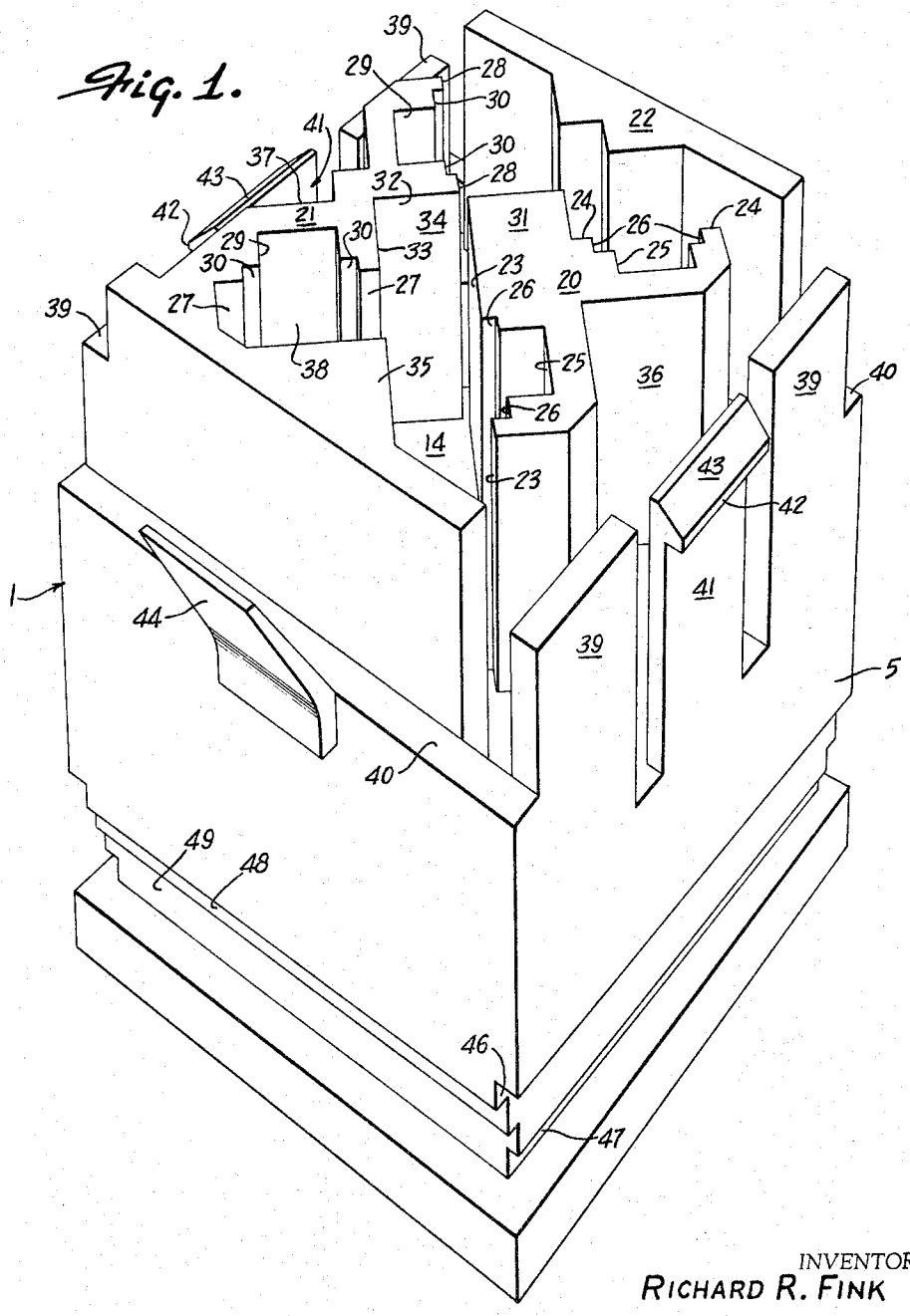
Oct. 25, 1966 R. R. FINK 3,281,753

ELECTRICAL CONNECTOR

Filed Oct. 31, 1963 3 Sheets-Sheet 1

Fig. 1.



