June 2, 1970 L. C. GOODRIDGE 3,516,049

MULTIPLE ELECTRICAL TERMINAL CONNECTOR
FOR PANELBOARDS AND/OR LOAD CENTERS

Filed June 12, 1968 2 Sheets-Sheet 1

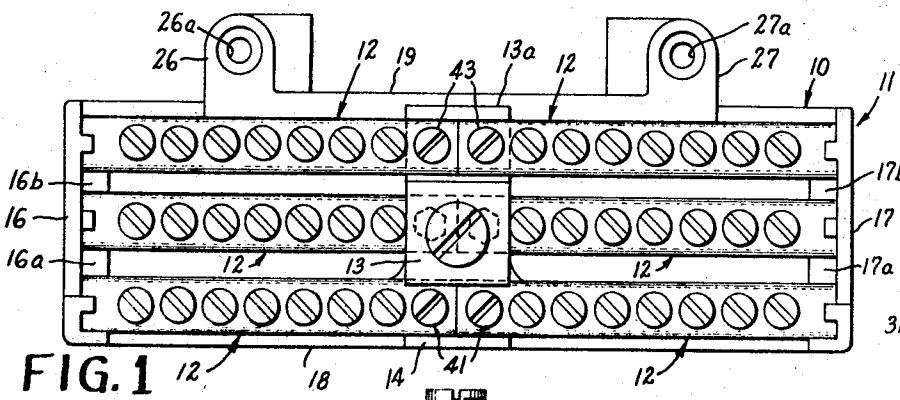


FIG. 1

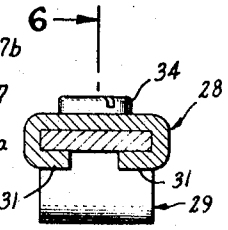


FIG. 5

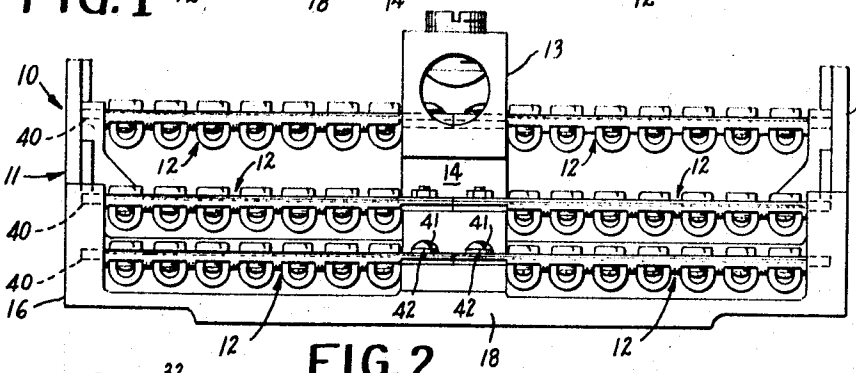


FIG. 2

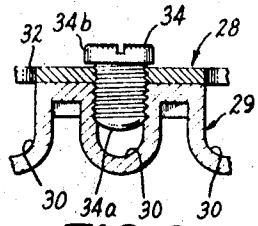


FIG. 6

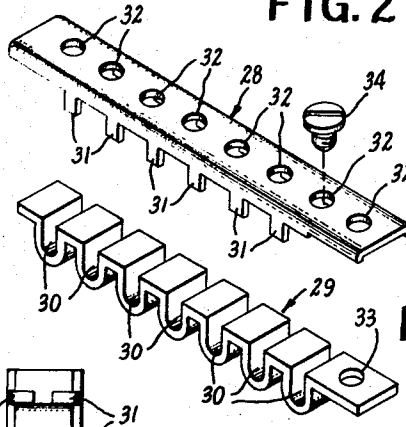


FIG. 3

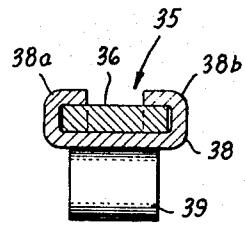


FIG. 10

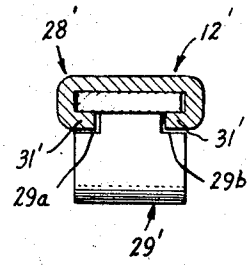


FIG. 8

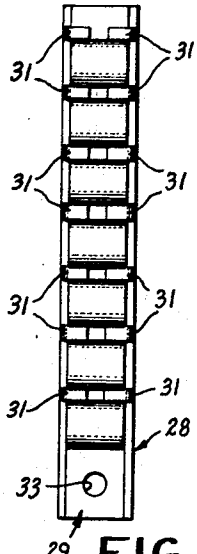


FIG. 4

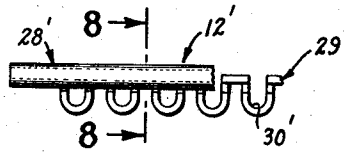


FIG. 7

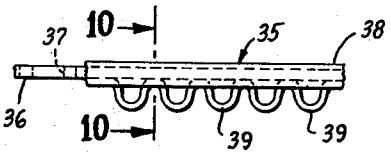


FIG. 9

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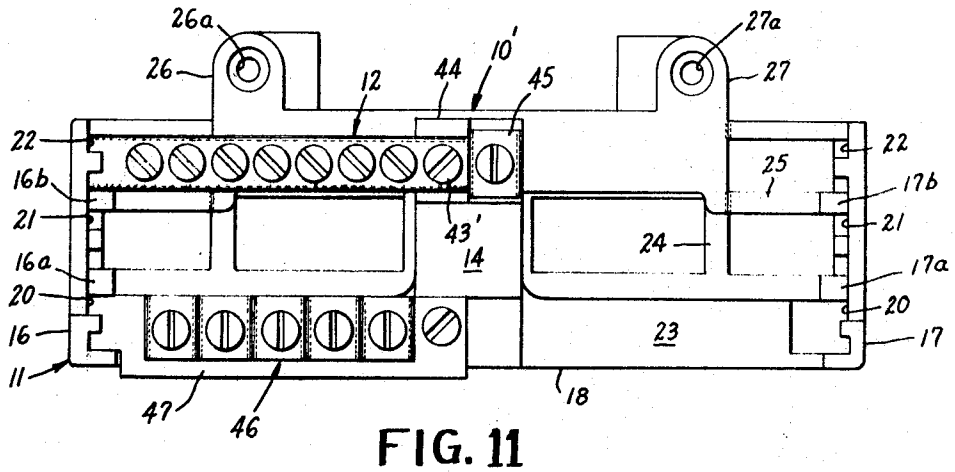


FIG. 11

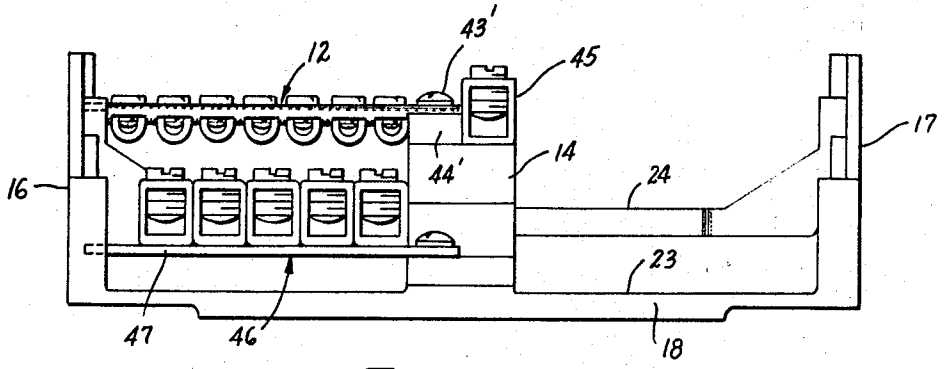


FIG. 12

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MULTIPLE ELECTRICAL TERMINAL CONNECTOR FOR PANELBOARDS AND/OR LOAD CENTERS

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Int. Cl. H01r 7/12
U.S. Cl. 339—242 8 Claims

ABSTRACT OF THE DISCLOSURE

A multiple electrical terminal connector for electrical panelboards and/or load centers comprising a strip of conductive material having a plurality of spaced semi-loops formed therein, an elongated support member of a high mechanical strength low cost metal such as steel having a plurality of spaced projecting portions engaging the strip and holding it in juxtaposed relation to the support member, and a plurality of clamping screws threaded into the support member for retaining in place wire conductors positioned in the aforesaid semi-loops.

