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APPARATUS FOR CONNECTING A PLURALITY OF CONDUCTORS

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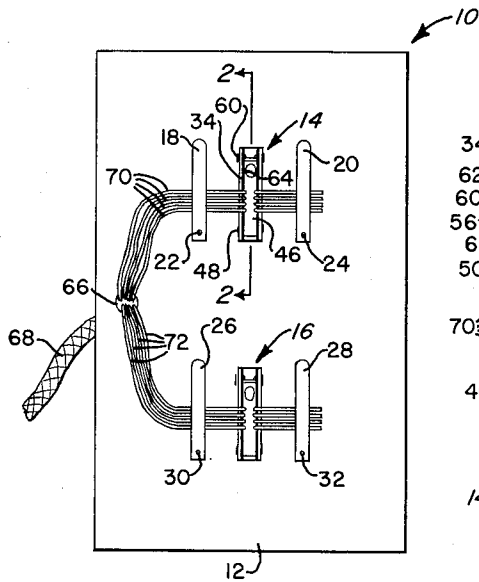


FIG. 1

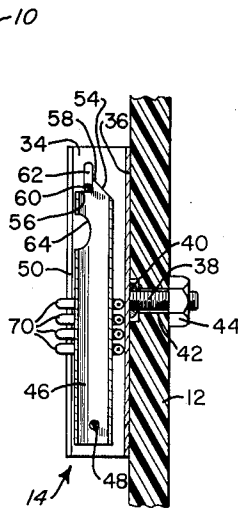


FIG. 2

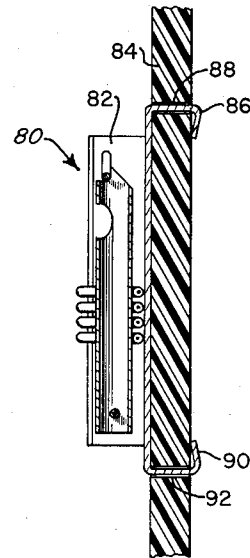


FIG. 3

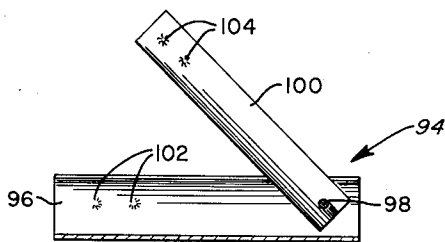


FIG. 5

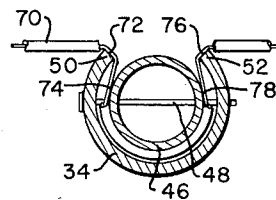


FIG. 4

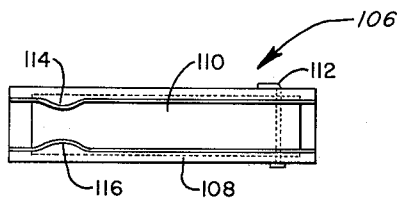


FIG. 6

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APPARATUS FOR CONNECTING A PLURALITY OF CONDUCTORS

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The present invention relates to new and useful improvements in means for establishing electrical connection between a plurality of electrical conductors, and more particularly relates to a junction clip or terminator which can be conveniently actuated to electrically connect a plurality of insulated and/or uninsulated conductors.

Broadly, the apparatus of the invention comprises an elongated, generally channel-shaped member of resilient character having a longitudinally-extending opening transversely bounded by opposed edged portions, a holding member disposed within and pivoted to the channel member for swinging movement through the opening in the channel member. The channel member and the holding member are so disposed and arranged that one or more insulated and/or uninsulated electrical conductors can be laid transversely across the opening in the channel member when the holding member is pivoted to an open or outward position and the holding member be thereafter swung into its position within the channel member, with the result that each of the electrical conductors is forced intermediate its ends down into the channel member with a scissor or shearing action being applied to the conductors between the lateral sides of the holding member and the edges of edged portions of the channel member so as to tear or strip the insulation from each of the electrical conductors as may be insulated so that, whether insulated or not initially, bare portions of electrical conductors are forced into and resiliently retained between and in electrical contact with at least one of said members, it being understood that the relative dimensions of the parts are such that the channel member will be under some degree of tension when wires of a size appropriate to the junction clip used are forced into the above-described position. The junction clip also includes means for releasably retaining the holding member in the channel-shaped member.