INVENTOR.
RICHARD R. FINK
BY
Andrus & Starke
ATTORNEYS

Oct. 25, 1966 R. R. FINK 3,281,753

ELECTRICAL CONNECTOR

Filed Oct. 31, 1963 3 Sheets-Sheet 2

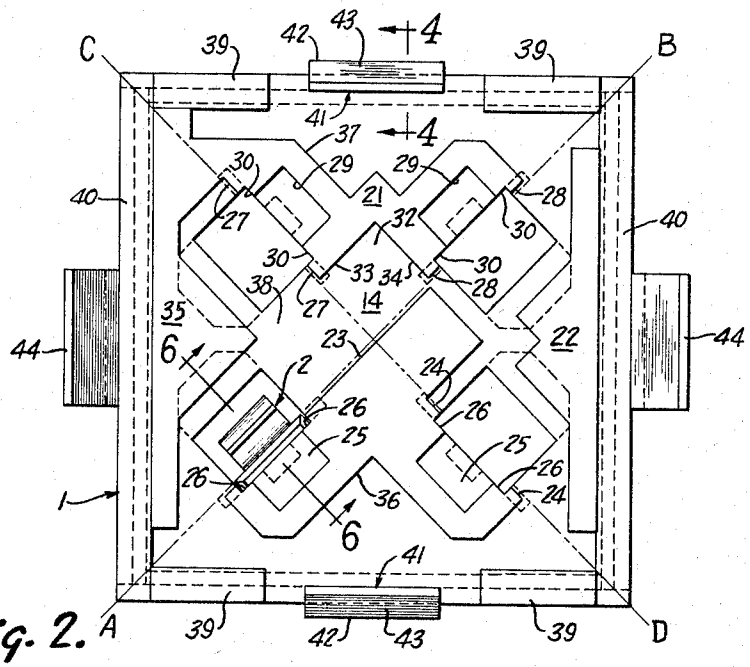


Fig. 2.

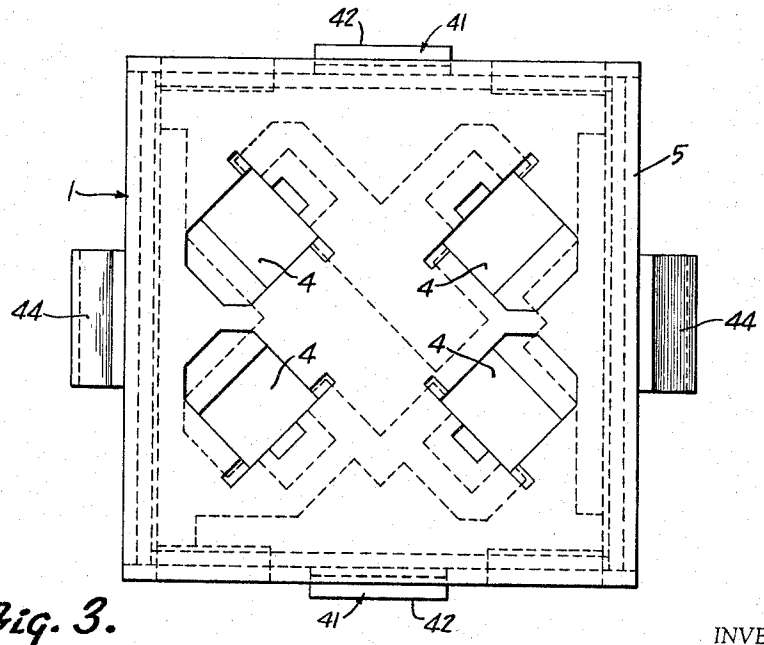


Fig. 3.

