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Van Son

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[54] **ELECTRICAL CONNECTOR**

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[52] **U.S. Cl.** .. **339/103 M,** 339/156 R, 339/186 M, 339/276 A

[51] **Int. Cl.** **H01r 13/58,** H01r 13/64

[58] **Field of Search** ..... 339/154, 156, 184, 339/186, 176 M, 103, 276 A

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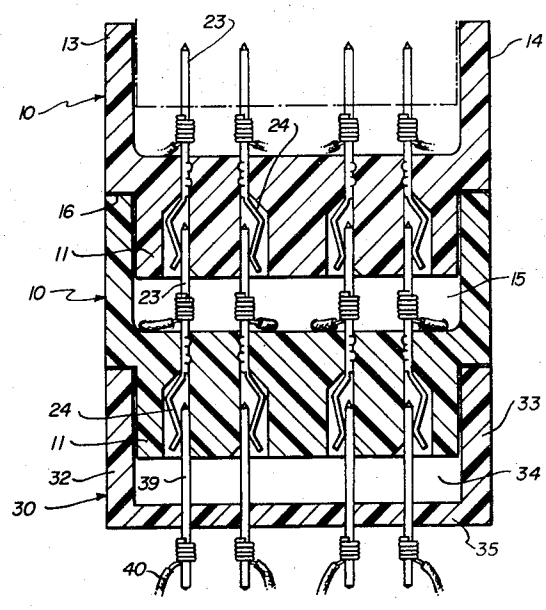
[57] **ABSTRACT**

A stackable electrical connector having a base portion with vertically disposed walls extending therefrom is disclosed. The walls form a receptable cavity and the base forms a plug which is proportioned such that it may be inserted into the receptable cavity of another connector. The base includes a plurality of pin receiving apertures into which connector pins are disposed. A portion of the pins extend into the cavity to permit electrical connection to another connector which may be plugged into the cavity.

