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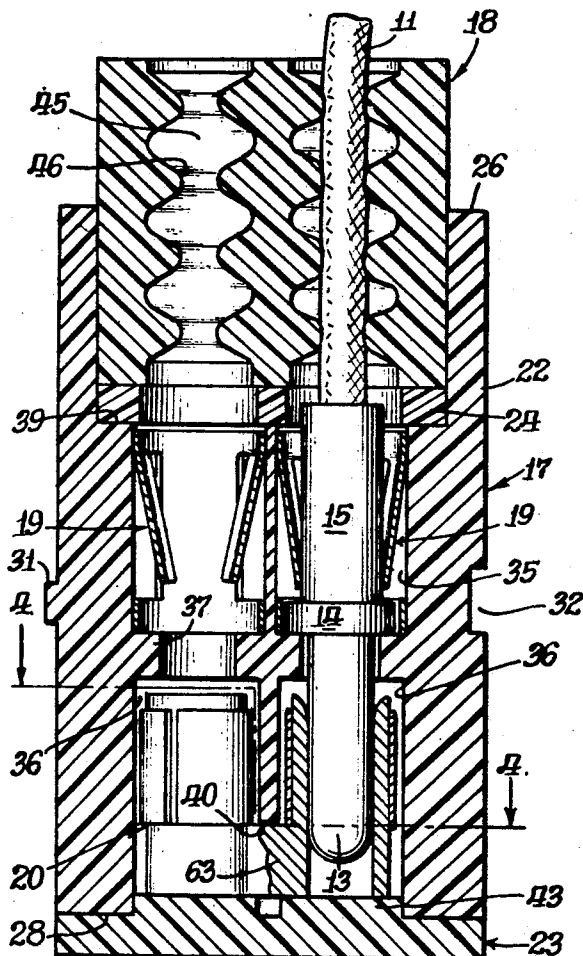
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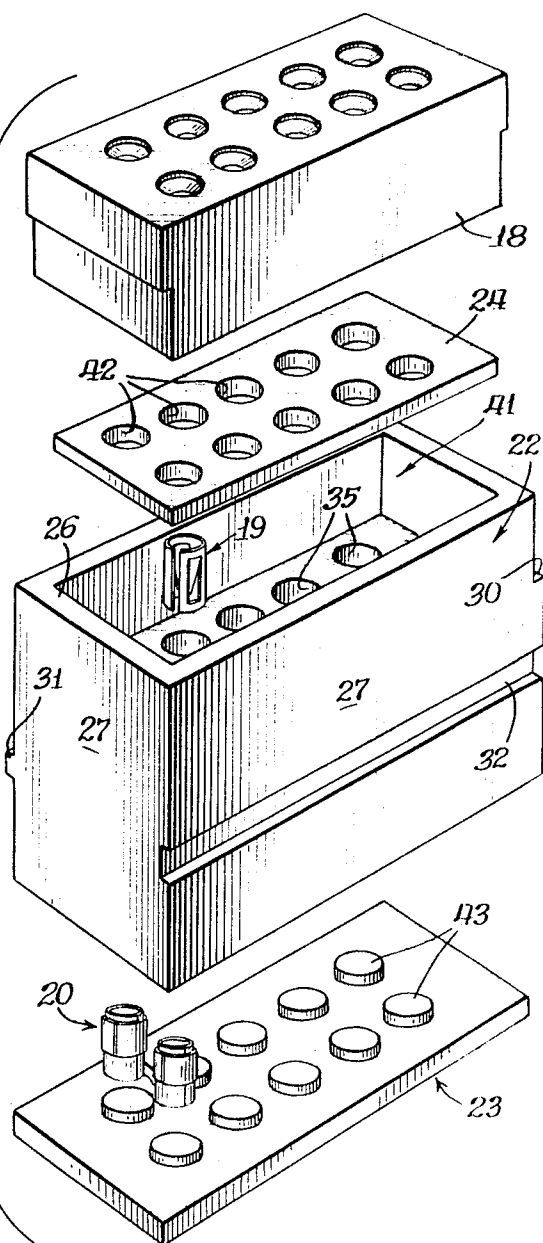