INVENTOR.
RICHARD R. FINK
BY
Andrus & Starke
ATTORNEYS

Oct. 25, 1966 R. R. FINK 3,281,753

ELECTRICAL CONNECTOR

Filed Oct. 31, 1963 3 Sheets-Sheet 3

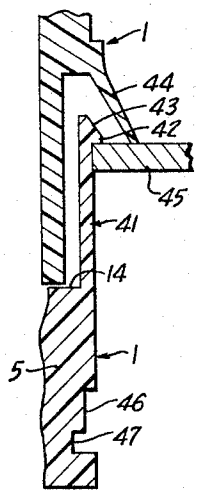


Fig. 4.

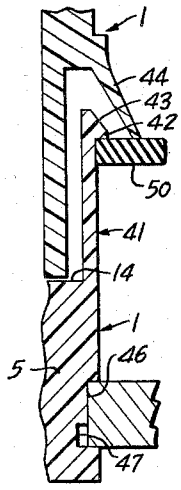


Fig. 5.

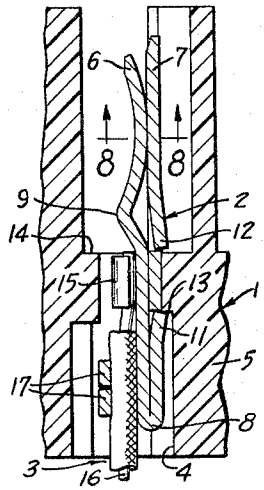


Fig. 6.

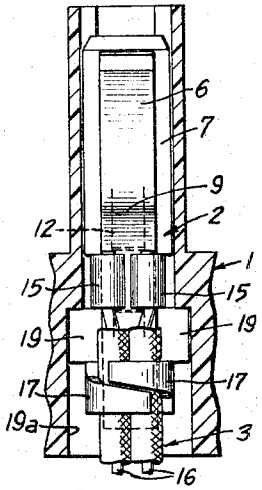


Fig. 7.

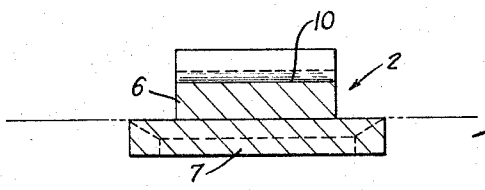


Fig. 8.

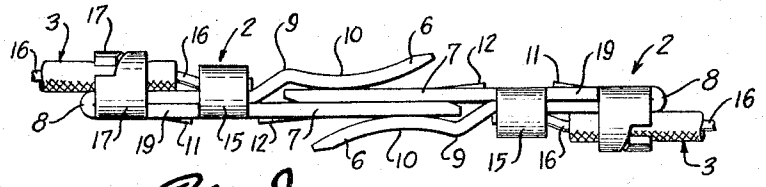


Fig. 9.

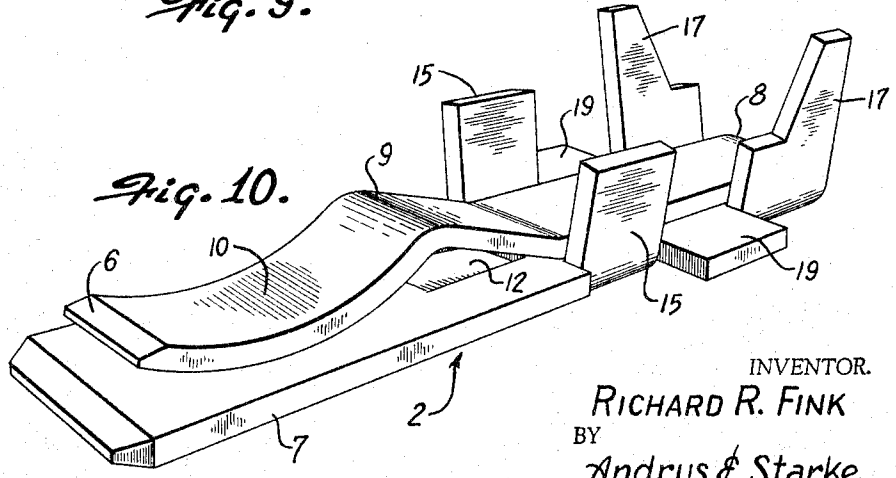


Fig. 10.

