of revolution. In this case the plane is represented by base 2 of the connector block. The intersections of the base with the surfaces of these ellipsoids are ellipses whose major axes coincide with the centerline of each lug receiving cavity 4. The minor axes of the ellipses coincide with a line parallel to the longitudinal edge of base 2 and spaced approximately midway between side yoke 5 and center yoke 6.

The ellipsoidal form of protrusions 8 has several advantages. The gradual slope along the major axis permits smooth insertion of the lugs into the cavities, an important factor in reducing the number of rejects due to broken or twisted lugs in an automated assembly operation. At the same time, the appreciable transverse extent of such an ellipsoidal protrusion produces, in conjunction with ears 13 and the recurving tongue of spring portion 12, an improved locking effect against the lugs being pushed or pulled out of position. That is, a protrusion shape which is relatively long in the direction transverse of the block provides less opportunity for the inherent flexibility of the lug to permit relatively small forces to push or pull it out of the cavity. Furthermore, an ellipsoidal shape effectively distributes the downward forces encountered during the crimping process so as to prevent crushing, cracking or spalling of the plastic block.

My invention is not limited, however, to an ellipsoidal form for protrusions 8 but embraces equivalent shapes for the crimping cavity portion as would suggest themselves to one skilled in the art to accomplish the same functions of securing the lugs without screws or rivets and of providing a crimping anvil.

Referring to FIG. 2, a connector block 1 is shown mounted in a sliding tray compression tool 20, such as is the subject of my copending application Ser. No. 814,348, filed Apr. 8, 1969.

The frame of compression tool 20 carries an L-head 21 in which is mounted a downward-facing crimping die 22. A movable jaw 23 reciprocates within the frame of tool 20 (by means not shown) toward and away from crimping die 22. A slotted base 24 is mounted in movable jaw 23 and, in turn, carries tray 25 for reciprocal sliding motion perpendicular to the direction of reciprocation of jaw 23 under the crimping die 22.

To use the tool, the operator places a connector block in the sliding tray and slides the tray to position the lug in the first crimping cavity 7 underneath the crimping die. Next, he places the end of an electrical conductor 15, from which the insulation 16 has been stripped, between the crimping ears 14 of the connector lug 10. By operation of the reciprocating means, he then raises jaw 23 toward L-head 21 so that ears 14 are squeezed between crimping die 22 and protrusion 8 to effect a tight electrical and mechanical bond with conductor 15.

Upon release of the reciprocating means, jaw 23 moves away from L-head 21, and an indexing mechanism, not shown, automatically permits the tension of spring 26 to cause tray 25 to slide one space so that the next cavity is positioned under the crimping die. The operating sequence is repeated until all lugs are crimped about their respective conductors.

It is apparent from the above description that by using my connector blocks having specially designed retaining yokes, and anvillike protrusions in each crimping cavity, and equipped with factory preassembled terminal lugs, an operator can produce completely wired connector blocks more easily and in less time than it formerly took to crimp separate lugs onto their electrical conductors. Furthermore, the lugs are never touched by the operator, thus eliminating the problems of corrosion, distortion and misalignment.

Referring to FIG. 3, two connector blocks 30 are shown mounted in a special plastic connector housing 40.

Housing 40 is generally in the shape of a flat, rectangular box, open along one side. The spacing between top 41 and bottom 42 is sufficient to provide a sliding fit for two connector blocks 30 placed face-to-face so that side yokes 5 are adjacent to each other. With the completely wired connector blocks held in this position, they can be easily inserted into the connector housing past fingers 43 of latches 44 by lightly pressing the bases 2 together against the action of spring contacts 12. Latches 44 are able to yieldably spring outward by reason of slits 45 cut transversely into the top and bottom of housing 40.

In the version shown in FIG. 3, the connector block housing 40 has two latches 44 on both top 41 and bottom 42 which are aligned with connector block cantilever springs 31 and 32. These springs push outward against fingers 43 when the blocks are latched into the housings, thus urging the opposite edges of the blocks against the beveled inside corners 46 of the housing. The lateral force of springs 31 and 32 against fingers 43 causes bases 2 to ride up on beveled corners 46 to move spring contacts 12 of opposite lugs in the two connector blocks together, so that the contact surfaces will seal against each other to prevent dust and oxidation from increasing the surface resistance when there is no printed circuit board inserted in the connector housing.