BACKGROUND OF THE INVENTION

Field of the invention

My invention relates to multiple electrical terminal connector assemblies, and more particularly to multiple electrical terminal connectors for use in electrical panelboards and/or load centers to provide means for connection of ground wires of branch lighting and power circiuts to the main power line ground.

Description of the prior art

In accordance with the prior art, multiple terminal connectors for electrical panelboards have been generally of two basic types. The first of these has involved the use of a conductive plate and terminal screws and wire retaining cup washers to make the wire connections. In the other type, a conductive member is provided having a generally rectangular cross-section with the wire conductors extending into holes in a side wall and being retained by means of clamping screws in holes suitably provided in the top wall.

A basic disadvantage of both of these types of terminal connectors is their cost. The first type is costly because of the material and labor involved in installing the retaining washers, while the second type is costly because of the substantial amount of relatively expensive conductor material required in the connector. Another undesirable feature is that although the first type of terminal connector is the less costly of the two types, its applicability is limited by the existence of electrical code requirements which limit the size of wire with which it may be used.

The second type of terminal connector generally is of two basic designs, those which have the entire housing made of a conductor material, and those which have a tubular housing of low conductivity material with a conductive bar inserted into it. The first design of this type uses a high-cost conductive material for both the electrical and mechanical functions of the terminals. The second design uses a straight bar of a conductor material only for the electrical function and a low conductivity material for the mechanical function. In doing so however the second design has sacrificed quality for cost and has certain inherent application limitations such as the fact that it is very difficult to pass the Underwriters' Laboratory test with this design for use with aluminum wire.

OBJECTS OF THE INVENTION

It is an object of the present invention to provide an improved multiple terminal connector for electrical panelboards which is simple in construction, easy to assemble, and inexpensive to manufacture.

Another object of the present invention is to provide a multiple terminal connector for electrical panelboards which provides for maximum contact between the wire conductors and the conductor portion of the connector thereby affording excellent electrical contact therebetween as well as good resistance to pull-out forces exerted on the wires.

A still further object of the present invention is to provide such a multiple terminal connector having improved heat transferring capabilities between the wire conductors and the connector.

Yet another object of the present invention is to provide such a multiple terminal connector which may be used in present designs of panelboards and load centers without requiring any substantial modification in such panelboards and load centers.

SUMMARY OF THE INVENTION

In accordance with the present invention there is provided a multiple terminal connector having a sandwich type construction comprised of two elongated members of dissimilar materials clamped together in juxtaposed relation. The first of these two members consists of a relatively narrow bar or strip of conductive material having a plurality of semi-loops formed therein along the length thereof in closely spaced relation relative to each other, each for the purpose of receiving a wire conductor. The second of the members comprises a relatively narrow bar of a high mechanical, low cost, essentially low conductivity material which is provided with a plurality of spaced tabs or integral projections. The tabs are suitably positioned in the spaces between the semi-loops of the first member to thereby securely clamp the two members together. The wire conductors are clamped in the semi-loops by means of screws threaded into openings suitably provided therefor in the layer of low conductivity material. The length of the screws is limited to not more than a predetermined magnitude to ensure that the wire conductors will not be severed as a result of overtightening the aforesaid screws.

