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ELECTRICAL CONNECTORS

Filed April 13, 1961

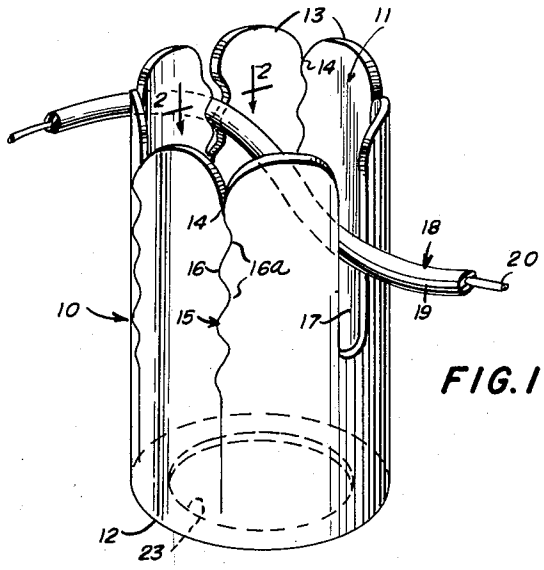

FIG. 1

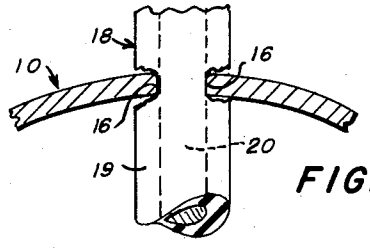

FIG. 2

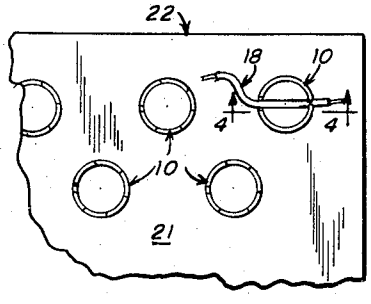

FIG. 3

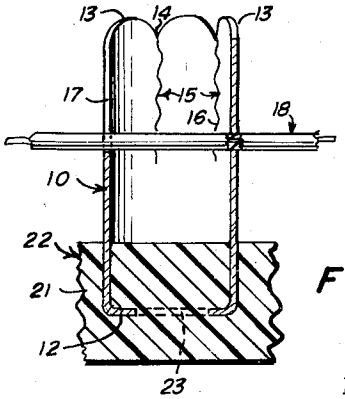

FIG. 4

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ELECTRICAL CONNECTORS

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This invention relates to a new and improved type of electrical connector and more particularly, to an electrical connector for low voltage insulated wires.

One of the most common means for effecting an electrical connection in industry is by means of soldering or welding two or more electrical conductors together. However, there are many instances in which these connections are not desirable since, to unconnect the conductors, it is necessary to loosen and break the soldered connection such as by the application of heat. Therefore, when it is necessary to effect new connections frequently and break old connections, such as on terminal connecting blocks in telephone distribution cabinets, the common soldered or brazed connections are unsatisfactory. For example, in cabinets of this type where it is necessary to allow ready connection of new subscribers and the disconnection of subscribers whose service is terminated, "solderless" connections are preferable.

"Solderless" connections depend on pressure or stress exerted by the connecting apparatus on the conductors to insure intimate electrical contact and to hold the conductors in place. Many types of "solderless" connections are known such as sockets or plugs wherein a male element is inserted into a female element. One common type of "solderless" connection, often used in terminal connecting blocks such as are used by the telephone industry, is the screw connection. Such a terminal connecting block may comprise a base of insulating material in which there are embedded a plurality of threaded terminals or posts, each post being provided with a nut. The terminals between a conductor coming from the exchange and a conductor or conductors going to the individual subscribers may be made on a single post by wrapping the conductors around the post and then tightening the nut. On the other hand, the terminals in one of the parallel rows may be connected to the incoming conductor from the exchange and the terminals in the other row may be connected to the conductors going to the subscribers. Connections between the two rows of terminals may be made, for example, by means of bridging wires. To use this type of terminal connecting block, it is necessary to strip the insulation from the ends of the conductors, wrap them around the post and then tighten the nuts to insure good contact and to hold the conductors in place. This type of electrical connector is subject to several disadvantages. In addition to the fact that the insulation must be manually stripped from the end of the conductor before it is connected to a terminal, it has been found that the pressure of the nut pressing down on the stud which is resisted by the upward thrust of the stud, results in metal fatigue, especially in the threads of the stud; and, after a period of time, results in a poor contact with the connector. Moreover, only a limited number of connections can be made effectively at anly one terminal post. Furthermore, when the connecting block is subjected to sustained periods of vibration, the nuts have a tendency to become loose and contact with the conductors may be lost.

