Oct. 20, 1959 G. C. SITZ 2,909,756

CONNECTOR BLOCK ASSEMBLY

Filed Sept. 23, 1955

Fig. 1

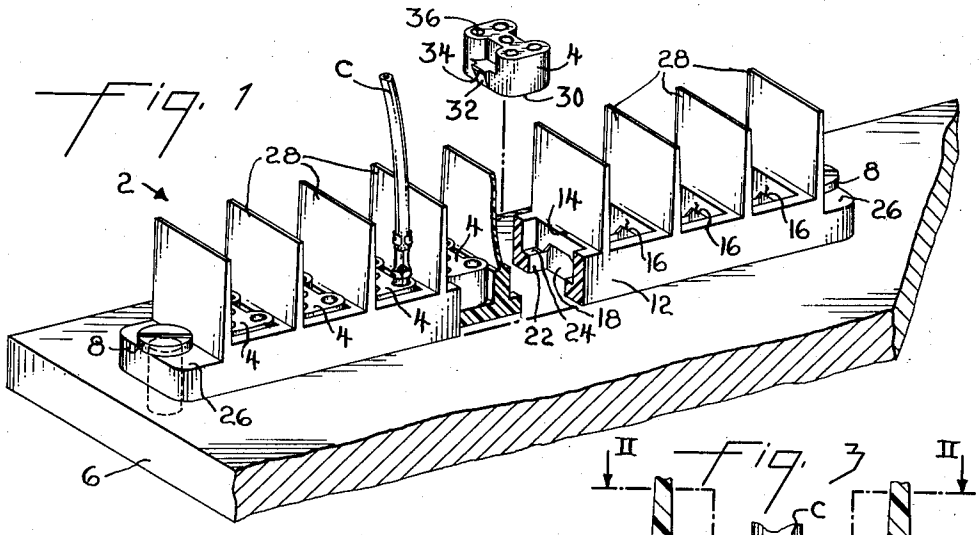



Fig. 2

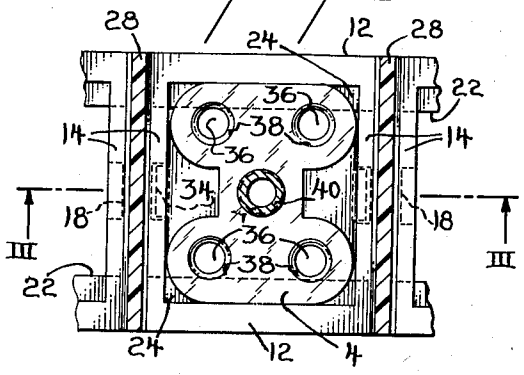



Fig. 3

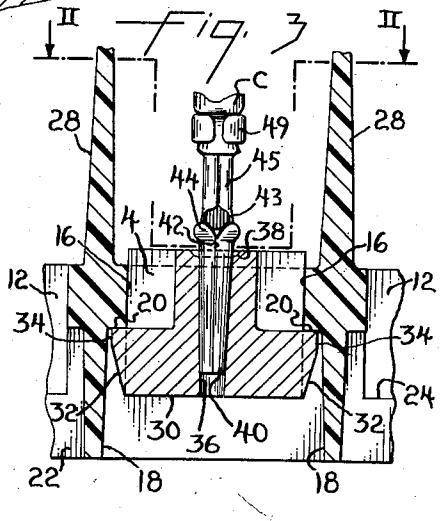



Fig. 4

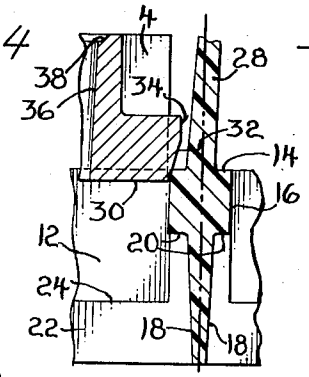



Fig. 5

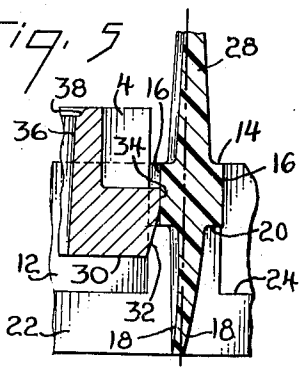
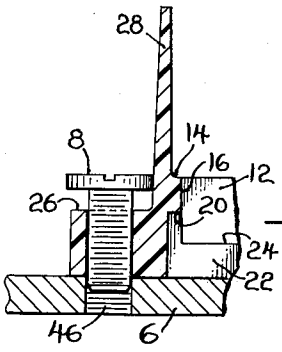



Fig. 6




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# CONNECTOR BLOCK ASSEMBLY

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Application September 23, 1955, Serial No. 536,088

1 Claim. (Cl. 339—198)

This invention relates to electrical interconnections among a plurality of conductors and means for making such interconnections.