The invention will be more fully understood from the following detailed description and its scope will be pointed out in the appended claims.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a plan view of a multiple terminal connector assembly constructed in accordance with the present invention;

FIG. 2 is a side elevation view of the terminal connector assembly of FIG. 1;

FIG. 3 is a perspective view of one of the multiple terminal connectors illustrated in FIGS. 1 and 2 in accordance with the present invention;

FIG. 4 is a bottom view of one of the terminal connectors illustrated in FIGS. 1 and 2 in accordance with the present invention.

FIG. 5 is a sectional view through one of the terminal connectors illustrated in FIGS. 1 and 2;

FIG. 6 is a sectional view of a portion of the terminal connector of FIG. 5, taken substantially on the section indicated by the line 6—6 of FIG. 5;

FIG. 7 is a side elevation view of another embodiment of a terminal connector in accordance with the present invention;

FIG. 8 is a sectional view of the terminal connector of FIG. 7 taken substantially on the section indicated by the line 8—8 of FIG. 7;

FIG. 9 is a side elevation view of another embodiment of a terminal connector in accordance with the present invention;

FIG. 10 is a sectional view of the terminal connector of FIG. 9, taken substantially on the section indicated by the line **10—10** of FIG. 9;

FIG. 11 is a plan view of another terminal connector assembly embodying terminal connectors in accordance with the present invention; and

FIG. 12 is a side elevation view of the terminal connector assembly of FIG. 11.

DESCRIPTION OF A PREFERRED EMBODIMENT

Referring now to FIG. 1, the invention is shown as embodied in a multiple terminal connector assembly **10** comprising an insulating base **11**, and a plurality of terminal connectors **12**, a main lug **13**, and a conductor **14**, all supported on the base **11**.

The insulating base **11** which is preferably of molded construction has a pair of protective end barriers **16** and **17**, a front wall **18**, and a back wall **19**. Each of the protective end barriers **16** and **17** is provided with a pair of spaced rib portions **16***a*, **16***b*, and **17***a*, **17***b*, respectively which are formed integrally therewith to provide three separate substantially non-interconnecting channels **20**, **21** and **22** in the end barriers **16**, **17**. Extending outwardly from the end barriers **16** and **17** in perpendicular relation thereto adjacent the channels **20**, **21**, and **22** are members **23**, **24**, and **25** formed as an integral part of the insulating base **11**, which cooperate with the rib portions **16***a*, **16***b*, **17***a*, and **17***b* to provide the insulating base **11** with a step-like internal construction.

Protruding from the rear of back wall **19** in spaced relation are a pair of bosses **26** and **27**, each having therein an opening **26***a*, **27***a*, respectively, capable of receiving appropriate fastening means (not shown) to detachably secure the insulating base **11** of the terminal connector assembly **10** to bus bars (not shown) in a panelboard or load center (not shown).

Referring now to FIGS. 3 and 4, the terminal connector **12** employed with the terminal connector assembly **10** of FIGS. 1 and 2 consists of a substantially U-shaped channel member **28**, and a bar **29** of good conductive material such as copper or aluminum formed to provide a plurality of wire receiving semi-loops **30** therein. In the form illustrated in FIG. 3, the bar **29** is constructed by extruding a member having a number of parallel channels and then slicing or cutting the member to provide pieces as shown.

The channel member **28** is preferably of a strong, low-cost material such as steel and may be of relatively low conductivity or even non-conductive, since it is not required to carry current. The member **28** has a plurality of threaded openings **32** along the center portion thereof. The bar **29** of conductive material is also provided at one end thereof with an opening **33** for a purpose to be described hereinafter.

Referring to FIG. 4, it can be seen that the spacing between the tabs **31** is such that when the U-shaped channel member **28** and the bar **29** are brought into juxtaposed relation such that the respective openings **32***a* and **33** therein are aligned, each of the tabs **31** will lie adjacent the space existing between adjoining semi-loops **30** in the bar **29**. To secure the member **28** and the bar **29** together, the tabs **31** are bent around the underside of the bar **29** whereby intimate continuous contact is provided between the member **28** and the bar **29**. It has been found in actual use that even though the mechanical layer, i.e., the U-shaped channel member **28**, is made from a relatively low conductivity material such as steel, it will carry some current thereby permitting the use of a smaller size conductive layer, i.e., a smaller size bar **29**.