Other types of "solderless" connectors are subject to similar and equally objectionable disadvantages—i.e., it is generally necessary to strip the insulation from the conductor manually before making the connection. Moreover, such connections are often difficult to make; and, the connection, once made, may be adversely affected by vibrations and variations in temperatures.

It is an object of this invention to provide an electrical connector which automatically strips the insulation from an electrical conductor in the use thereof in making a connection. It is another object of this invention to provide an electrical connector which will maintain good electrical contact indefinitely. It is a further object of this invention to provide a device by which electrical connections may easily and simply be made. Still another object of this invention is to provide a terminal connecting block which will permit a number of connections to be made on one terminal in a much more compact space than has previously been possible.

Briefly, the objects of this invention are attained by providing an electrical connector which comprises a hollow cylindrical body having at least one open end. In addition, the cylindrical body is provided with a plurality of vertically disposed insulation severing slots which extend longitudinally from the open end thereof downwardly in the peripheral wall of the body. In a preferred embodiment, the cylindrical connector body is embedded in a base of an electrical insulating material with an open end of the body exposed, thereby forming a terminal connecting block. An insulated wire conductor may be connected to the novel connector of this invention by inserting the insulated wire in the slot and forcing it downwardly between the walls of the slot, thereby severing the insulation on the wire and making a permanent electrical connection.

The preferred embodiment of this invention is illustrated in the accompanying drawings wherein:

FIG. 1 is a perspective view of the side of a cylindrical connector constructed according to this invention and also showing an insulated electrical conductor connected thereto.

FIG. 2 is a sectional view taken along line 2—2 of FIG. 1 showing the insulation stripped from the electrical conductor which is in electrical connection with the connector.

FIG. 3 is a top plan view of a terminal connecting block having a plurality of the connectors shown in FIG. 1 mounted therein.

FIG. 4 is a cross-sectional view taken along line 4—4 of FIG. 3 and shows how a terminal connector of the type shown in FIG. 1 may be embedded in a base member.

The drawings are more fully explained hereinafter with particular reference to the various numerical designations, each individual numeral having the same significance in the different figures.

FIG. 1 shows an electrical connector 10 having a hollow cylindrical body. The hollow, cylindrical connector 10 may be constructed of any suitable resilient, conducting material and is preferably a metal such as an alloy of Phosphor bronze, beryllium-copper, etc. It is preferred that the metal be plated with tin to prevent corrosion of the connector. The cylindrical connector 10 has an open end 11 and a partially closed end 12. The edge of the open end 11 contains a series of scalloped portions 13 which converge to form cusps 14. A sinuous insulation severing slot 15 extends downwardly from the point of each cusp 14, thereby providing a plurality of vertically disposed insulation severing slots 15—15 extending downwardly in or along the peripheral wall of the connector 10. It is preferred, but not essential, that these slots 15—15 be perpendicular to the open end 11. The opposing edges 16 of each of the insulation severing slots have a series of serrations 16*a*—16*a* thereon. The serrations 16*a*—16*a* are preferably disposed on the opposing edges 16—16 in an interdigital relationship as shown in FIG. 1 so that the opposing edges 16—16 may mesh, when not separated by an electrical conductor, to form a solid surface. If the electrical connector is con-

structed so that the opposing edges of the slots are not in contact with each other when not separated by an electrical conductor, it is essential that the distance between the edges be no greater than the diameter of the conductor wire which is to be connected thereto, and preferably this distance is no more than ⅔ the diameter of the conductor wire. The cylindrical electrical conductor is also provided with an entrant slot **17** which extends perpendicularly downward from the open end **11**. This entrant slot **17** is large enough to allow the admittance of a plurality of insulated wires in stacked relation.