In the manufacture of complex electrical and electronic equipment such as radar equipment, tabulating and computing machines, electronic control equipment, etc., it is frequently necessary to interconnect a very large number of conductors, either one to another or one to a plurality of other conductors. It is highly desirable, if not essential, that such interconnections be compact, easily made, capable of being disconnected to permit circuit changes, that the arrangement be neat and orderly, and, of course, that the unions possess a high degree of electrical conductivity. Compactness is essential, particularly in the case of equipment intended for use in aircraft where the amount of available space is limited and compactness is highly desirable in all other circumstances where a large number of conductors are involved. As a practical matter it is essential that the interconnections be of such nature that they can be easily made and taken apart in order that assembly and repair costs and time be minimized. Also, it is desirable that the interconnections be of such nature that one conductor may be removed from a union involving, say, four or five conductors, without disturbing the electrical union of the remaining conductors in order to facilitate servicing or the making of minor changes to the circuits. The desideratum that the interconnections be neat and orderly in order to permit rapid tracing of the conductors is concomitant with the practical consideration of ease of repair and servicing.

A further consideration in making a large number of electrical connections within a relatively limited space is that of preventing arcing and current leakage between conductors which, of necessity, are disposed relatively closely together. The problem of arcing is of particular importance in aircraft installations since as the altitude increases the "break-down voltage" (i.e. the voltage at which arcing will take place) decreases. The problem of current leakage across insulating materials used in making or covering the connections sometimes becomes serious, particularly if moisture happens to collect on the surface of the connection.

It is an object of the present invention to provide electrical interconnections and means for making electrical interconnections which satisfy the above-listed requirements of neatness, compactness, ease of assembly and disassembly, ease of tracing the circuitry, protection against arcing and current leakage, and a high degree of electrical conductivity.

It is a further object of the invention to provide a dielectric connector block and a metallic conductor-receiving insert block therefore by means of which such interconnections can be made.

It is a further object of the invention to provide a connector block which can be easily mounted within a small space at any desired location.

It is a further object of the invention to provide a metallic connector block insert which can be expeditiously and securely assembled to a dielectric connector block.



It is a further object of the invention to provide means for interconnecting a plurality of conductors by means of tapered terminations on the conductor ends thus permitting both rapid initial assembly and minor rearrangement of the circuitry after manufacture with a minimum of difficulty.

An additional objective resides in the provision of a commercially feasible organization which will be substantially foolproof in use and which overcomes certain well-known disadvantages inherent in the prior art.

Other important features and objects of the invention to which reference has not been made hereinabove will appear hereinafter when the following description and claim are considered with the accompanying drawings, in which:

Figure 1 is a persepctive view, with parts broken away, of a preferred embodiment of my invention;

Figure 2 is a fragmentary top plan view, taken along the line 2—2 of Figure 3, of the embodiment of Figure 1 showing an insert block disposed within an aperture in the connector block;

Figure 3 is a sectional view taken along the line 3—3 of Figure 2;

Figures 4 and 5 are fragmentary views illustrating certain relationships to each other of two components incorporating the invention; and

Figure 6 is a fragmentary sectional view of one end of the embodiment of Figure 1.

In the disclosed embodiment, the reference numeral 2 generally indicates a connector block in which are disposed a plurality of metallic connector block inserts 4, one of which is shown as exploded from connector block 2 in the interest of clarity. The connector block is shown as being secured to a panel 6 by means of fasteners 8 and a single electrical conductor C is shown as being connected to one of the inserts 4. It is understood that under actual conditions of use the connector block might be secured to a panel in a computing or tabulating machine or other electronic device, and that each of the inserts will receive a plurality of conductors. Also, a plurality of connector blocks might be mounted in side-by-side relationship to provide a large number of interconnections, the disclosed embodiment being shown in a relatively simple environment to simplify the illustration.

The connector block should be of a dielectric material and somewhat deformable in order to permit assembly of the inserts in a manner described below. Also, the material should possess adequate strength and should not be subject to deterioration upon aging to any great extent. I have found that new nylon is eminently suited as a material for the block inasmuch as it has excellent dielectric properties, can be molded into a wide variety of shapes, and may be sufficiently deformable when fashioned in accordance with my invention to be assembled to the block.