Along the center line of the side of housing 40 opposite to the open side is a narrow slot 47 adapted to receive the edge of a printed circuit board 50 having contact surfaces 51 in spaced alignment with spring contacts 12 of the lugs mounted in the two connector blocks. The printed circuit board slides into slot 47 and between spring contacts 12, which provides an electrical path from the conductors, through the lugs, to the individual contact surfaces 51 on the board 50. Beveled corners 46 insure that there will be good electrical connection between spring contacts 12 and contact surfaces 51 regardless of variations in printed circuit board thickness. Thicker boards, acting on spring contacts 12, will tend to push the connector blocks apart, but this motion will be resisted by the force of springs 31 and 32 so that bases 2 will reach an equilibrium position on beveled corners 46 for each board thickness.

Referring to FIG. 4, an alternate form of connector block housing is shown for use as a junction box for connecting two sets of electrical conductors. In this version, two connector blocks are inserted from opposite sides of housing 60. The height of each of the connector block receiving compartments 61 and 62 is designed to provide a snug fit to the mating dimension between the bottom of base 2 and top of side yoke 5 of each connector block 1. In addition, the two receiving compartments 61 and 62 are offset from each other, not only to permit proper mating between spring contacts 12 but also to provide shoulders 63 and 64 which act as stops for the connector blocks. Latches 65 and 66 act in conjunction with shoulders 63 and 64 to lock the blocks against lateral motion inside housing 60.

FIG. 5 illustrates still another form of housing for use when it is desired to hold two connector blocks carrying different electrical signals. Housing 70 is similar in shape to housing 40 in FIG. 3, and both connector blocks are similarly inserted from the same side. However, in housing 70 the blocks are placed base-to-base so that there will be no electrical contact between their respective connector lugs. Instead, spring contacts 12 engage mating contact strips 71 and 72 which are imbedded in the inside surfaces of the top 73 and bottom 74, respectively, of housing 70. The ends of strips 71 and 72 are led out through the top and bottom surfaces of sidewall 75 to suitable connector fittings, either solder or crimp type.

The main portions of top 73 and bottom 74 of housing 70 are spaced apart to provide a sliding fit for the outer surfaces of center yokes 6 and partitions 3 of the two connector blocks 1. The edges of top 73 and bottom 74 which abut the open side of housing 70 are reduced in thickness to form flexible latches 76 and 77. The reduced thickness not only improves the flexibility of the latches but also provides internal clearance to accommodate side yokes 5 of the connector blocks 1.

To provide additional support and to insure that the pressure of spring contacts 12 is equalized against contact strips 71 and 72, ridges 78 and 79 are molded along the inner surface of sidewall 75 and extend laterally across each end of block 1. Ridges 78 and 79 are spaced symmetrically about a horizontal plane through the center of block 70 and are spaced to provide a sliding fit for the double thickness of bases 2 and shoulders 9 (see FIG. 1) of the two connector blocks.

In order for the edges of bases 2 to slide between the longitudinally extending portions of ridges 78 and 79, the connector blocks in FIG. 5 have modified partitions 3 which extend only between side yokes 5 and center yokes 6. Because of the support of the side and center yokes in conjunction with the locking effect of protrusions 8, there is no danger that the lugs will become loose or short against one another by reason of eliminating the portions of partitions 3 which extend transversely past center yokes 6.

Having thus described the invention, it is not intended that it be so limited, as changes may be made therein without departing from the scope of the invention. Accordingly, it is intended that the subject matter described above and shown in the drawings be interpreted as illustrative and not in a limiting sense.

I claim:

1. In a plastic electrical connector block of the type having an elongated generally rectangular base with a plurality of equally spaced transversely extending partitions molded thereon to form a series of transverse lug receiving cavities, the improvement which comprises a plurality of protrusions formed on said base within each lug receiving cavity and located on a line parallel to one of the longitudinal sides of said block, for serving as anvils upon which to crimp connector lugs, preassembled in said lug receiving cavities, about corresponding electrical conductors, each of said protrusions being electroplated to provide increased surface hardness whereby the effectiveness of said protrusions as crimping anvils is improved.