The invention will be best understood upon a study of the accompanying drawing, wherein preferred embodiments of the invention are illustrated taken in the light of the following description thereof.

In the drawing:

FIGURE 1 is a front elevational view of a panel employing a pair of junction clips embodying the instant invention;

FIGURE 2 is an enlarged sectional detail view of one of the junction clips as shown in FIGURE 1, this view being taken upon the plane of the section line 2-2 shown in FIGURE 1;

FIGURE 3 illustrates a junction clip like that shown in FIGURE 2, except as to the use of a modified means for securing the junction clip to the panel plate;

FIGURE 4 is an enlarged transverse sectional view of the channel and holding members of the junction clip according to the instant invention, this view being illustrative of the manner in which an electrical conductor is retained within the junction clip and portions thereof bared of insulation held in electrical contact with both the outer channel member and the holding member;

FIGURE 5 is a longitudinal sectional view of a junction clip of somewhat different form than those forms thereof

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shown in FIGURES 1 through 3, this modification differing primarily in the character of the means for securing the holding member in closed position; and

FIGURE 6 is a top plan view of another modified form of junction clip, wherein yet a different means is provided for securing the holding member in closed position.

Referring first to FIGURE 1, there is disclosed a panel designated generally at 10 which is comprised of a mounting plate 12 disposed in the vertical position illustrated, such plate being preferably constructed of an electrically nonconductive material, such as plastic, hard rubber, etc. The plate 12 is provided with a pair of identical junction clips 14 and 16, the junction clips 14 and 16 being secured to the plate 12 in a manner described subsequently. For a purpose presently to be explained, a pair of spring clips 18 and 20 are secured to the plate 12 on opposite sides of the junction clip 14 by rivets 22 and 24, respectively. In an analogous manner, spring clips 26 and 28 are secured to the plate 12 on opposite sides of the junction clip 16 by rivets 30 and 32, respectively. Each of the spring clips 18, 20, 26, and 28 is formed of substantially flat strips of spring steel preferably encased in an insulating material, such as rubber or plastic, and are biased so that the upper ends and the intermediate portions thereof are urged against or toward the plate 12.

Attention is now directed to FIGURE 2 for an understanding of the construction of the junction clip 14 and the manner in which the same is attached to the plate 12. It will be understood that the junction clips 14 and 16 are identical and that a description of one of such junction clips will suffice for both. The junction clip 14 comprises an elongated, generally C-shaped metallic channel member 34 of resilient character, the web or bight portion 36 of which is seated against the plate 12. The channel 34 is secured to the plate 12 by a threaded stud 38 which is suitably secured by welding 40, or the like, to the web or bight portion 36 of the channel 34. The threaded stud 38 extends through an opening 42 in the plate 12, the opening 42 being enlarged so as to accommodate the welding 40, and the outer end of the threaded stud 38 is provided with a nut 44 that is tightened against the plate 12 to hold the junction clip 14 firmly in position.

Disposed within the channel 34 is an elongated holding member 46, the latter being pivoted by means of a pin 48 carried by the channel 34 that extends through the holding member 46 to permit the upper end and an intermediate portion of the holding member 46 to be swung outwardly or to the left, as seen in FIGURE 2, from the plate 12 through the longitudinally-extending opening bounded by the opposed edges of edged portions 50 and 52 of the channel 34.

With the holding member 46 disposed in the position shown in FIGURE 2, it will be noted that the channel member 34 and the holding member 46 are generally concentric (see FIGURE 4 for a clear illustration of such relationship), and it will be also observed that the external dimensions of the holding member 46 are substantially less than the internal dimensions of the channel 34, the reason for this will be clear presently. It also will be observed that the transverse spacing between the edged portions 50 and 52 is such as to constitute a restricted entrance to the interior of the channel member 34 and corresponds roughly to the maximum dimensions of the holding member 46 in a parallel direction, the reason for this construction feature also being made clear presently.