Connector block 2 comprises a pair of upstanding side walls 12 which are maintained in parallel spaced-apart relationship by a plurality of transversely extending ribs 14 spaced from each other in such manner as to provide a plurality of insert receiving apertures 16, several of these apertures being shown in Figure 1 as having insert blocks 4 disposed therein. Each of the ribs 14 provides a relieved or cut out portion 18 on each side, as shown best in Figure 3, so that the lower portion of each rib, as viewed in Figure 3, presents a somewhat thinner section than the upper part. The relieved portions 18 of each rib define reentrant bearing surfaces 20 which in the disclosed embodiment face substantially downwardly (see Figures 1 and 3).

As best shown by the cut-out section of Figure 1,

each of the side walls 12 is of substantially L-shaped cross-section and provides a ledge 22 extending inwardly of each of the apertures 16, which ledge defines a shelf surface 24 facing in a direction substantially opposed to bearing surfaces 20. At each end of block 2 there is provided an ear 26 having an aperture therein for accommodation of fastener 8. On the upper side of block 2 (see Figure 1) a plurality of fins 28 are provided, each fin being coplanar with and extending from one of the ribs 14 as best shown by Figure 3. These fins function to increase the air gaps and leakage paths separating adjacent insert blocks and conductors entering adjacent insert blocks as is fully explained below.

Insert blocks 4 provide a base portion 30 from each side of which extends a camming and locking lug 32 which tapers upwardly, as viewed in Figure 3, to a substantially flat portion 34. Lugs 32 and flat portion 34 thereof are preferably of substantial width, as shown, rather than being extremely narrow and pointed, in order to facilitate assembly of inserts 4 to the block 2. The electrical interconnections are made by means of tapered apertures 36, which may be countersunk as at 38, contained within the insert block. Each of these apertures is adapted to receive a tapered connector portion 40 of an electrical connector which preferably may be of the type disclosed in the copending application of Kemper M. Hammell, Serial No. 400,996, filed December 29, 1953, now Patent No. 2,816,275 dated December 10, 1957, for Electrical Connector. As explained in that application, tapered connectors take the form of both conical pins as shown in the drawing and flat tabs having tapered sides. The tapered pin type connector is produced by rolling flat strip material in such manner that the two side edges meet at a parting line indicated in Figure 3 at 42. Pin connections of this type also provide a bead portion 44 joining a neck portion 43 which, in turn, joins a connector barrel 45, the barrel providing the actual union between conductor C and the connector. Connectors of the type shown also provide an insulation supporting portion 49 which, when crimped onto the conductor as shown, supports the end of the insulation so that the conductors are all substantially parallel to each other in the immediate vicinity of the insert block and do not tend to become interwoven or tangled with each other.

The disclosed insert is of substantially I-shaped cross-section in its upper half, as shown by Figures 1 and 2, in the respect that it contains a depression on each side immediately above locking lugs 32. This configuration is provided primarily for the purpose of minimizing the weight of the block, the disclosed embodiment of which is particularly intended for use in aircraft. Inserts 4 may be of any suitable metal or alloy having the requisite properties and the particular material used will depend in part upon the conditions expected to be encountered in use. I have found that a 70% Cu, 30% Zm brass is well suited as a material for this insert. Such brass inserts may be produced either by casting or machining and preferably are plated with a flash coating of nickel which in turn is plated with gold or silver. The plating improves the corrosion resistance of the inserts and additionally enhances the electrical conductivity of the interconnection between the several connectors 40.

Generally, in the use of the invention, the inserts 4 are assembled to the connector block 2 prior to mounting the block in its desired location. This is best accomplished with a light press or a suitable hand tool by means of which the necessary force can be applied to the upper face of the insert. As shown in Figures 4 and 5, in the assembly operation, insert 4 is first placed over one of the apertures 16 with lugs 32 disposed above cut-out portions 18. As insert 4 is initially forced downwardly the lugs cam the ribs outwardly (Figure 4) as the taper progressively travels downwardly. As previously mentioned, lugs 32 should be of substantial width in order



to provide an adequate bearing surface between the lugs and the ribs and preclude gouging or cutting of the connector block. As insert 4 is forced into the aperture the flexure of the ribs is progressively increased and the central and lower portions are bowed outwardly as shown in Figure 5. Upon further movement of the block, the ribs snap back into their original position as bearing surface 20 is forced below the upper thickened portion of the ribs and the lugs enter cut-out portions 18, see Figure 3. The ledges 22 are so dimensioned that the vertical distance separating shelf surfaces 24 and the upper limit of the cut-out portions is substantially equal to the height of the insert from base 30 up to the bearing surface in the tops of lugs 32. After assembly, the insert is retained between shelf surfaces 24 and the thickened part of ribs 14. With molded nylon connector blocks of the particular form shown it has been found that removal of the inserts after assembly is virtually impossible without destruction of the connector block itself.