8 Claims, 7 Drawing Figures



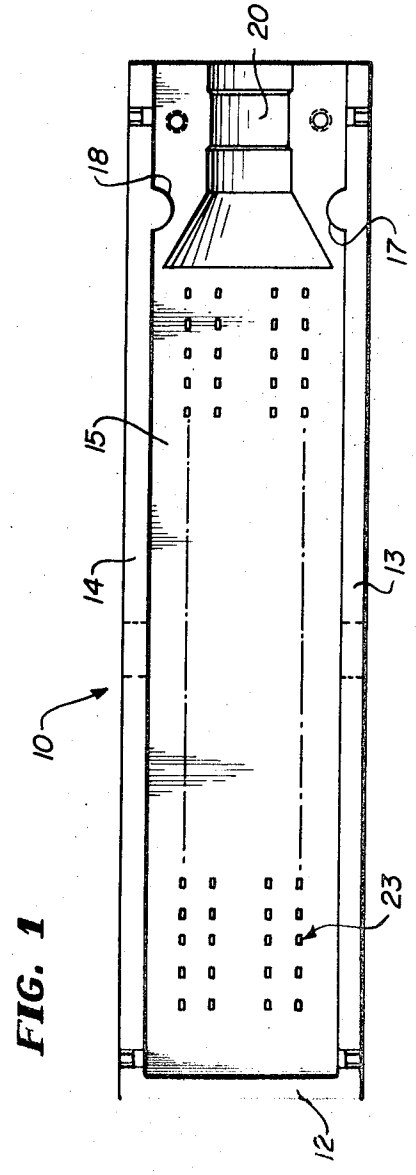


FIG. 1

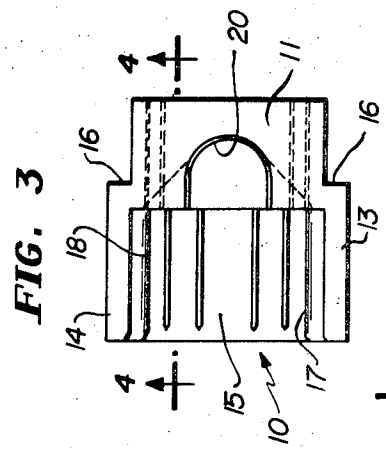


FIG. 3

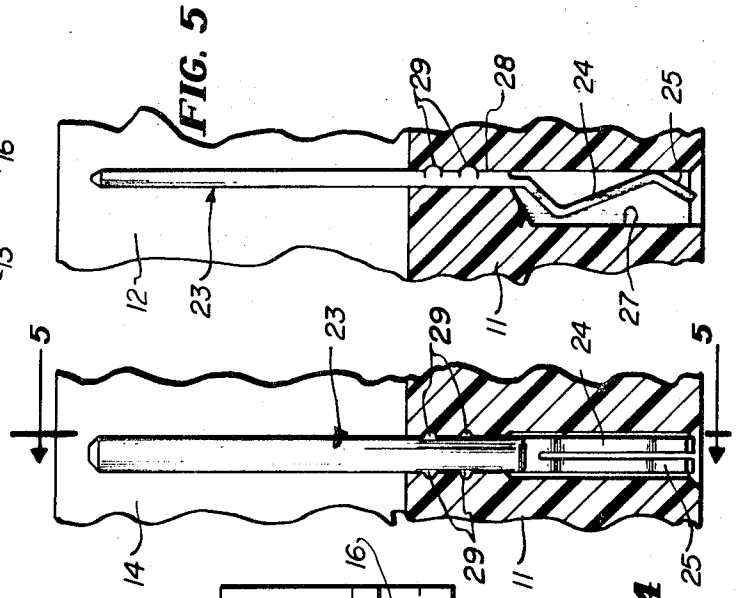


FIG. 5

FIG. 4

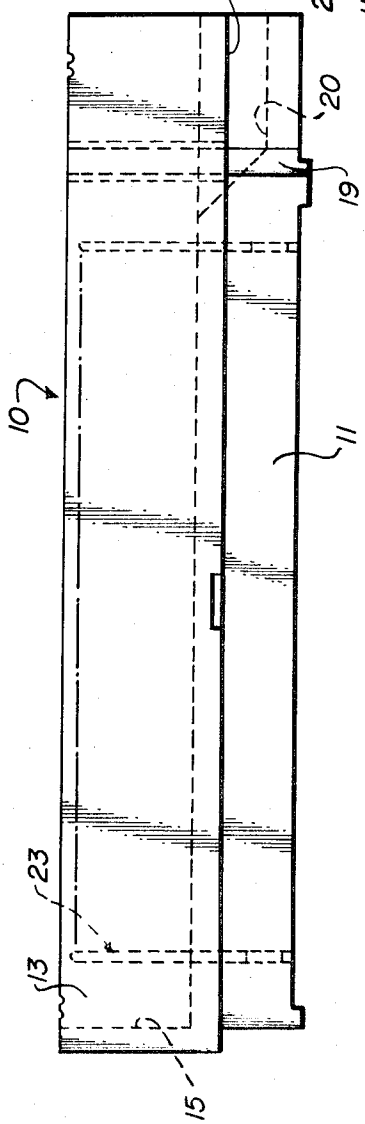
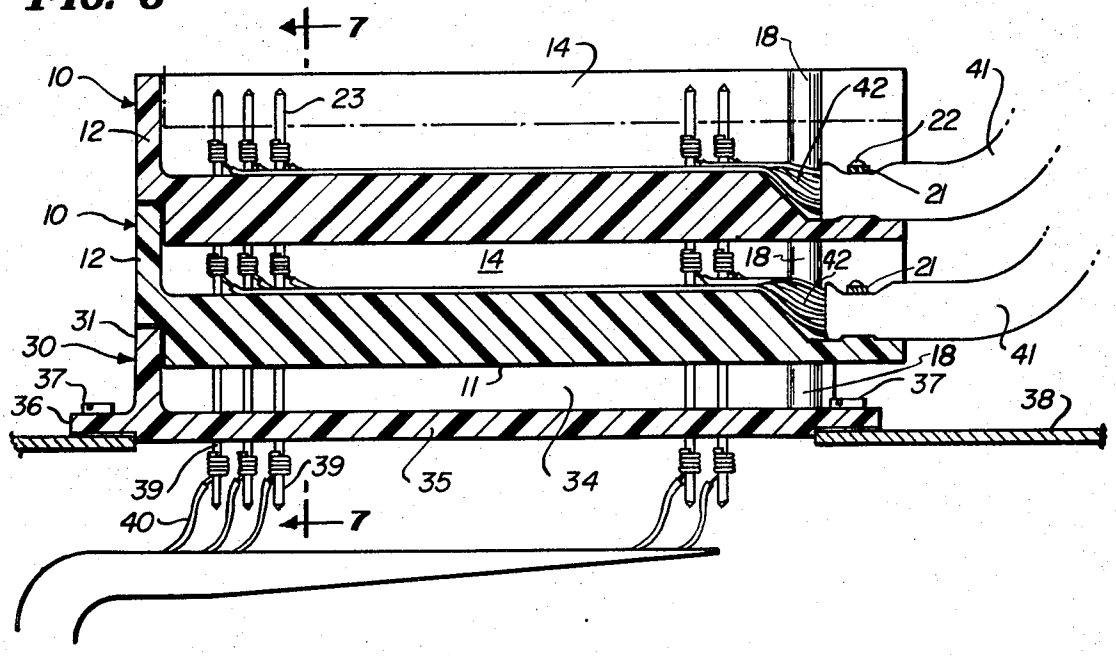