With the member **28** and the conductive bar **29** so assembled, each of the semi-loops **30** is capable of receiving a conventional wire conductor (not shown). The semi-

circular shape of the loops **30** in the conductive bar **29** provides almost the maximum amount of contact possible between the wire conductor and the bar **29**. There is thus provided excellent electrical contact therebetween as well as good resistance against the pull-out forces exerted on the wire conductors.

In accordance with the preferred embodiment of the invention, screws **34** are utilized to retain the wire conductors in the semi-loops **30**. The screws **34** are threaded in the tapped holes **32** provided therefor at spaced intervals in the center portion of the U-shaped channel member **28**. The openings **32** are suitably spaced along the member **28** such that when the member **28** and the bar **29** are in the assembled condition, one of the openings **32** will be aligned with each of the semi-loops **30**. The member **28** provides increased mechanical strength for the screw threads although in accordance with the preferred embodiment of the invention the screws **34** are themselves made of a high strength, low cost material which may be of relatively low conductivity, such as steel. It has been found to be unnecessary to provide the semi-loops **30** with pre-cut threads for receiving the set screws **34** when the latter are threaded into the openings **32**. Instead, the dimensions of the semi-loops and of the screws are so chosen that when the screws **34** are tightened they form partial threads in the side wall portions of the semi-loops **30**. This occurs by virtue of the fact that the material of which the bar **29** is made is relatively soft as compared to the material from which the screws **34** are formed.

As seen in FIG. 6, the point **34***a* of the screw **34** is rounded to prevent it from creating an excessive weakening in the wire conductor when the screw is tightened onto the wire conductor. In addition, the length of the screw **34** is controlled such that the head **34***b* of the screw will seat against the top surface of the member **28** surrounding the opening **32** before the screw **34** can be overtightened thereby preventing excessive distortion or weakening of the wire conductor.

Insofar as the manufacture of the terminal connector **12** is concerned, the U-shaped channel member **28** is preferably formed by a simple stamping process with the openings **32** and **32***a* therein being provided in a subsequent manufacturing step. The bar **29** as noted previously is cut to the proper width from a sheet of extruded conductor material, the semi-loops having been already formed in the sheet during the extrusion process. The opening **33** is thereafter provided in one end of the bar **29**. The terminal connector **12** may then be readily assembled in the manner previously set forth, i.e., by bending the tabs **31** inwardly along the underside of the bar **29** in the spaces existing between the semi-loops **30**.

In accordance with the modification in the terminal connector **12'** which is illustrated in FIGS. 7 and 8 of the drawings, the bar **29'** is provided with a pair of elongated slots **29***a* and **29***b*, respectively, which extend along the entire length of the bar **29'** adjacent the underside of the center portion thereof. The slots **29***a* and **29***b* are provided for the purpose of receiving the tabs **31'** which in accordance with this modification of the invention when bent inwardly are positioned in the aforesaid slots rather than in the spaces existing between the semi-loops **30'** as described previously with regard to the terminal connector **12** illustrated in FIGS. 3, 4, 5, and 6.

To assemble the member **28'** and the bar **29'** of FIGS. 7 and 8, the tabs **31'** are first bent inwardly, and then the bar **29'** is slid along between the underside of the center portion of the member **28'** and the tabs **31'** until the openings (not shown) in the member **28'** are in alignment with the semi-loops **30'** in the bar **29'** in the manner previously described in connection with the terminal connector **12**. With screws (not shown) positioned in the respective openings in the member **28'**, the bar **29'** is prevented from moving out of its proper position relative to the member **28'**.