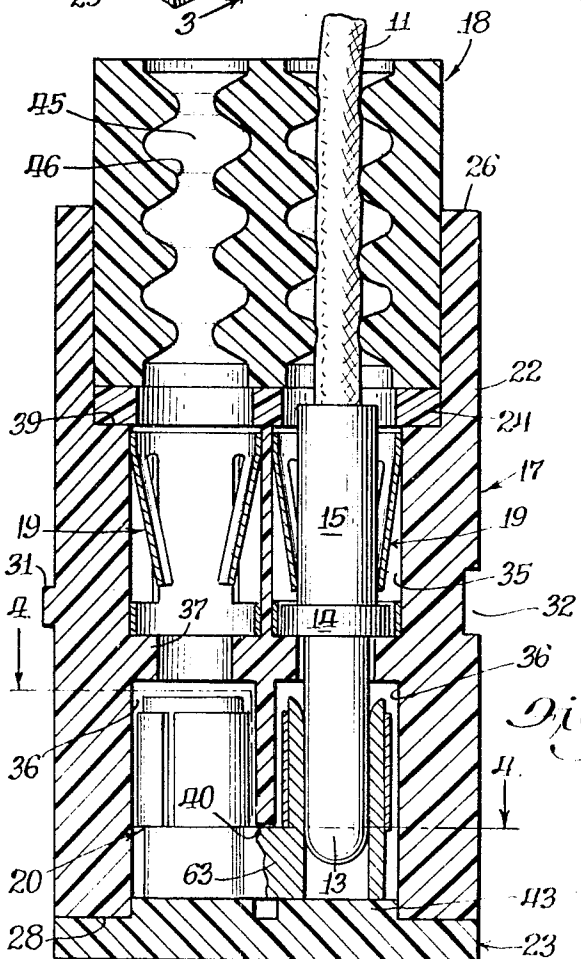
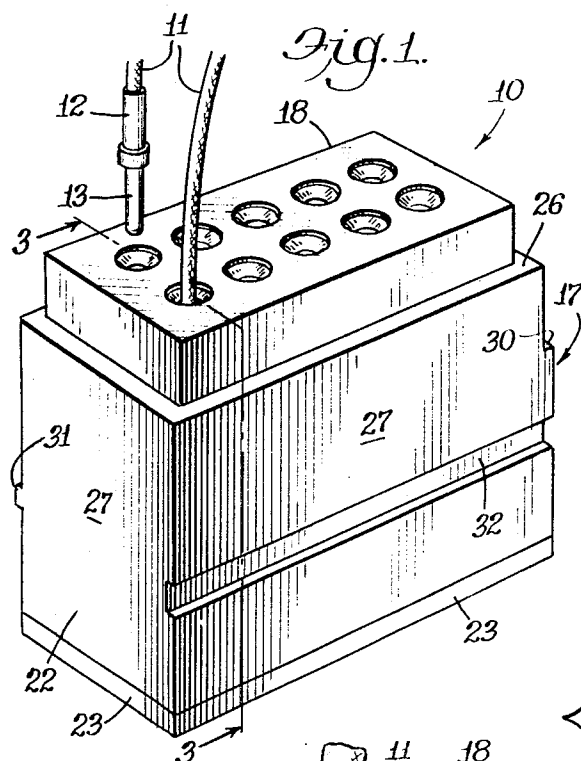
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[54] **TERMINAL BLOCK CONNECTORS**
2 Claims, 12 Drawing Figs.