Bearing in mind that the embodiment of the invention shown in FIGURES 1 and 2 is normally disposed in the vertical position shown in FIGURE 1, the means for retaining the holding member 46 in the position shown thereof in FIGURE 2 will now be described. The upper

end of the holding member 46 is beveled to form the camming surfaces indicated at 54, and is also cut away at a somewhat lower level at 56 to define the teeth or latch keeper 58. The beveled portion 54 of the holding member 46 and the teeth 58 cooperate with a pin or latch element 60 fitted in slots 62 in the opposite sides of the channel 34, it being understood that the opposite ends of the pin 60 are enlarged at their extremities to prevent longitudinal removal of the pin 60 from the channel 34. The operation of the described latching means will be quite apparent. The holding member 46 upon being swung closed from its open or outward position from the plate 12 will initially make contact with the pin 60, and through the camming action of the surfaces 54 raise pin or latch 60 to clear the upper end of the teeth or latch keeper 58 with further inward pivotal movement of the holding member 46 moving the teeth 58 to such a position that the pin or latch 60 drops in the slots 62 into the latching position shown thereof in FIGURE 2 through the action of gravity, from which position outward swinging movement of the holding member 46 is prevented. It will be evident that while the illustrated form of the latching means relies upon gravity to move the pin or latch 60 into latching position, it will be obvious to those skilled in the art that if deemed necessary or otherwise desirable, spring means, not shown, could be provided to take over the described function of gravity so as to secure positive operation of the latching means notwithstanding the orientation of the junction clip. Of course, the holding member 46 can be released and swung outwardly from the position shown thereof by the simple expedient of manipulating the pin or latch 60 from its latching position against the action of gravity or such spring means as might otherwise be provided.

In order to facilitate convenient application of considerable pressure in swinging the holding member 46 from its outward position to the closed position shown thereof in FIGURE 2, or vice versa, the holding member 46 which is preferably tubular or hollow is also provided with an opening 64 that is accessible between the edged portions 50 and 52 of the channel 34. The opening 64 is for the purpose of permitting the insertion of one leg of an L-shaped tool, not shown, into the hollow interior of the holding member 46 so that a torque either for the purpose of opening or closing the holding member 46 can be applied by the other leg of the tool.

Referring again to FIGURE 1 in particular, for an understanding of the use of the junction clips 14 and 16 and the clips, 18, 20, 26, and 28, it will be noted that the plate 12 is provided with an opening 66 for admitting the passage of a multi-conductor cable 68 to the front of the plate 12 from the rear thereof. For the purpose of ready understanding, it will be assumed that the cable 68 includes four insulated electrical conductors 70, which it is desired to connect electrically, as well as four other insulated electrical conductors 72 also to be electrically connected. As shown, the conductors 70 and 72 are freed from the outer restraining sheath of the cable 68, with the conductors 70 and 72 being dressed as shown toward the spring clips 18 and 26, respectively.

Initially, the holding members 46 of the clips are each in the open position. The conductors 70 are dressed in parallel as shown in a vertical sequence between the spring clips 18 and 20 and also between the clips and the plate 12. Furthermore, the conductors 70 are placed in parallel vertical sequence between the channel 34 and an intermediate portion of the holding member 46 so as to pass over the open side of the channel 34. It will be appreciated at this point that the clips 18 and 20 greatly facilitate the proper orientation of a plurality of conductors 70 with respect to the junction clip 14. This is especially true when a very large number of conductors must be connected, it being emphasized at this point that the clips 14 and 16 can be made of proportionately far greater length than appears in the drawing when the connection

of larger numbers of conductors is necessary. It will also be appreciated that greater longitudinal extent for the clips 14 and 16 can also be indicated so that a single junction clip can concurrently accommodate conductors of appreciably different size, such accommodation being realized upon laterally spacing wires of differing size and allowing the resiliency of the channel 34 to accommodate itself to the smaller conductor in the lateral interval or space between the conductors. The value of the spring clips 18 and 20 in achieving such spacing as may be necessary will be evident. Though two spring clips are shown in relation to each junction clip, it must be clear that a single spring clip can be of substantial help in dressing the conductors both prior to and during the actuation of the junction clip to its closed position.

Actuation of the holding member 46 to its closed and latched position such as is shown in FIGURE 2 serves to force each of the conductors 70 into the channel 34, with the result that each of the conductors is subjected to a scissors or shearing action against the opposed edges of edged portions 50 and 52. This action strips the insulation from the electrical conductors 70 and can typically so bare the wire that two points of electrical contact 72 and 74 (see FIGURE 4) are made between the portion of the conductor 70 stripped by the somewhat sharp edge of edged portion 50 and the channel 34 and the holding members, respectively, with analogous electrical contacts 76 and 78 being made due to the stripping action of the sharp or angular edge of edged portion 52.