FIGS. 9 and 10 illustrate another embodiment **35** of a terminal connector which includes a flat strip **36** of conductive material having a plurality of threaded openings **37** provided therein at spaced intervals along the length thereof. In addition, the terminal connector **35** includes an inverted channel-shaped member **38** having a plurality of spaced semi-loops **39** which are lanced out of the center portion of the member **38**. The member **38** also is provided with continuous side wall flange portions **38***a* and **38***b*, respectively, bent inwardly toward each other in spaced relation to the center portion of the member **38**, with the flange portions **38***a* and **38***b* being substituted for the plurality of spaced tabs **31** provided in the terminal connector **12** of FIGS. 3, 4, 5, and 6. To assemble the component parts of the terminal connector **35**, the flat strip **36** is slid along between the flange portions **38***a*, **38***b*, and the center portion of the channel-shaped member **38** until an opening **37** in the flat strip **36** is aligned with each of the semi-loops **39** in the member **38**. With screws (not shown) threaded into the openings **37** provided in the flat strip **36** and into the semi-loops **39**, the flat strip **36** will be kept properly positioned relative to the channel-shaped member **38**.

Referring again to FIGS. 1 and 2 of the drawings, the terminal connector assembly **10** as illustrated therein includes the maximum number, i.e., a total of six, terminal connectors **12**. The connectors **12** are arranged in pairs, with each pair thereof being offset vertically and horizontally from the remaining two pairs of terminal connectors **12**. To mount the terminal connectors **12** on the insulating base **11**, the end portion of each of the terminal connectors which does not have the openings **32**, **33** therein is slid into a notch **40** suitably provided in one of the channels described hereinbefore which are formed in the protective end barriers **16** and **17** of the insulation base **11**.

The other end of each of the terminal connectors **12** cooperates with the conductor **14** which has a double Z-shape, i.e., step-like, configuration. The conductor **14** is positioned approximately midway between the end barriers **16** and **17**, and in juxtaposed relation to each of the three steps formed in the base **11**. The horizontally extending portions of the conductor **14** which overlie the steps of the base **11** are suitably provided with a pair of threaded openings (not shown) whereby with the conductor **14** positioned on the base **11** as seen in FIGS. 1 and 2, the opening **32***a*, **33** in each of the terminal conductors **12** will be aligned with one of the threaded openings provided in the conductor **14**.

Suitable fastening means such as the screws **41** and the washers **42**, the former being received in the opening **32***a*, **33** of each of the lowermost pair, as viewed in FIG. 2, of terminal connectors **12** and in the cooperating openings in the conductor **14**, are utilized to fasten the lowermost terminal connectors **12** to the conductor **14**, and the latter in turn to the insulating base **11**. The terminal conductors **12** positioned in the middle step of the base **11** as viewed with reference to FIG. 2 are similarly secured by suitable fastening means to the conductor **14**, and the latter also to the base **11**.

Referring particularly to FIG. 1 of the drawings, the uppermost pair of terminal connectors **12** overlie the leg portion **13***a* of the main lug **13**, which in turn overlies the horizontal portion of the conductor **14** which is positioned in juxtaposed relation to the upper step of the insulating base **11**. Screws **43** which are received in the openings **32***a*, **33** of the terminal connectors **12**, the openings (not shown) provided for this purpose in the leg portion **13***a*, and the previously described threaded openings (not shown) in the conductor **14**, are employed to secure the terminal connectors **12**, the main lug **13**, and the conductor **14** to the base **11**. Thus, as described hereinabove, the terminal connectors **12** are all mechanically secured to the base **11**, and by virtue of the conductor **14** which is common to all the terminal connectors **12** are electrically interconnected with each other and with the main lug **13**.

As seen with reference to FIGS. 11 and 12 of the drawings, only one terminal connector **12** is utilized in the terminal connector assembly designated therein by the reference numeral **10'**. The only modification in the terminal connector assembly **10'** necessitated by this over that of the terminal connector assembly **10** as shown in FIGS. 1 and 2 is the replacement of the main lug **13** of terminal connector assembly **10** with a conductive spacer **44** and a lug **45** which is of smaller dimension as compared to main lug **13** and does not include any portion corresponding to the leg portion **13***a* of lug **13**. In the terminal connector assembly **10'**, the terminal connector **12** is secured to the spacer **44** by means of screw **43'**, and the spacer **44** is secured through the conductor **14** to the base **11** in a manner similar to that previously described in connection with the terminal connector assembly **10** of FIGS. 1 and 2. It will be noted that here also the conductor **14** electrically interconnects the terminal connector **12**, spacer **44**, etc.