FIG. 2

FIG. 6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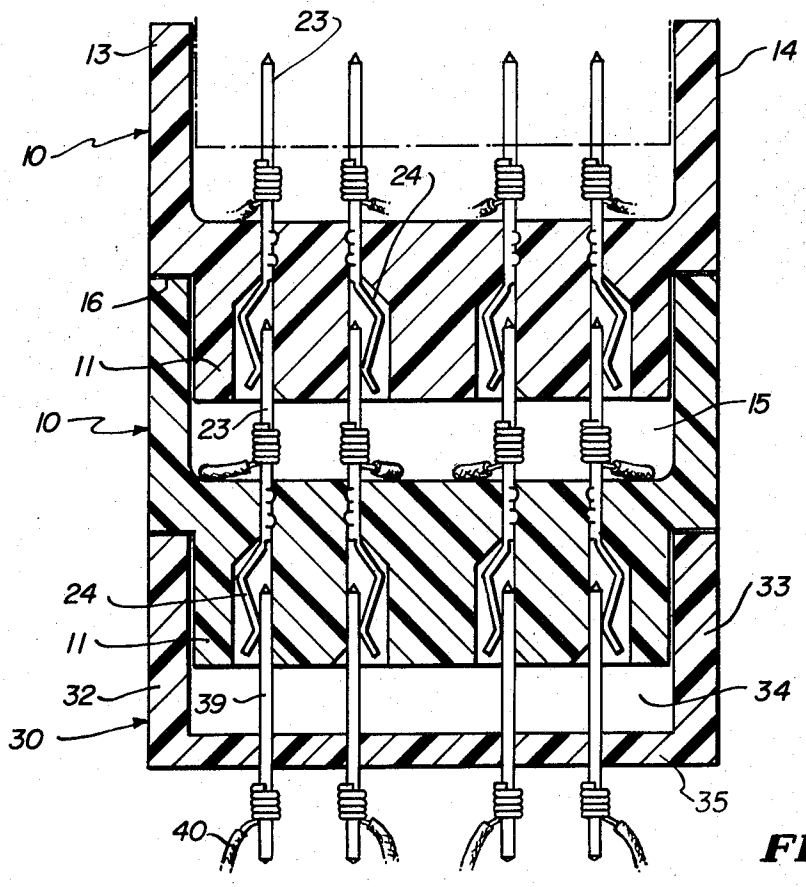
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FIG. 7

ELECTRICAL CONNECTOR

This invention relates, in general, to improved electrical connectors and, in particular, to improved electrical connectors which can be easily and quickly connected together, one atop another.

In the telephone industry, there is a growing need for quick connecting central office equipment. While there are presently available numerous different types of electrical connectors, they all generally suffer or lack certain features or characteristics which are desirable or necessary for such applications.

For example, many of these electrical connectors are difficult to wire, i.e., to electrically connect wires to them. Others are simply difficult to connect to its counterpart, for these connectors normally contain a relatively large number of electrical contacts or pins, and the connector and its counterpart must be precisely aligned in order that these contacts make proper electrical contact, and these connectors lack any provisions to assure proper alignment. Or, if they do, considerable effort is required to properly engage the alignment means. Others are not stackable, i.e., will not accept another similar electrical connector as, for example, when it is desired to couple test apparatus to the equipment.

Accordingly, it is an object of the present invention to provide improved electrical connectors.

More particularly, it is an object to provide improved electrical connectors which can be easily and quickly aligned and connected.