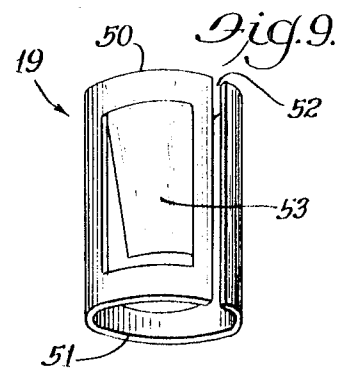
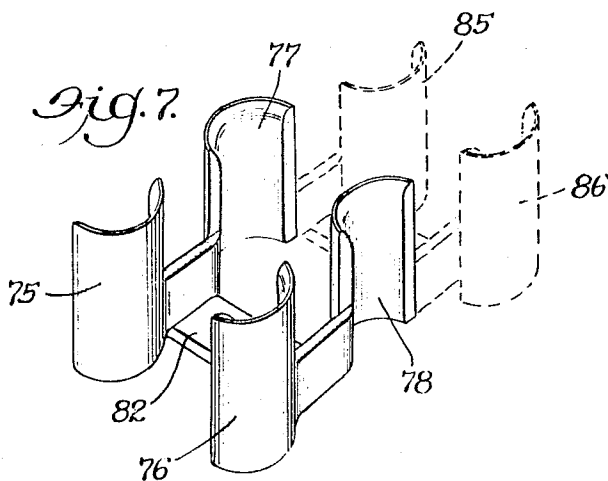
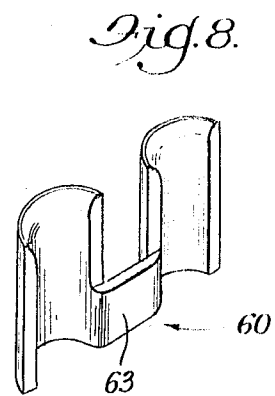
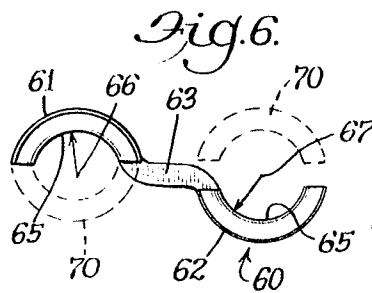
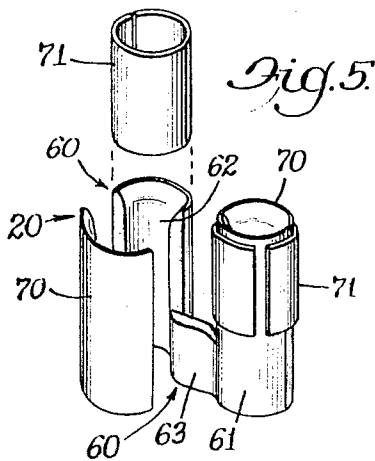
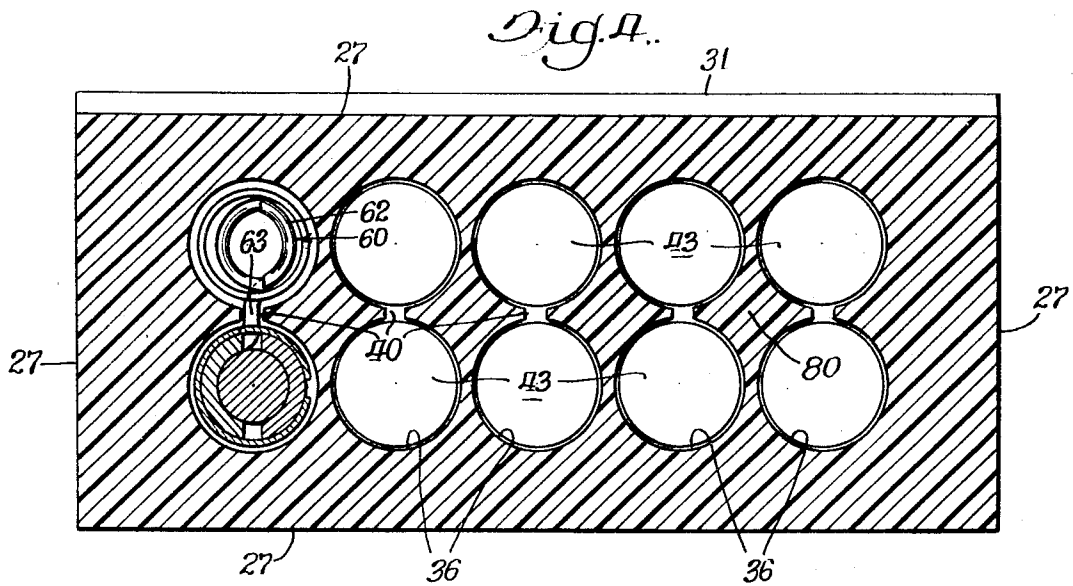
[52] U.S. Cl..... 339/198 P,
339/19 R, 339/248 S, 339/255 R
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198, 248, 255, 258 R, 258 P, 259