The channel member 34 and the holding member 46 are each preferably of metallic composition and consequently of electrically conductive character. Consequently, either one of the set of contacts 72 and 76 (assuming the channel 34 to be conductive) or either one of the contacts 74 and 78 will (assuming the holding member to be conductive) serve to electrically connect all the conductors 70. The resiliency of the channel 34 assures a snug electrical contact between the conductors 70 and the members 34 and 46, it being understood that the conductors 70 constitute a tight fit in the space between the channel and holding members 34 and 46. The holding member 46 is preferably tubular, and is provided with an opening 64 through which an L-shaped tool, not shown, can be introduced to facilitate the application of torque to the holding member 46 when either opening or closing the clip 14.

The operation of connecting the conductors 72 through the use of the spring clips 26 and 28, and the junction clip 16 will now be self evident.

A junction clip was made of hard drawn aluminum and found to produce very satisfactory results with 24 AWG wire (20.10 mils diameter) having a conventional plastic insulation. This junction clip corresponded in transverse configuration generally to FIGURE 4, with the channel member having an outside diameter of 0.250 inch and a wall thickness of 0.018 inch. The holding member was tubular as shown and had an outside diameter of 0.1875 inch, so that the concentric spacing of such member was about 0.0133 inch. Obviously, such dimensions stressed the channel member 34 so as to maintain a firm mechanical pressure upon the electrically contacting areas.

The choice of materials used in the above example was dictated by expediency, it being actually preferred that such member be made of such materials as resilient forms of phosphor-bronze, of beryllium-copper alloy for example, though the final choice should be dictated with a view as to the character of the chemical and/or electrochemical properties of the same in relation to the wire used therewith. This will be obvious to those skilled in the art so as to avoid the consequences of corrosion such as may be caused by electrolysis. If deemed desirable or expedient for use in extreme environments or for long period, trouble-free service, surfaces of the channel

and/or the holding member can be plated or coated with, for example, a noble metal such as gold.

Referring to FIGURE 3, the numeral 80 indicates a clip identical to the clips 14 and 16 except as to the mode of mounting on a plate 84. Here, a tab 86 is provided at one end of the channel member 82, such tab 86 extending through an opening 88 in the plate 84 and being bent as shown to secure the clip 80 to the plate 84 in cooperation with a similar tab 90 at the other end of the channel member 82 that extends through another opening 92.

FIGURES 5 and 6 illustrate alternate arrangements for securing or retaining holding members in closed position. The holding clip 94 shown in FIGURE 5 is comprised of a channel member 96 to which is pivoted by means of pivot pin 98 a holding member 100. The inner surface of the channel member 96 at a position remote from the pivot pin 98 is provided with upstanding beads 102 which are resiliently biased into and interlock with generally complementary recess 104 in the holding member 100 when the latter is in closed position.

The junction clip 106 shown in FIGURE 6 includes a channel 108 to which a holding member 110 is pivoted by a pin 112. The sides of the channel 108 are extended toward each other as shown at 114 and 116 at a position spaced longitudinally from the pivot pin 112. The extensions 114 and 116 overlie the holding member 110 when the latter is in closed position. However, the holding member 110 can be closed relatively easily as the same will cam against the curved edges of the extensions 114 and 116 as will be plain.

Having described the principles of the invention sufficiently to convey a full and complete understanding thereof, attention is now directed to the appended claims in order to ascertain the actual scope of the invention.

I claim:

1. Apparatus for establishing an electrically conductive connection between a plurality of electric conductor wires comprising, an elongated channel-shaped member of resilient material, said channel-shaped member having a longitudinally-extending lateral opening bounded by portions of said member constituting a restricted entrance to the interior of said member, an elongated holding member disposed in the channel-shaped member and having an intermediate portion of its longitudinal extent in spaced relation thereto, at least upon resilient flexure of the channel-shaped member said holding member having one end pivotally connected to the channel-shaped member for swinging movement of the intermediate portion of the holding member outward from the channel-shaped member through said restricted entrance to the latter, means disposed at a position that is adjacent the other end of the holding member and entirely removed longitudinally from said intermediate portion of the holding member for restraining outward swinging movement of the holding member, said portions of the channel-shaped member having edges that are opposed to each other and adapted to bear resiliently against and strip electrical insulation from an insulated wire forced transversely into the channel-shaped member by the intermediate portion of the holding member, and at least one of said members being electrically conductive.