INVENTOR.
RICHARD R. FINK
BY
Andrus & Starke
ATTORNEYS

United States Patent Office 3,281,753 Patented Oct. 25, 1966

3,281,753
ELECTRICAL CONNECTOR

Richard R. Fink, Waukesha, Wis., assignor to D. J. Campbell Co., Inc., Waukesha, Wis., a corporation of Wisconsin

Filed Oct. 31, 1963, Ser. No. 320,398
11 Claims. (Cl. 339—49)

This invention relates to an electrical connector and more particularly to an electrical connector utilizing identical bushings and identical terminals.

Multiple electrical connectors are used in appliances and other equipment for joining a series of circuits. The conventional multiple connector includes a male and female insulating bushing, and each bushing carries a series of terminals. When the bushings are inserted in mating engagement, the terminals are brought into electrical contact to complete the circuits. It has been proposed in the past to use identical terminals in both the male and female bushings in order to cut down the cost of inventory and simplify assembly. However, there has been no satisfactory attempt to employ both identical bushings and identical terminals in electrical connectors.

The present invention relates to an improved electrical connector utilizing identical bushings as well as identical terminals. More specifically, each bushing includes a base having a series of openings to receive the terminals. A series of spaced columns or projections extend outwardly from the base, and the terminals extend within the spaces or recesses between the columns. The cross sectional area of each column in a 90° quadrant is substantially equal to the cross sectional area of the recess between the columns in the adjacent 90° quadrant. With this relationship, by rotating one bushing 90° with respect to the other bushing, the columns of one bushing can be inserted within the recesses of the other bushing and the terminals of one bushing are brought into electrical contact with the terminals of the other bushing to provide the electrical connection.

The bushings can be locked within an opening in a chassis or supporting structure by a hook-and-ear mechanism. Opposite sides of each bushing are provided with hooks, while the other sides are provided with ears. By rotating one bushing 90° with respect to the other bushing, the hooks of one bushing are inserted through the opening in the chassis and bear against a surface of the chassis while the ears of the same bushing bear against the opposite surface of the chassis. This same relationship exists for the second bushing so that both bushings are locked to the chassis or other supporting structure.

The use of identical bushings and identical terminals in the electrical connector substantially lowers the cost of manufacture and requires a smaller inventory of parts. The use of identical bushings and terminals also simplifies assembly of the connector in that the person assembling the connector is not required to select and handle as many different parts during assembly.

The terminals in each bushing are insulated from each other by the columns in both the unassembled and assembled condition, and this minimizes the possibility of accidental contact between terminals or between the terminals and outside objects.

As both bushings are locked to the chassis or other supporting structure, a more positive connection is provided which prevents the bushing from being loosened due to vibration or jarring and insures that the electrical connection between the lines will be maintained at all times. In addition, as both of the bushings lock to the chassis, half of the assembled connector will be on one side of the chassis while half will be on the other, which provides greater stability.

Other objects and advantages will appear in the course of the following description.

The drawings illustrate the best mode presently contemplated of carrying out the invention.

In the drawings:

FIG. 1 is a perspective view of one of the identical bushings of the electrical connector without the terminals;

FIG. 2 is a top plan view of the bushing with one terminal connected to the bushing;

FIG 3 is a bottom view of the bushing without the terminals;

FIG. 4 is an enlarged fragmentary section taken along line 4—4 of FIG. 2 showing the connection of the bushings to a chassis;

FIG. 5 is in enlarged fragmentary section showing a modified form of the connection to the chassis;

FIG. 6 is a section taken along line 6—6 of FIG. 2 and showing the attachment of a terminal to the bushing;

FIG. 7 is a plan view of a terminal connected to a conductor;

FIG. 8 is an enlarged section taken along line 8—8 of FIG. 6;

FIG. 9 is a side elevation of two terminals in assembled relation; and

FIG. 10 is a perspective view of a terminal before attachment to a conductor.