ABSTRACT: An improved terminal block assembly including at least one parallel pair of female contacts electrically connected together by a bridge formed integrally therewith. Preferably each of the female contacts include a base portion and a floating portion, and the bridge connects the base portions in an undulating pattern in end view.

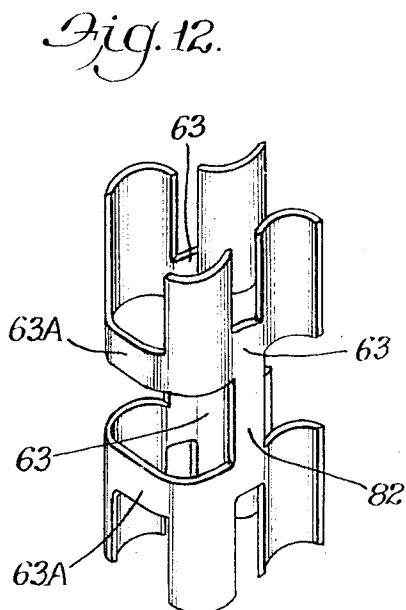
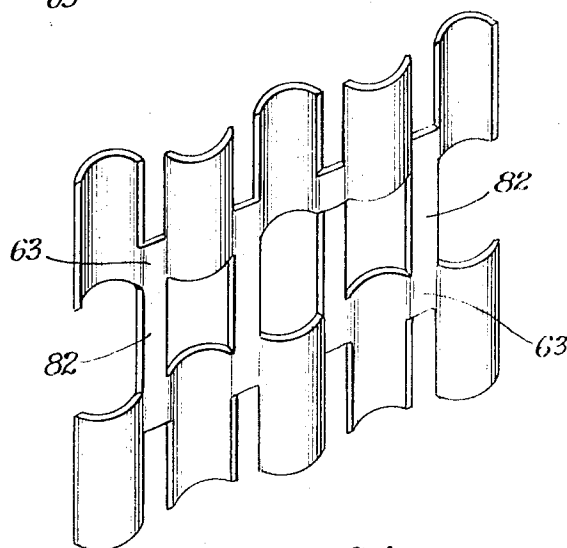
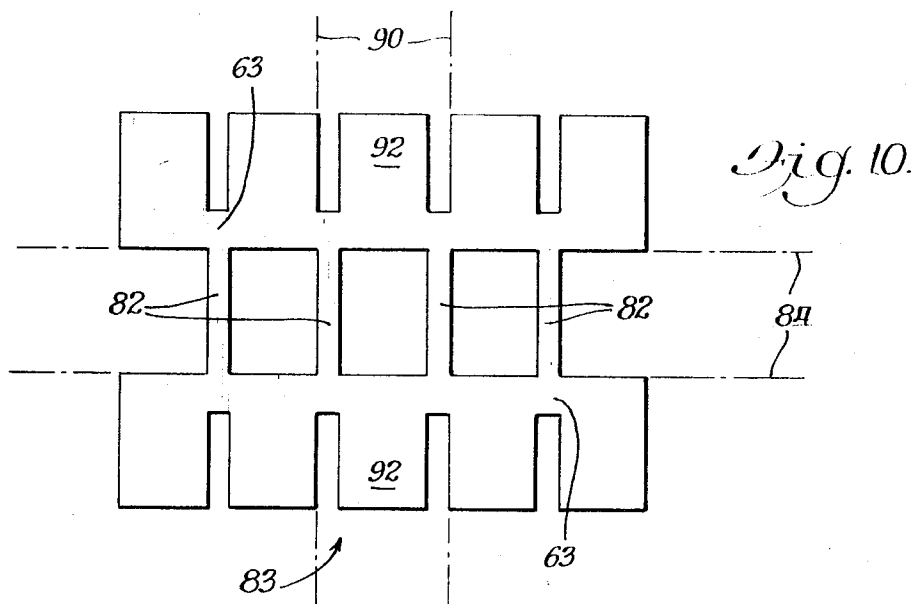