2. Apparatus for establishing an electrically conductive connection between a plurality of electric conductor wires comprising, an elongated channel-shaped member of resilient material, said channel-shaped member having a longitudinally-extending lateral opening bounded by edged portions of said member, an elongated holding member disposed in the channel-shaped member and having an intermediate portion of its longitudinal extent in spaced relation thereto, at least upon resilient flexure of the channel-shaped member, said holding member having one end pivotally connected to the channel-shaped member for swinging movement of the other end and the intermediate portion of the holding member outward from the channel-

shaped member through said opening in the latter, means disposed at a position that is adjacent said other end of the holding member and entirely removed longitudinally from said intermediate portion of the holding member for releasably restraining outward swinging movement of the holding member, said holding member being tubular and having a lateral opening in registry with said longitudinally-extending opening to afford tool access to the interior of the holding member for forcing pivotal movement of the holding member, said edged portions of the channel-shaped member having edges that are opposed to each other and adapted to bear resiliently against and strip electrical insulation from an insulated wire being forced transversely into the channel-shaped member by the intermediate portion of the holding member, and at least one of said members being electrically conductive.

3. In apparatus for establishing an electrically conductive connection between a plurality of electric conductor wires, the improvement comprising an elongated member that is generally C-shaped in transverse section and having a longitudinally-extending lateral opening bounded by portions of said member with a spacing such as to define a restricted entrance to the interior of the C-shaped member, an elongated member disposed in the C-shaped member having an intermediate portion of its longitudinal extent in spaced relation thereto and having one end pivotally connected to the C-shaped member for swinging movement of the intermediate portion of the holding member outward from the C-shaped member through the restricted entrance to the latter, said members being so constructed and arranged that the intermediate portion of the holding member can force an insulated wire transversely into the C-shaped member to subject the insulation of the wire to shearing forces against the bounding portions of the C-shaped member, and at least one of said members being electrically conductive.

4. In apparatus for establishing an electrically conductive connection between a plurality of electric conductor wires, the improvement comprising an elongated member of resilient material that is C-shaped in transverse section, said member having a longitudinally-extending lateral opening bounded by portions of said member having a spacing from each other such as to constitute a restricted entrance to the interior of the C-shaped member, an elongated member disposed in the C-shaped member having an intermediate portion of its longitudinal extent in spaced relation thereto and having one end pivotally connected to the C-shaped member for swinging movement of the intermediate portion of the holding member outward from the C-shaped member through the restricted entrance to the latter, said restricted entrance having a width that approximates the corresponding transverse dimension of the intermediate portion of the holding member, at least one of said portions of the C-shaped member having a wire-stripping edge directed generally toward the restricted entrance and adapted to bear resiliently against and strip electrical insulation from an insulated wire forced transversely into the C-shaped member through the restricted entrance by the intermediate portion of the holding member, and at least one of said members being electrically conductive.

5. In apparatus for establishing an electrically conductive connection between a plurality of electric conductor wires, the improvement comprising an elongated member that is generally channel-shaped in transverse section and having a longitudinally-extending lateral opening bounded by portions of said member, an elongated member disposed in the channel-shaped member having an intermediate portion of its longitudinal extent in spaced relation thereto and having one end pivotally connected to the channel-shaped member for swinging movement of the intermediate portion of the holding member outward from the channel-shaped member through the longitudinally-extending opening in the latter, means disposed at a position that is adjacent the other end of the hold-

ing member and entirely removed longitudinally from said intermediate portion of the holding member for restraining outward swinging movement of the holding member, at least one of said bounding portions of the channel-shaped member having an insulation-stripping edge directed generally toward the other bounding portion and adapted to shear against electrical insulation on an insulated wire being forced transversely into the channel-shaped member through the longitudinally-extending opening by the intermediate portion of the holding member, and at least one of said members being electrically conductive.

6. The combination of claim 1, including a panel, said channel-shaped member having a web portion, means fastening the web portion of the channel-shaped member to the panel, and a spring clip mounted on the panel adjacent the channel-shaped member for holding a plurality of wires arranged to extend transversely across the opening between the channel-shaped member and the intermediate portion of the holding member when the latter is in its outward position.

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