The drawings illustrate a multiple electrical connector comprising a pair of identical, electrically insulating bushings **1** which carry a series of identical terminals **2** connected to lead wires **3**.

Each of the terminals **2** is located within an opening **4** in the square base **5** of bushing **1**, and includes a pair of leaves **6** and **7** which are joined together at their outer ends by a bend **8**. The leaf **6** is provided with a bent or crimped area **9** and a generally curved portion **10** which bears against the other leaf **7**. The crimp **9** serves to provide a spring force or resiliency to urge the curved portion **10** of the leaf **6** into engagement with the leaf **7**. The curved portion **10** also spaces the inner end of the leaf **6** from the corresponding end of the other leaf **7** so that leaves of the corresponding terminal of the other bushing can be inserted between the leaves **6** and **7**.

As best shown in FIG. 6, the leaf **7** is provided with a pair of cutouts or ears **11** or **12** which project outwardly from the surface of leaf **7**. The ear **11** is adapted to engage a shoulder **13** formed in the base, while the other ear **12** is adapted to engage the outer surface **14** of the base **5**. The ears **11** and **12** serve to prevent longitudinal movement of the terminal **2** within the opening **4**.

To connect the terminal **2** to the lead wire **3**, the terminal is provided with a pair of ears **15** which are crimped around, and into electrical conductive relation with, the conductors **16** of lead wire **3**. In addition to ears **15**, the terminal is also provided with a pair of ears **17** which are bent or crimped over the insulation **18** of the lead **3**. The ears **15** and **17** serve to positively connect the terminal **2** to the lead **3**.

As best shown in FIG. 7, the leaf **6** is narrower in width than the leaf **7**. However, the width of the leaf **6** is approximately equal to the width of the portion of the leaf **7** on either side of the ears **11** and **12**, which insures that the current-carrying capacity of the leaves **6** and **7** is approximately equal.

The terminal **2** is also provided with a pair of laterally extending flanges **19** which are received within recesses **19*a*** in base **5**. The engagement of the flanges **19** within recesses **19*a*** restrains lateral movement of the terminal as well as movements in a direction normal to the face of the leaf **7**.

A series of columns **20**, **21** and **22** extend outwardly from the surface **14** of base **5** and project outwardly

beyond the ends of the terminals 2. The column 20 is provided with a pair of walls 23 and 24 which extend along the diagonals of the bushing. As best shown in FIG. 2, the wall 23 extends along the diagonal OA while the wall 24 extends along the diagonal OD. Each of the walls 23 and 24 is provided with a recess 25 which extends the length of the column 20. In addition, a pair of recesses 26 are formed in each of the walls 23 and 24 along the sides of the recesses 25.

The leaves 6 and 7 of the terminals 2 straddle the respective diagonal, and the side edges of each leaf 7 project within recesses 26. The portion of the column 20 defining each recess 26 serves to support the leaf 7 and prevent lateral movement of the leaf. The recess 25 serves as a space within which the leaf 6 and the crimp 9 of the corresponding terminal of the other bushing are received when the bushings are in the assembled condition.

The column 21 is also provided with a pair of walls 27 and 28 which extend the length of the column and are disposed along the diagonals OC and OB, respectively. Each of the walls 27 and 28 is provided with a recess 29 and a pair of communicating recesses 30 similar to recesses 25 and 26 in walls 23 and 24. The leaves 6 and 7 of the terminals straddle the diagonals and the side edges of the leaf 7 are received within the recesses 30.