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TERMINAL BLOCK CONNECTORS

CROSS-REFERENCE TO RELATED APPLICATION

The specific structural configuration of an individual female contact which forms a part of the present invention was disclosed and claimed in a copending application Ser. No. 770,518, filed on Oct. 25, 1968, entitled "Electrical Connectors," now abandoned. That application was the parent of two continuation-in-part applications filed on Oct. 20, 1970, both being entitled "Electrical Connector." The serial numbers of these two applications are 82,451 and 82,452.

BACKGROUND OF THE INVENTION

This invention relates to improvements in connectors, designed to receive pin contacts.

In certain of the better known terminal block assemblies in use today, the female contacts within the assembly are bused together by means of a separate or auxiliary conductor in the form of a bar, wire or plate which is soldered or in some other way permanently and electrically connected to two or more of the contacts. Other currently used methods include those of introducing a bus bar alongside the contacts and biasing the contacts thereagainst, or by biasing one end of each contact against the internal sidewall of a hole drilled therefor in a common conductive plate. The first method described above is not only costly, but may create alignment problems, while the electrical transmission qualities of the latter two techniques are not as good as those incident with an integral or soldered type of solid connection.

Thus, it is desirable to create an improved electrical bridge between a plurality of contacts in a terminal block assembly which not only introduces a minimal amount of resistance and voltage drop between corresponding electrical leads, but which also does not create any alignment problems in its housing. Additionally, it would be desirable to connect these contacts at a minimum centerline-to-centerline distance to anticipate the ever changing requirements and requests for more compact electrical devices.

SUMMARY OF THE INVENTION

The present invention achieves all the desirable ends set forth above in a structure wherein two or more of the base elements forming the female contacts are integrally joined in the stamping or other process by which they are produced. In the preferred embodiment, the shape of each base element permits a connection to be formed between it and an inserted prong according to the invention described in my aforementioned copending patent application. Each adjacent and connected pair of base elements may have a characteristic "S" or undulating configuration which permits the distance between their centerline to be minimized, thus permitting the design of an unusually compact terminal block.

While the invention is shown in the drawings to assist in an understanding of one embodiment of the invention, this description and these drawings are in no way intended to limit the invention to the specific embodiments shown and described or to defeat that purpose of a patent which is to protectively cover all inventive concepts contained therein. The appended claims are the chief aid toward this purpose as it is these that point out the scope of the invention.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a 10-contact terminal block assembly with one lead fully inserted therein, and it also shows a male pin type of contact separated therefrom and positioned for insertion therein.

FIG. 2 is an exploded perspective view of the terminal block assembly with the parts in their proper relative position prior to assembly.

FIG. 3 is a cross-sectional view of the terminal block shown in FIGS. 1 and 2 taken substantially along the lines 3—3 of FIG. 1.

FIG. 4 is a cross-sectional view of the connector block assembly taken through the lower contact end generally along the lines 4—4 of FIG. 3.

FIG. 5 is a perspective view of a double female contact, several of the components being disassembled and in spaced-apart relation in this subassembly to clarify its construction.

FIG. 6 is an end view of the connected base portions of the double female contact shown in FIG. 5.

FIG. 7 is a perspective view of four female contacts joined together, two more of which are shown in dotted lines to show how large numbers of females can be integrally formed.

FIG. 8 is a perspective view of the base portion of a slightly different form of double female contact.

FIG. 9 is a perspective view of one of the contact retainers contained within the terminal block which prevents removal of a male pin after it is fully inserted therein.

FIG. 10 is a plan view of a sheet metal blank, as punched, which includes 10 interconnected and potential female contacts, this blank having the capability of being trimmed and formed to produce the contact configurations of FIGS. 5—8 as well as others to follow.