A still further object is to provide improved electrical connectors of the above-described type which can be connected together, one atop another, i.e., stacked.

Still another object is to provide improved electrical connectors of the above-described type which can be easily wired.

Still another object is to provide improved electrical connectors of the above-described type which are simple in construction and relatively easy to fabricate in comparison to similar type electrical connectors.

Other objects of the invention will in part be obvious and will in part appear hereinafter.

The above objectives are accomplished with an electrical connector which comprises, generally, a base portion which functions as a plug and which has vertically disposed walls on its top which are proportioned to form a receptacle cavity for receiving therein the base portion of another like connector. A number of electrical connector pins are disposed within pin receiving apertures in the base portion, and are of a length to extend into the receptacle cavity and establish electrical contact with the electrical connector pins in another like electrical connector, when the latter's base portion is plugged into the receptacle cavity. Interlocking means are provided on the walls and on the base portion, and these interlocking means in cooperation with the walls permit the base portion of another like connector to be easily and quickly aligned and plugged into the receptacle cavity, to establish electrical contact between the two connectors. The construction of the electrical connectors furthermore is such that they can be easily wired by, for example, wire wrapping the electrical connector pins, with conventional wire wrapping apparatus.

The invention accordingly comprises the features of construction, combination of elements, and arrangement of parts which will be exemplified in the construction hereinafter set forth, and the scope of the invention will be indicated in the claims.

For a fuller understanding of the nature and objects of the invention, reference should be had to the following detailed description taken in connection with the accompanying drawings in which:

FIG. 1 is a top plan view of an electrical connector exemplary of the present invention;

FIG. 2 is a side plan view of the electrical connector of FIG. 1;

FIG. 3 is an end plan view of the electrical connector of FIG. 1;

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

FIG. 5 is a partial sectional view taken along lines 5—5 of FIG. 4;

FIG. 6 is a sectional view generally illustrating the manner in which the electrical connectors are stacked atop one another, and are received within a similarly constructed terminal box; and

FIG. 7 is a sectional view taken along lines 7—7 of FIG. 6.

Similar reference characters refer to similar parts throughout the several view of the drawings.

Referring now to the drawings, particularly FIGS. 6 and 7 thereof, there is illustrated several electrical connectors **10** which are stacked together and are, in turn, received or stacked within the terminal block **30**. The terminal block **30** is affixed by means of fastener means such as threaded screws **37** to the housing **38** (only partially shown) of, for example, a bay of central office telephone equipment.

The electrical connectors **10**, as can be best seen in FIGS. 1—3, include a base portion **11** having an end wall **12** and two parallel side walls **13** and **14** integrally formed atop of it. These side walls **13** and **14** and the end wall **12** define therebetween a receptacle cavity **15** which is proportioned to receive therein the base portion **11** of another electrical connector **10**. A shoulder **16** extends about three sides of the electrical connector **10** and forms a stop. The length of the base portion **11** is such that it firmly seats within a receptacle cavity **15** and is not easily accidentally dislodged therefrom, with its bottom spaced from the bottom of the receptacle cavity **15**. This space permits the connectors to be more easily wired and stacked together, as described more fully below.

Interlocking tongues or ribs **17** and **18** are formed on respective ones of the side walls **13** and **14**, and interlocking grooves **19** (only one of which is shown) are formed in the base portion **11**. These interlocking tongues **17** and **18** and grooves **19** are correspondingly positioned so that the tongues **17** and **18** on one connector **10** interlock or matingly engage with the grooves **19** on the base portion **11** of another connector **10**, and in conjunction with the side walls **13** and **14** and the end wall **12** function to align the two connectors with one another, to assure precise alignment between the respective electrical connector pins **23**.