Connection of a low-voltage insulated electrical conductor **18** to the cylindrical electrical connector **10** may be quickly and easily accomplished by inserting the insulated conductor **18** through the entrant slot **17** and into the arcuate entrant portion or cusp **14** at the top of one of the insulation severing slots **15**. The conductor is then forced downwardly between the opposing serrated edges **16—16** of the insulation severing slot. As shown in FIG. 2, the insulation **19** on the insulated conductor **18** is thereby ruptured and pierced at the point of contact of the insulation with the edges **16—16** of the slot and electrical contact is thus established between the electrical connector **10** and the electrical conductor **20**. The eletrical conductor may be easily disconnected from the connector by simply pulling the conductor up and out of the insulation severing slot. Since the insulation on the insulated conductor is pierced only at the point of contact with the edges of the slot, there are no large areas of bare conductor exposed or showing.

The serrations on the edges of the slots have the effect of stripping the insulation on the conductor more effectively than would be possible if the edges were not serrated. Moreover, the configuration of the serrated edges, i.e., the serrations on the opposing edges of the slots being disposed in an interdigital or interlocking relationship provides a superior gripping action on the conductor, thereby rendering the connection unaffected by long periods of extensive vibrations or extreme variations of temperatures. The initial compressional stresses exerted by the connector on the conductor are more than sufficient to compensate for any subsequent relaxation of stress and the conductor is firmly gripped by the edges **16—16** of the slot to lock the conductor in the connector.

By the use of an electrical connector constructed according to this invention it is possible to make a large number of electrical connections in an extremely limited space since several insulated electrical conductors may be positioned in stacked relation in the entrant slot **17** and inserted in each of the insulation severing slots. As a practical matter, generally no more than about six or seven electrical conductors are connected in each insulation severing slot. If the cylindrical connector has six insulation severing slots, it is therefore possible to make as many as thirty-six or more electrical connections of conductors on just one electrical connector.

FIG. 3 shows a further preferred embodiment of this invention in which a plurality of the electrical connectors **10—10** previously described are embedded in a base member **21** thereby forming a terminal connecting block **22**. The base member **21** may be made of any electrical insulating material such as phenol-formaldehyde resins, lignin resins, vinyl resins, etc. The connectors **10—10** are preferably embedded in the base member **21** by molding them into it at the same time the base member is formed. The plurality of cylindrical connectors **10—10** are positioned in a mold of the desired shape and size and the electrical insulating material in a plastic or liquid state is introduced into the mold. As shown in FIG. 4, the electrical insulating material not only surrounds the lower portion of each connector but also flows through the hole **23** in the partially closed end **12** of each connector, thereby filling the lower portion of each cylindrical connector to the same level as the electrical insulating material which surrounds each of the connectors. When the electrical insulating material hardens or sets, each of the electrical connectors **10—10** is firmly anchored in the base member **21**. The annular flange in the partially closed end **12** surrounding the opening **23** locks the connector in the base **21** so that the connector is not removable therefrom. Such a terminal connecting block provides a convenient and orderly means of making mass wire terminations. By the use of this block, it is possible to make a greater number of electrical connections in a limited space than has hitherto been possible.

Many variations and related embodiments other than those described above will be apparent to those skilled in the art. For example, the cylindrical connectors constructed according to this invention may be used in association with structures other than the terminal block previously described—e.g., they may be used in connecting one or more insulated conductors to a bolt, binding post or other electrical outlet.

I claim:

1. An electrical connector comprising a hollow cylindrical body having a wall of a resilient electrical conducting material, said body having at least one open end and at least one insulation severing slot extending from said open end along said wall, said slot forming opposed serrated edges on said wall, said opposed edges having their serrations interdigitated, said slot having a substantially uniform width less than the thickness of an electrical conductor which is to be held therein.

2. An electrical connector as defined in claim 1 wherein said slot has a sinuous configuration along a face of said wall.

3. An electrical connector as defined in claim 1 wherein said opposed edges are contiguous.

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