To assemble the bushings, one of the bushings is rotated 90° with respect to the other bushing and the columns 20, 21 and 22 are then inserted within the recesses between the columns of the other bushing. To index the bushings so that they can only be inserted or assembled in a given relationship, an indexing projection 31 is associated with the column 20 and when the bushing is rotated 90°, the projection 31 is received within the recess 32 of the other bushing. The recess 32 is defined by the walls 33 and 34 of the column 21.

The column 22, as well as the portion 35 of column 21, are located in spaced relation to the terminals 2 and serve to prevent the accidental contact between the terminals and outside objects when the bushings are in the unassembled condition. As best shown in FIG. 2, the column 22, column section 35, as well as the wall 36 of column 20, and the wall 37 of column 21, serve to insulate the terminals 2 from lateral contact so that the only manner in which the terminals can be contacted when the bushings are in an unassembled condition, is from the outer end or top.

The column 20–22 are designed with a size and shape to insulate the terminals from lateral contact and to mate with the recesses between the columns of the other bushing when the bushings are in the assembled relation. Generally, the cross sectional area of the columns within any 90° quadrant of the bushing is substantially equal to the cross sectional area of the recess between the columns in the next adjacent 90° quadrant. For example, the cross sectional area of the portion of the column 20 located within quadrant AOD is substantially equal to the area of the recess 38 between columns 20 and 21 in quadrant OAC. Thus, by rotating one bushing 90° with respect to the other bushing, the column 20 in the quadrant AOD will be received within the recess 38 in quadrant AOC.

Locating the terminals 2 along the diagonals AB and CD of the bushing is important in obtaining identical bushings that will mate. In addition, locating the width of the leaves 6 and 7 along the diagonals, rather than at an angle to the diagonals, provides the smallest sized bushing with a given spacing between the terminals.

The opposite sides of the bushing 1 are provided with a pair of walls 39 which extend upwardly from the surface 14 of the base, and the outer ends of the walls 39 terminate below the outer ends of the columns 20–21. In addition, each of the other sides of the bushing 1 is provided with a wall 40 which extends along the entire side of the bushing. The walls 40 also extend upwardly from the surface 14 and terminate below the walls 39. When the bushings are assembled together, the outer ends of the walls 40 of one bushing will be in opposed relation to the outer ends of the walls 39 of the other bushing. Thus, in the assembled condition, the walls 39 and 40 provide an outer enclosure which provides a complete insulation for the terminals.

To lock the bushings 1 together in the assembled position, a latching member 41 is secured to opposite side walls of each bushing between the walls 39. The upper end of the latching member 41 terminates in a hook 42, and a sloping surface 43 connects the hook to the outer tip of the latching member. In addition to the latching members 41, each bushing is provided with a pair of flexible latching ears 44 which are located on the other sides of the bushing from the latching members 41.

To assemble the bushings 1 within an opening in a cabinet or chassis 45, as shown in FIG. 4, one of the bushings is inserted within the opening and the sloped surfaces 43 of latching members 41 engage the chassis 45 and wedge the latching members 41 inwardly so that the hooks 42 will pass through the opening and engage the opposite surface of the chassis 45. The second bushing is then rotated 90° with respect to the first bushing and inserted in mating engagement with the first bushing. As the second bushing is inserted into the opening in the chassis 45, the sloped surfaces 43 of the latching members 41 of the second bushing ride on the edge of the chassis bordering the opening and wedge the latching members 41 inwardly so that the hooks 42 engage the opposite surface of the chassis, similar to the action of the hooks 42 of the first bushing. The latching ears 44 of the first bushing will bear against the opposite surface of chassis 45 from the hooks 42 of the first bushing, as shown in FIG. 4. However, the hooks 42 and ears 44, along any one side of the assembled connector, bear against the same side of the chassis, although the hooks 42 of one bushing bear against the opposite surface of the chassis from the ears 44 of the same bushing. This prevents the bushings from being withdrawn from the chassis unless the hooks are flexed inwardly and the bushings can then be withdrawn from the opening.