A cable receiving cavity **20** is formed in the base portion **11**, on the end opposite the end wall **12**, for receiving therein the insulated end of a cable **41** (FIG. 6) formed of many conductor wires **42** which ultimately are to be wired to respective ones of the electrical connector pins **23**. The cable **41** is seated within the cable receiving cavity **20**, and is retained therein with fasten-

ing means such as the bar clamp **21** which is affixed or clamped over the cable and secured to the connector by means of threaded screws **22.**

The electrical connector pins **23** can be of various different constructions, but as can be best seen in FIGS. **4** and **5,** preferably and advantageously they are of the spade type having a generally W-shaped bend in one end thereof. The base portion **11** of the connectors **10** has pin receiving apertures formed therein, in the form of a generally rectangular-shaped slot **27** which extends into it from the bottom and merges with an opening **28** having or of substantially the same cross-sectional shape and dimensions of the connector pins **23.** The connector pins **23** are extended through the base portion **11** from the bottom thereof, so that the W-shaped bend **24** seats in the rectangular-shaped slot **27,** and the straight length portion thereof extends through opening **28** into the receptacle cavity **15.** The connector pins **23** are crimped to provide a pair of projecting tabs **29** which frictionally bind to assist in retaining the connector pins **23** in position when force-fitted or friction fitted in the pin receiving apertures. The W-shaped bends **24** provide a spring type or resilient action to the connector pins **23,** to maintain them in electrical contact with the other connector pins plugged into the pin receiving apertures. The lower knee of the W-shaped bend **24** forms a camming surface **25,** to permit a connector pin **23** to be more easily aligned and plugged into a pin receiving aperture.

The terminal block **30** is generally a straight through connector pin terminal block having a bottom wall **35,** with an end wall **31** and two side walls **32** and **33** integrally formed on top of it. These end walls **31** and side walls **32** and **33,** like the end walls **12** and side walls **13** and **14** on the electrical connectors **10,** form a receptacle cavity **34** therebetween and are proportioned to receive therein the base portion **11** of the electrical connectors **10.** Apertures (not shown) are provided in the bottom wall **35** and in an extending flange **36** for receiving threaded screws **37** or the like, to secure the terminal block **30** to a housing **38** or other surface. The side walls **32** and **33** have interlocking tongues **17** and **18** formed therein for receiving the interlocking grooves **19** on the base portion **11** of a connector **10.**

The electrical connector pins **39,** in this case, are generally like the connector pins **23,** but they are simply of a straight length and extend both above and below the bottom wall **35.** A portion of the connector pins **39** extending above the bottom wall **35** is of a length such as to plug into the pin receiving apertures in a connector **10,** when the base portion **11** of the latter is plugged into the receptacle cavity **34** of the terminal block **30,** while the portion below the bottom wall **35** permits conductor wires to be easily and quickly connected to the connector pins **39** by, for example, wire wrapping them, as illustrated in FIG. **7.**

From the above description, it can be seen that a terminal block **30** can be affixed to the housing **38** of, for example, a bay of central office telephone equipment, by means of fasteners such as the threaded screws **37.** Its electrical connector pins **39** can be easily and quickly wired, by wire wrapping the ends of conductor wires **40** about the portion thereof extending below its bottom wall **35.**

The base portion **11** of an electrical connector **10** is plugged into the receptacle cavity **34** of the terminal block **30,** to establish electrical contact between the electrical connector pins **39** and **23.** The end wall **31** and the side walls **32** and **33** in cooperation with the interlocking grooves **19** in the base portion **11** and the interlocking tongues **17** and **18** in the side walls **32** and **33** of the terminal block **30** provide a precise alignment between the base portion **11** and the receptacle cavity **34,** to assure correct electrical contact is made between the corresponding ones of the connector pins **39** and **23.**

The conductor wires **42** of a cable **41** are wired to the connector pins **23,** about the portion of the connector pins **23** extending into the receptacle cavity **15.** The fact that the connector pins **23** are exposed on the top portion of the connector **10** permits this wiring to be easily and quickly accomplished by, for example, wire wrapping the end of the conductor wires about the connector pins.

A second electrical connector **10** can be stacked atop another electrical connector, by plugging its base portion **11** into the receptacle cavity **15** of the lower connector, since the base portions **11** and the end wall **12** and the side walls **13** and **14** forming the receptacle cavities **15** all are proportionally formed to provide this plug-in, stackable feature. The spacing between the bottom of the base portions **11** and the receptacle cavities **15** permit the connector pins **23** to be wired, in a fashion such that the wiring does not interfere with or prevent two connectors being stacked together. In this fashion, various pieces of equipment can be easily and quickly multiplied together, or test equipment or the like can be removably coupled to the equipment.