FIG. 11 is a perspective view of the interconnected female contact combination of a five-position feedthrough terminal block, this combination having an in-line configuration and being formed from the blank shown in FIG. 9.

FIG. 12 is also a perspective view of the interconnected female contact combination of a four-position feed-through terminal block, however this combination has a square configuration.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings, there is shown a terminal block assembly 10 used to electrically connect two or more wires together, such as those shown at 11. Each of the wires 11 has a male pin 12 crimped onto its stripped end. Pin 12 forms no part of the present invention, however, it includes a generally cylindrical contact end 13, retaining means in the form of an enlarged central flange 14, and a hollow crimp barrel 15 into which the wire 11 is inserted for attachment by crimping.

The terminal block assembly includes generally a housing 17, a sealing grommet 18, a plurality of contact retainers 19 and one or more contact subassemblies 20.

While the housing to be described next takes the form of a feedback terminal block, or one in which the wires all enter from the same direction, it will be understood that the terminal block could be of other configurations, such as, for example, the feed-through variety where wires can enter the terminal block on opposite side thereof.

Housing 17 consists basically of three parts: a main body portion 22, a lower baseplate 23, and upper closure plate 24. Main body 22 is preferably molded of a nonconductive material such as diallyl phthalate. Although its exterior configuration is substantially a rectangular parallelepiped as defined by an upper plane 26, four sidewalls 27, and a lower plane 28, one of the sidewalls 27 has a step 30 molded therein, another has a tongue 31 molded thereon, and the sidewall opposite the tongue has a groove 32 molded therein. Tongue 31 and groove 32 permit a plurality of terminal blocks to interlock in side-by-side fashion, particularly when fitted within a suitable track designed therefor (not shown), and step 30 along with a portion of surface 26 provide bearing surfaces 65 which coact with structural features forming a part of the track to hold the terminal blocks therein.

Within main body 22 are a number of parallel and generally cylindrical cavities, each of which is divided into an upper chamber 35 and a lower chamber 36 by means of a centrally disposed and inwardly directed flange 37. Between the upper portions of upper chamber 35 and surface 26 is a large opening or void 41 which receives both upper closure plate 24 and sealing grommet 18. Upper chambers 35 extend between flange 37 and a surface 39, while lower chamber 36 extends between flange 37 and lower plane 28. The sidewalls which

separate lower chambers 36 can be cut away as at 40 to provide for intercommunication between any two or more chambers, and in the configuration shown, adjacent transversely oriented pairs are thus joined. As will be described in greater detail later, this cutaway portion 40 of the internal sidewall provides a passage through which the electrical link between adjacent female contacts in a contact subassembly 20 may extend.

Between the surface 39 and upper surface or plane 26 is an enlarged cavity 41 which contains both the upper closure plate 24 and the lower portion of sealing grommet 18. Upper closure plate 24 is a thin platelike piece of nonconductive material and has a plurality of ten holes 42 therethrough which are axially aligned with the ten cavities in main body 22, but of slightly smaller diameter. Closure plate 24 has an outer peripheral shape permitting it to be snugly inserted within cavity 41, and its lower surface is permanently bonded to surface 39 of the main body.

The lower baseplate 23 includes a plurality of 10 shallow and upstanding tabs 43 which, when the plate 23 is properly positioned, extend slightly up into the lower chambers 36 of the main body 22. After the contact subassemblies 20 are properly inserted into main body 22, lower baseplate 23 is bonded to its lower surface 28.

Having completed a description of the housing 17, there follows hereinbelow a discussion of the other components which make up the entire block assembly 10.

Sealing grommet 18 includes a plurality of 10 holes or cavities 45 therethrough, each of these holes being aligned both with one of the upper chambers 35 in the main body 22 and with the hole 42 immediately thereabove in closure plate 24. These holes are internally fluted as at 46 to provide snug engagement with the wires 11, thereby sealing same when the attached pins 12 are fully engaged.