FIGS. 11 and 12 also illustrate another form of terminal connector **46** being utilized in the terminal connector assembly **10'**. The connector **46** is comprised of a flat strip **47** of conductive material upon which are mounted a limited number of lugs similar to the lug **45** referred to hereinabove. Terminal connectors of this latter type are generally required when using fairly large size wire conductors.

As illustrated in FIGS. 11 and 12, however, terminal connectors **12** are compatible for use in combination with other forms of terminal connectors such as for example that designated by reference numeral **46**, or when fewer than the maximum number of terminal connectors capable of being employed in a particular terminal connector assembly are required for a given job installation.

While certain preferred embodiments of the invention have been specifically disclosed, it will be understood that I do not wish the scope thereof to be limited thereto since many modifications thereof may readily be made.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. A multiple terminal connector comprising:

(a) a first generally planar elongated member;

(b) a second generally planar elongated conductive member having a plurality of generally U-shaped offset portions intermediate the ends thereof closely spaced in a row along the length thereof, each of said U-shaped portions including a pair of parallel leg portions and a connecting bight portion and defining a wire-receiving passageway extending substantially at right angles to the length of said strip;

(c) means supporting said second elongated member in juxtaposed face-to-face parallel relation to said first elongated member with predetermined portions of said first elongated member bridging the space between said leg portions of said U-shaped portions at the ends thereof opposite said bight portion; and

(d) wire retaining screws threaded into said predetermined portions of said first member for retaining wire conductors in said U-shaped portions of said second member.

2. A multiple terminal connector as set forth in claim **1** wherein:

(a) said first elongated member is of relatively low conductivity, high strength material; and

(b) said second elongated member is of relatively high conductivity material.

3. A multiple terminal connector as set forth in claim **1** wherein said supporting means comprises a plurality of tabs formed on said first elongated member engaging said second elongated conductive member at spaced points along the length thereof.

4. A multiple terminal connector as set forth in claim 1 wherein:

(a) said first elongated member is of relatively low conductivity, high strength material;

(b) said second elongated member is of relatively high conductivity material; and

(c) said supporting means comprises a pair of inwardly bent flange portions formed on said first elongated member engaging said second elongated conductive member.

5. A multiple terminal connector as set forth in claim 4 wherein:

(a) said relatively low conductivity, high strength material is steel; and

(b) said relatively high conductivity material is aluminum.

6. A multiple terminal connector comprising:

(a) a first generally planar elongated conductive member;

(b) a second generally planar elongated member hava plurality of generally U-shaped offset portions intermediate the ends thereof closely spaced in a row along the length thereof, each of said U-shaped portions including a pair of parallel leg portions and a connecting bight portion and defining a wire-receiving passageway extending substantially at right angles to the length of said strip;

(c) means carried by said second elongated member supporting said first elongated conductive member in juxtaposed face-to-face parallel relation to said second elongated member with predetermined portions of said first elongated conductive member bridging the space between said leg portions of said U-shaped portions at the ends thereof opposite said bight portion; and

(d) wire retaining screws threaded into said predetermined portions of said first elongated conductive member for retaining wire conductors in said U-shaped portions of said second elongated member.

7. A multiple terminal connector as set forth in claim 6 wherein:

(a) said first elongated member is of relatively high conductivity material;

(b) said second elongated member is of relatively low conductivity, high strength material; and

(c) said supporting means carried by said second elongated member comprises a pair of inwardly bent flange portions formed on said second elongated member engaging said first elongated conductive member.

8. A multiple terminal connector as set forth in claim 7 wherein:

(a) said relatively high conductivity material is aluminum; and

(b) said relatively low conductivity, high strength material is steel.

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