2. In a plastic electrical connector block of the type having an elongated generally rectangular base with a plurality of equally spaced transversely extending partitions molded thereon to form a series of transverse lug receiving cavities, the improvement which comprises a plurality of protrusions formed on said base within each lug receiving cavity and located on a line parallel to one of the longitudinal sides of said block, for serving as anvils upon which to crimp connector lugs, preassembled in said lug receiving cavities, about corresponding electrical conductors, each of said protrusions being in the form of a portion of an ellipsoid having its major axis aligned transversely of said block.

3. In a plastic electrical connector block of the type having an elongated generally rectangular base with a plurality of equally spaced transversely extending partitions molded thereon to form a series of transverse lug receiving cavities, the improvement which comprises a plurality of protrusions formed on said base within each lug receiving cavity and located on a line parallel to one of the longitudinal sides of said block, for serving as anvils upon which to crimp connector lugs, preassembled in said lug receiving cavities, about corresponding electrical conductors, said connector block having a side yoke extending longitudinally across the tops of said transverse partitions along one edge of the block and a center yoke extending parallel to and spaced from said side yoke, whereby a terminal lug may be securely held in each of said lug receiving cavities without the need for separate fasteners.

4. An electrical connector block as defined in claim 3, in which said protrusions are located on a longitudinal line spaced between said side yoke and said center yoke.

5. An electrical connector block housing assembly comprising:

a. at least two elongated plastic electrical connector blocks, each having: (1) a flat rectangular base with a plurality of spaced transverse partitions molded thereon for dividing the base into a series of transverse lug receiving cavities, and (2) spring means formed on one edge of the base thereof;

b. a plurality of malleable metallic terminal lugs removably secured by molded retaining means in said lug receiving cavities, and each lug having means at one end for making a mechanical and electrical connection with an electrical conductor, and being formed with a spring contact portion at the other end; and

c. a molded hollow rectangular plastic housing having: (1) at least one open side for slidably receiving said connector blocks, said connector blocks being oriented in said housing so that said one end of each of the terminal lugs is adjacent said open side; (2) flexible latching means for removably securing said blocks to said housing; and (3) stop means disposed within said housing, said spring means of the connector blocks cooperating with said flexible latching means to yieldably urge the opposite edges of said connector block base against said stop means.

6. An electrical connector block housing assembly as defined in claim 5 wherein said flexible latching means comprise integral portions of at least one of the faces of said housing adjacent said open side and having finger portions extending in the way of said open side for releasable engagement with said blocks when they are completely inserted in said housing.

7. An electrical connector block housing assembly as defined in claim 6 wherein said housing is adapted to receive two connector blocks oriented so that the spring contact surfaces of the terminal lugs face each other and includes

a. an elongated opening in the side opposite said open side for receiving the edge of a printed circuit board, said board having electrical contact strips extending perpendicularly from said edge and spaced coincidentally with the spring contact surfaces of said terminal lugs, whereby said strips will make electrical contact with the opposing spring contact surfaces of said terminal lugs when the board is inserted in said elongated opening and

b. wedge means whereby the thrust of said spring means against the fingers of said latching means tends to force the inner edges of the bases of said connector blocks together whereby the opposing surfaces of said lug spring contact portions will make sealing contact when said printed circuit board is withdrawn from said assembly.

8. An electrical connector block comprising a base having a plurality of mutually spaced partitions formed thereon to define a series of lug receiving cavities, with a protrusion formed on said base within each lug receiving cavity and located on the longitudinal centerline thereof for serving as an anvil upon which to crimp connector lugs, preassembled in said lug receiving cavities, about corresponding electrical conductors, said protrusions being in the form of a portion of an ellipsoid and being electroplated to provide increased surface hardness whereby the effectiveness of said protrusions as crimping anvils is improved.

9. An electrical connector block comprising a base having a plurality of mutually spaced partitions formed thereon to define a series of lug receiving cavities, with a protrusion formed on said base within each lug receiving cavity and located on the longitudinal centerline thereof for serving as an anvil upon which to crimp connector lugs, preassembled in said lug receiving cavities, about corresponding electrical conductors, said electrical connector block having a first yoke extending longitudinally across the tops of said partitions along one edge of the block, and a second yoke extending parallel to

and spaced from said first yoke and also extending across the tops of said partitions, whereby a terminal lug may be securely held in each of said lug receiving cavities without the need for separate fasteners.

10. An electrical connector block as in claim 9 in which said protrusions are located between said first yoke and said second yoke.