Contained within upper chambers 35, and entrapped therein by means of upper closure plate 24, are contact retainers 19. These retainers are of conventional construction, but their general structure will be briefly described here. With particular reference to FIG. 9, the contact retainer 19 consists of a thin piece of copper alloy possessing spring characteristics and rolled in the shape of an open ended and hollow cylinder having an upper end 50 and a lower end 51. Extending longitudinally between these ends is a slightly open slit 52, and struck inwardly from the sidewalls are a pair of fingers 53. As will be understood, the spring retainer 19 is compressed radially and inserted into the upper chamber 35 until lower end 51 bears against the upper shoulder formed by the main body's central flange 37. After the upper closure plate 24 is bonded in place thereabove, retainers 19 cannot be removed.

Contained within each lateral pair of lower cavities 36 are what I shall herein describe as an integral or combined pair 60 of base elements 61 and 62. Each of these base elements is in the shape generally of an elongate segment of a cylinder, and the two are formed in side-by-side relationship with an integrally formed bridge in the form of a strip of material 63. Strip 63 electrically bridges the two base portions, and it also maintains their relative alignment.

Each of the base elements 61 and 62 has an inner and concave contact surface 65 having a radius of curvature substantially identical to the radius of curvature of the mating pins 12. The angle subtended by this radius of curvature (see FIG. 6), as measured from one of the external axes 66 or 67 is somewhat less than 180° to permit the pin 12 to nest flushly therein and provide large area contact therebetween. The details of this specific type of contact are set forth in great detail in the aforementioned pending application, and they will not be described in any great detail herein. Suffice it to say that this type of connection affords particularly good electrical contact which is both consistent between all connections and very low in millivolt loss.

It should perhaps also be mentioned at this point that the material of which the female contacts are made is preferably copper. The copper used can be dead soft since there is no

particular reason for it to possess any spring characteristics, and thus, not only can the most conductive material be used, but this material is relatively easy to blank and form.

As will be observed, the contact surface 65 of base element 61 is concave in one direction while the contact surface 65 of base element 62 is concave in the opposite direction. Thus, an end view of the pair exhibits a generally undulating or extended "S" shape (see particularly FIG. 6). Naturally, the base elements 61 and 62 could perhaps more easily be formed so that they displayed a generally "E" or "M" shape in end view, that is, with both concave surfaces facing the same direction. This latter shape is shown in FIG. 8, but it cannot be made as compact as the alternating direction or "S" configuration. The stamping operation which produces the U-shaped blank must remove some minimum width of material from between the unattached ends of the base portions 61 and 62, this minimum width depending upon stock thickness. In the forming operation which contours the blank to the shape shown, the fact that the contact surfaces 65 begin on opposite sides of a line joining the two axes 66 and 67 together is the prime consideration which permits the centerline-to-centerline distance to be closer in the "S" configuration than in the configuration of FIG. 8.

Diametrically opposed from each of the base elements 61 and 62 is a split shoe 70 of substantially identical shape as one of the base elements, and it is held in opposed relationship therewith by means of a short cylindrical spring element 71. Since both the base elements and the split shoes are somewhat less than half of a cylinder, when the two of them are held together by means of spring 71 they form something less than a cylindrical hole therebetween (note element 61 and its split shoe 70 in dashed lines in FIG. 6). However, when pin 12 is inserted therein, the split shoe 70 moves away from intimate contact with the base portion to the position generally as shown in dashed lines in the right half of FIG. 6.

In assembling the terminal block assembly 10, the contact subassemblies 20 are inserted into adjacent lateral pairs of lower chambers 36, the joined end following the unconnected end so that connection strip 63 extends through the cutaway portion 40 of the common internal sidewall. Lower baseplate 23 is then positioned and bonded in place. Contact retainers 19 are compressed slightly and fitted within upper chambers 35, and they are then entrapped therein by upper closure plate 24 which is also bonded in position. Sealing grommet 18 is then cemented in cavity 41 to complete the assembly.