It will thus be seen that the objects set forth above, among those made apparent from the preceding description, are efficiently attained and certain changes may be made in the above construction. Accordingly, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

Now that the invention has been described, what is claimed as new and desired to be secured by Letters Patent is:

1. A plug-in, stackable electrical connector comprising a base portion having vertically disposed walls integrally formed therewith on the top thereof, said walls forming a receptacle cavity having an outlet for receiving an electrical cable comprising a plurality of electrical conductor wires and said base portion forming a plug which is correspondingly proportioned to be plugged into the receptacle cavity of another one of said electrical connectors, whereby a plurality of said electrical connectors can be plugged together in a stacked relationship one atop the other, a plurality of pin receiving apertures in said base portion in predetermined spaced relationship, an electrical connector pin disposed within respective ones of said pin receiving apertures and extending into said receptacle cavity to permit said electrical connector pins to be received in and to make electrical contact with the electrical connector pins in the correspondingly aligned pin receiving apertures in an electrical connector plugged therein, the thickness of said base portion being less than the depth of said receptacle cavity, whereby an open cavity is provided between the base portion and the bottom of said receptacle cavity of another one of said electrical connectors when said electrical connectors are plugged together, said electrical connector pins being exposed in said open cavity and permitting the

electrical conductor wires of an electrical cable extended through said outlet to be electrically connected with them.

2. The electrical connector of claim 1, wherein said base portion is rectangular-shaped and has an end wall and two side walls vertically disposed on the top thereof forming said receptacle cavity.

3. The electrical connector of claim 1, further including interlocking means on said base portion and said side walls for locating and aligning a pair of said electrical connectors plugged together.

4. The electrical connector of claim 3, wherein said interlocking means comprise tongue and groove interlocks on respective ones of said base portion and said side walls.

5. The electrical connector of claim 2, further including a cable receiving cavity in the top surface of said base portion opposite said end wall for receiving therein an electrical cable, and means for retaining said electrical cable in said cable receiving cavity to affix said electrical connector to said cable.

6. The electrical connector of claim 1, wherein said pin receiving apertures each is in the form of a generally rectangular-shaped slot extending partially through said base portion from the bottom thereof and merging with an opening which substantially corresponds with the cross-sectional configuration of said electrical connector pins and which extends the remaining distance through said base portion, said electrical connector pins each being a straight length having a generally W-shaped bend in one end thereof, the straight length of said electrical connector pins being extended through said openings of said pin receiving apertures and said W-shaped bends thereof being disposed within said rectangular-shaped slots, the one knee of said W-shaped bend providing resiliency to said electrical connector pin to maintain electrical contact with another electrical connector pin and the other knee thereof forming a camming surface for guiding another electrical connector pin into said pin receiving aperture.

7. The electrical connector of claim 6, wherein said electrical connector pins each is rectangular-shaped in cross-section.

8. In combination, a terminal block and a plug-in, stackable electrical connector, said terminal block comprising a bottom wall having at least three vertically disposed walls integrally formed therewith on the top thereof forming therebetween a receptacle cavity having an outlet for receiving an electrical cable comprising a plurality of electrical conductor wires and a plurality of electrical connector pins extending through said bottom wall in predetermined spaced relationship, said plug-in, stackable electrical connector comprising a base portion having at least three vertically disposed walls integrally formed therewith on the top thereof, said walls forming a receptacle cavity having an outlet for receiving an electrical cable comprising a plurality of electrical conductor wires and said base portion forming a plug which is correspondingly proportioned to be plugged into the receptacle cavity of another one of said electrical connectors and said receptacle cavity in said terminal block, thereby permitting said electrical connector to be coupled to said terminal block and a plurality of said electrical connectors to be stacked one atop the other, a plurality of pin receiving apertures in said base portion, an electrical connector pin disposed within respective ones of said pin receiving apertures and extending into the receptacle cavity of said connector, said electrical connector pins of said terminal block being received in and making electrical contact with the electrical connector pins in the correspondingly aligned pin receiving apertures in said electrical connector and the electrical connector pins of the latter being received in and making electrical contact with the connector pins in the correspondingly aligned pin receiving apertures in the electrical connector stacked atop of it, the thickness of said base portion being less than the depth of said receptacle cavity in said terminal block and said electrical connector, whereby an open cavity is provided between the base portion and the bottom of said receptacle cavity of another one of said electrical connectors of said terminal block when plugged together, said electrical connector pins being exposed in said open cavity and permitting the electrical conductor wires of an electrical cable extended through said outlet to be electrically connected with them.

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