As shown in FIG. 4, the assembled connector is attached at its mid-point to the chassis 45 which produces a balanced condition, particularly if the connector is free-hanging. Approximately one-half of the assembled connector lies on one side of the chassis wall, while one-half of the connector lies on the opposite side of the chassis wall.

In some instances where access is limited, it may be desired to mount the connectors substantially on one side of the chassis 45. To provide for this type of mounting, opposite surfaces of the base 5 of each bushing are provided with a pair of slots 46 and 47 and the other two opposite sides of the base 5 of each bushing are provided with a pair of slots 48 and 49. The slots 46–49 are all of a different width and enable the bushings to be mounted or assembled with chassis of four different guage thicknesses. In this case, the bushing is slid into a slot or recess in the chassis 45, as shown in FIG. 5, with the chassis, depending on the thickness, being received within one of the slots 46–49 in the base. The use of the series of slots enables the bushing to be used with a wide variety of gauge thicknesses.

When the connector is assembled to the chassis by means of the slots 46–49, it may be desired to position an auxiliary connector ring 50 around the assembled bushings. The hooks 42 and latching ears 44 engage the ring 50 and prevent the bushings from being accidentally separated. Without the use of the ring 50, the bushings are held together primarily by the frictional contact of the terminals 2.

While the drawings illustrate the bushings 1 as being generally square in shape, it is contemplated that the

bushings can have any desired shape, such as polygonal, circular, or the like.

As the electrical connector of the invention utilizes identical bushings, as well as identical terminals, the cost of the unit is reduced and a substantial inventory savings results in that only a single bushing and a single terminal is required in inventory.

The terminals are insulated from other terminals in the same bushing by the columns which separate the terminals, and the terminals are also insulated against lateral contact with outside live and dead metal objects.

The bushings are locked to the chassis by means of the hooks and ears to provide a positive connection that will not be disengaged until the hooks are depressed. In addition, one-half of the connector is located on one side of the chassis and one-half on the other, which provides greater stability. In some instances where access is limited on either side of the casing, the bushing can be installed in a slot in the chassis by use of the grooves **46–49**. As four different grooves are provided, each of which has a different width, the electrical connector is readily adaptable to different chassis thicknesses.

Various modes of carrying out the invention are contemplated as being within the scope of the following claims particularly pointing out and distinctly claiming the subject matter which is regarded as the invention.

I claim:

1. An electrical connector, comprising a pair of identical mating bushings, and a pair of identical electrical terminals with one of said pair of terminals associated with each of said bushings with the cross section of said bushing being divided into four quadrants by a pair of perpendicular lines extending through the center of said bushing, each bushing including a base having at least one opening therein to receive said terminal, each bushing also having a plurality of spaced columns extending outwardly from the outer surface of the base with the columns being separated by recesses and the terminal extending in one of said recesses, the cross sectional area of the column in each quadrant of the bushing corresponding generally in size and shape to the cross sectional area of the recess between columns in the adjacent quadrant whereby the column in each quadrant is received in said recess of the adjacent quadrant when one bushing is rotated 90° and mated with the other bushing and the terminal of said one bushing contacts the terminal of the other bushing.

2. The connector of claim **1**, in which first opposite portions of the periphery of each bushing are each provided with a first groove, with said first grooves being of the same width and adapted to slidably receive a first support member, and second opposite portions of the periphery of each bushing are each provided with a second groove, said second grooves being of the same width and being of a different width than the first grooves and adapted to slidably receive a second support member of different thickness than said first support member.

3. The connector of claim **1**, in which said bushings are generally square in cross section and have a pair of opposite first walls and a pair of opposite second walls, each of said first walls having a plurality of first grooves of different widths extending transversely of the axis of the bushing and each of said second walls having a plurality of second grooves of different widths extending transversely of the axis of the bushing, said second grooves having different widths than said first grooves, said first and second grooves adapted to receive support members of different thicknesses to thereby support the assembled connector.