As can perhaps best be seen in FIG. 3, a pin 12 can be inserted into the female contact by way of the upper or grommet end of the assembly, the central flange 14 thereof snapping beyond fingers 53 of the contact retainer 19 and resting on central flange 37 within the main body 22. Fingers 53 of the contact retainer captivate the pin within the assembly and prevent its removal without the use of a special finger-spreading tool. When two such pins are inserted in laterally adjacent holes, the contact subassembly 20 forms an electrical bridge therebetween.

The solid lines of FIG. 7 show a plurality of four base elements, herein denoted as elements 75, 76, 77 and 78, which could be used to join four electrical leads in the same terminal block assembly. Lower portions of the common center wall 80 (see FIG. 4) between four adjacent cavities 36 are cut away, in addition to wall portions 40, to accommodate the strap 82 which forms an electrical bridge between two integral pairs 60. Strap 82 is formed integrally with strips 63 in the blanking operation, a typical blank being shown at 83 in FIG. 10. If a larger number of joined base elements is desired, for example six, the integrally formed unit appears generally as shown in FIG. 7 including the elements 85 and 86 there shown in dashed lines. This, as well as eight- and 10-contact combinations, can also be made from the blank of FIG. 10.

As will be understood, a single shape blank such as that of FIG. 10 can be used to produce a number of differently shaped or patterned combinations as well as a different number of contacts in each combination. As noted before, the

combinations of FIG. 7 can be produced by forming operation in which the blank is bent 90° about each of the axes designated 84 in FIG. 10. If eight, six, four, or even two contacts are desired rather than the 10 shown in the figure, the excess contacts are sheared off in one stage of a progressive die between the blanking and forming operations.

To produce the combination of FIG. 11, all of the individual contact elements or portions are simultaneously formed into their partial cylindrical shape. The combination is then assembled into a feed-through type of housing into which pin contacts can be inserted from each of two opposite sides.

A square configuration for a four-position, eight-contact combination is shown in FIG. 12. This produced by forming the blank 83 about a pair of axes 90 (as shown in FIG. 10), shearing away the center two straps 82, and shearing away the outer extending ends 92 of the two center contacts. Naturally, the part could also be produced from a specifically designed blank. In either event, the lengths of the bridging strips here designated 63A is greater than that of the other interconnection strips 63. This difference in length is necessary to get the four contacts into their square configuration.

Whereas the terminal block assembly and variations shown and described herein all incorporate the principles of the aforementioned copending application, the principles of this invention are not to be construed as necessarily requiring these types of contacts.

We claim:

1. A nonpermanent terminal block connection for electrically connecting at least a pair of pin contacts, comprising: a nonconductive housing, a female contact assembly carried in said housing, said female contact assembly including a pair of stamped pure contacts having the singular purpose of electrical current transmission, each contact having a base portion connected at its bottom to the bottom of the base portion of the other contact by means of an integrally formed bridging

strip to give the connected pair of contacts a U-shaped configuration in side view and thereby permit electrical transmission therebetween, each of said portions having a concave and cylindrical contact surface for creating intimate contact with one of said pin contacts over a total arc of less than 180°, the sole contact surfaces of adjacent base portions facing in opposing directions, and biasing means comprising a cylindrical spring member encircling the unconnected end of each female contact for biasing a pin contact inserted into the housing into intimate contact with said cylindrical surface.

2. In a terminal block assembly for use with contact pins of a given external diameter, which assembly has a plurality of female contacts having interfaces to receive and make electrical connection between said pins inserted into the contacts, the improvement comprising:

a pair of said contacts, the interface of each contact of the pair being a segment of a cylinder which segment is less than 180°, said segment being elongate in the axial direction, said interface being formed on a radius substantially identical to half of said diameter, each of said contacts having a longitudinal edge spaced from and parallel to the longitudinal edge of the other contact,

a bridge connecting said contacts longitudinally thereof along each said longitudinal edge, the dimension of said bridge in said axial direction being substantially less than that of said contacts,

said pair of contacts and said bridge being made from a unitary segment of dead soft copper so as to achieve simplicity of construction and relatively high conductivity between pins in said pair of contacts,

said pair of contacts each carrying separate spring means resiliently urging the pins in the respective contacts in intimate face-to-face relationship with said cylindrical faces.

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