Connector block 2, having inserts 4 disposed therein, may then be mounted in the desired location by means of fasteners 8 as shown in Figure 6. In my preferred embodiment I provide a headed screw having a head of such diameter as to compress the end rib into firm engagement with the end insert block. As is apparent from Figure 6, when screw 8 is threaded into aperture 46 the head of the screw will cam the end rib 16 inwardly against the insert block, thereby locking insert blocks 4 within the connector block. Alternatively a screw providing a somewhat smaller head can be used and a locking effect will be achieved so long as the screw head prevents outward movement of the end rib.

The desired interconnections can then be made by merely inserting the tapered connectors into the apertures. Preferably, the connectors are inserted by means of a hand tool of the type shown and claimed in the copending application of Kemper M. Hammell, Serial No. 414,602, filed March 8, 1954, for Methods and Tools for Making Connections. Where more than five conductors are to be interconnected by the illustrative form here shown, jumper leads can be inserted in adjacent insert blocks and the conductors being interconnected can be inserted into these adjacent blocks.

When the tapered end portions of the connectors are properly inserted into tapered openings 36, a connection results which is extremely secure and possesses a high "pull-out" strength; for example, pins approximately ½" in length and having a maximum diameter of about 0.065" can easily be inserted in such manner that a pulling force of 15 or more pounds is required subsequently to disconnect them from the insert block. Such high pull-out forces obviate the danger of accidental disengagement of the pin from the block but permit disassembly if required by a change in the circuit. Furthermore, the pin connectors can be reinserted at least three or four times so that a technician can make any necessary changes rapidly and without replacing any of the parts involved. Also, where a change in the circuit requires the removal of only one conductor from an insert block, that one conductor can be removed without handling or disturbing the remaining conductors in the same insert block.

As previously mentioned, the fins 28 function to increase the air gap and the leakage path separating adjacent insert blocks and separating conductors entering adjacent insert blocks. As is evident from Figure 1, the shortest leakage path separating two adjacent insert blocks extends along the surface of connector block 2 out and around the fin which separates the insert blocks. The shortest air gap separating conductors disposed in adjacent connector blocks likewise must extend around the edge of the separating fin. It should be further noted that in the disclosed preferred embodiment, each of the fins extends upwardly to a level above the insulation

gripping portion of the connector so that where a great number of insulated conductors enter the insert blocks, only insulated portions of the conductors are without the additional protection of the barrier fins.

The invention is of particular utility in connection with installations involving a very great number of rather small diameter conductors. One presently used embodiment of the invention comprises a connector block of approximately 4¾" in length (exclusive of ears **26**), ⅝" in width, and 1" in height (including fins **28**). This block provides accommodation for ten insert blocks each of approximately 0.34" x 0.4" x 0.28" in overall dimensions. Since each insert block is capable of receiving five conductors, this arrangement thus permits interconnection of 50 conductors within an area 4¾" long and ⅝" wide. As previously pointed out, any desired number of such blocks can be disposed side-by-side thereby to provide interconnections for any desired number of conductors.

In the foregoing description, the disclosed embodiment is described with particular reference to its position as shown in the drawing, i.e., as secured to a horizontal surface with fins **28** pointing vertically upwardly. In the interest of clarity and facility of description such terms as "upwardly," "downwardly" and the like have been used to define certain parts of the invention with reference to other parts in the particular position of the device shown. However, the use of such terms is not intended in a limiting sense. The invention can be used in any desired orientation. For example, the connector block **2** can be mounted on a vertical or an overhead panel if convenient, with the fins pointing horizontally or downwardly, without danger of disengagement of the connector fins from the insert blocks or the insert blocks from the connector blocks.

Changes in construction will occur to those skilled in the art and various apparently different modifications and embodiments may be made without departing from the scope of the invention. The matter set forth in the foregoing description and accompanying drawings is offered by way of illustration only.



I claim:

Means for electrically interconnecting a plurality of electrical conductors comprising: a relatively hard elastically deformable connector block providing a pair of substantially parallel sidewalls connected together by a plurality of transversely extending ribs to define a plurality of side-by-side apertures, each of said ribs providing relieved portions on the side thereof defining reentrant bearing surfaces effective substantially normally of the planes of said sidewalls, each of said sidewalls providing ledges extending at least partially inwardly of the apertures and defining shelf surfaces facing in a direction substantially opposed to said bearing surfaces, metallic, substantially non-deformable connector-receiving blocks disposed within at least some of said apertures, said blocks being retained between said bearing surfaces and said shelf surfaces, each of said blocks providing a plurality of tapered connector receiving openings, and tapered connectors on the terminal ends of electrical conductors received and retained within at least some of said openings whereby electrical conductors having tapered connectors retained within openings in a common block are electrically interconnected.

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