4. In an electrical connector, a pair of identical electrically insulating bushings disposed in mating engagement when in the assembled condition, a plurality of identical electrical terminals associated with each of said bushings with the terminals of one bushing being in electrical contact when the bushings are in mating engagement with corresponding terminals of the other bushing, each of the bushings being generally square in cross section and having a pair of opposite first walls and a pair of opposite second walls, a first locking member connected to each of said first walls, and a second locking member connected to each of said second walls, each first locking member disposed to cooperate with a second locking member when one bushing is rotated 90° with respect to the other bushing to lock the bushings within an opening in a supporting structure.

5. The structure of claim **4**, in which the first locking members are flexible ears disposed to bear against a surface of said supporting structure adjacent said opening and said second locking members are provided with hooks disposed to engage the same surface of the supporting structure as the corresponding ear located on the same side of the assembled connector.

6. The connector of claim **1** and including indexing means for effecting mating engagement of the bushings in only one relative position and for preventing mating engagement of the bushings in other relative positions.

7. The connector of claim **5** in which the indexing means is a projection extending outwardly from the base of each bushing and receivable within the recess of the other bushing and the projection is located adjacent the center of the bushing and lies along both of said lines which extend through the center of the bushing.

8. In an electrical connector, a pair of identical mating electrical insulating bushings with the cross section of each bushing being divided into four generally equal quadrants by a pair of perpendicular lines passing through the center of the bushing, and a plurality of identical electrical terminals associated with each of said bushings with the terminals of each bushing being identical to the other terminals of said bushing and the terminals of each bushing being identical with the terminals of the other bushing, the terminals of one bushing being in electrical contact with corresponding terminals of the other bushing when the bushings are in mating engagement, said terminals being spaced from the center of the bushing and being located along said lines extending through the center of said bushing.

9. The structure of claim **8** in which the bushings are generally square in cross section and said lines extend diagonally between the corners of said bushing.

10. The structure of claim **8** in which each terminal includes a pair of generally flat leaves with the leaf of one terminal of one of said bushings being disposed between the leaves of the corresponding terminal of the other bushing when the bushings are in mating engagement, and the leaves of each terminal straddle the diagonal lines extending between opposite corners of the bushing.

11. In an electrical connector, a pair of identical electrically insulating mating bushings, a plurality of electrical terminals associated with each of said bushings with the terminals of one bushing being in electrical contact with the terminals of the other bushing when the bushings are in mating engagement, the outer surface of each bushing having a pair of first locking members disposed 180° apart and said outer surface of each bushing also having a pair of second locking members disposed approximately 180° apart and disposed 90° from said first locking members, each first locking member disposed to cooperate with the second locking member of the other bushing when one bushing is rotated 90° with respect to the other bushing and mated therewith to thereby lock the bushings within an opening in a supporting structure.

References Cited by the Examiner

UNITED STATES PATENTS

398,769	2/1889	Currie	339—49 X
2,124,207	7/1938	Neesen	339—49
2,384,267	9/1945	Andersen	339—49

(Other references on following page)

7

UNITED STATES PATENTS

2,386,177	10/1945	Andersen	339—49
2,756,403	7/1956	Francis et al.	339—59
2,891,103	7/1959	Swengel	339—126 X
3,011,143	11/1961	Dean	339—49
3,034,089	5/1962	Curtis	339—49
3,054,979	9/1962	Buiting	339—49
3,072,340	1/1963	Dean	339—49
3,079,581	2/1963	Klumpp	339—128

8

3,083,345	3/1963	Scheller	339—47
3,086,188	4/1963	Ross	339—49

FOREIGN PATENTS

930,520	7/1963	Great Britain.
56,178	10/1943	Holland.

EDWARD C. ALLEN, *Primary Examiner.*

PATRICK A. CLIFFORD, *Examiner.*