ABSTRACT

A pair of clamping members each have a pair of parallel legs which are joined together at one end by a transverse cross member and which terminate in foot-like elements at their other ends. The foot-like elements are substantially at right angles with the leg to which they are attached. Such foot-like members on each clamping member are passed through a pair of apertures in the connector in such a manner that said foot-like members on the two clamping means face in opposite directions which permits insertion of said foot-like members in said apertures and further permits the two clamping members to be pivoted apart. Further, when the two clamping members are pivoted together to grip the conductors between their transverse cross members, the foot-like members pivot in an outwardly direction and become locked behind the connector wall in which said apertures are formed. Securing means are pivoted together.
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STRAIN RELIEF MEANS FOR ELECTRICAL CONNECTORS

BACKGROUND OF THE INVENTION

This invention relates generally to strain relief means for relieving strain on conductors secured within a connector, as for example, the strain created when a disconnection is made by pulling on the conductors, and more particularly the invention relates to a strain relief means which can be selectively employed or not employed with a connector and further to a strain relief means which can be installed and later removed after the conductors have been secured in the connector means.

To effect a disconnect of a connector, the human operator frequently simply takes hold of the conductors leading into the connector and pulls on them in order to make the disconnection. Such a procedure obviously tends to weaken the connection between the conductors and the connector, and eventually will result in pulling the conductors out of the connector, or at least disturb the electrical connection between the connector and the conductors. Such electrical connections often are very sensitive, especially when low currents are being conducted therethrough.

In order to minimize the possibility of repairmen or anyone else damaging electrical connections of expensive electrical equipment many structures have been developed to relieve the strain on conductor-connector connections when a disconnect is made by pulling on the conductors.

Many of such strain relief mechanisms have involved means which are integral with the connector itself and adapted to grip the conductor at a plurality of points. At one of the points, perhaps the foremost point, electrical connection is made. Strain relief is effected at the point behind such foremost point.

One of the disadvantages of the aforementioned approach to strain relief is that, if for some reason, such as damage to a conductor, it should be desired to change a connector in the connector, problems are encountered in that it is difficult to change a connector without disturbing the other conductors and without damaging the particular conductor involved.

It is a primary object of the invention to provide a simplified strain relief means which is usable with a plurality of conductors to provide insurance against damage to the conductor-connector connection even if disconnect should be made by pulling on the conductors.

A second aim of the invention is a strain relief means which can be employed, or not employed, at the designer's discretion, with any given connector.

A third object of the invention is a strain relief means which is removable from a connector to permit access to one or more conductors connected to said connector and which further functions to provide strain relief collectively for a plurality of conductors.

A fourth object of the invention is the improvement of strain relief means generally.

BRIEF STATEMENT OF THE INVENTION

In accordance with the invention there is provided a strain relief means for one or more conductors secured within a connector, and comprising first and second aperture means formed either in the main body of said connector or in flanges or ears attached thereto, with the cross-sectional area of each of said aperture means lying in a common plane and on either side of an opening through which extends the conductors secured within the connector. Also provided are first and second clamping means, each of which is constructed to have a pair of legs arranged in parallel manner and connected by a transverse element to form a resultant generally U-shaped element. Each leg of said first and second clamping elements has a foot-like member attached thereto and positioned substantially normal to the direction of said legs and lying in a plane substantially normal to a plane joining together the centerlines of the legs.

The legs of each pair of legs are spaced apart a distance which is substantially equal to the distance between said first and second aperture means to enable the foot-like members attached to a given pair of legs to be inserted into the aperture means in such a manner that the clamping elements can be rotated about a pivot line defined by the junction between the pair of legs and the foot-like members attached thereto.

The two clamping means are positioned so that the two pairs of legs attached thereto extend through to the back side of the element containing said first and second aperture means, with the foot-like members on said two pairs of legs extending in opposite directions from each other on the back side of said element. In the foregoing position the two clamping means can be pivoted away from, or towards each other, about the pivot lines defined by the junctions between said pair of legs and the foot-like members attached thereto.

The transverse connecting elements of the two clamping means are configured so that when said clamping means are pivoted together, the two transverse elements form a variable size aperture therebetween. Such variable aperture varies in size in accordance with the proximity of the two transverse elements and for the purpose of accommodating various cross-sectional areas of conductors which pass therethrough. Furthermore, securing means are provided for securing said first and second clamping means together in selected degrees of proximity to provide for the various aperture sizes required to grip different cross-sectional areas of conductors.

The above-mentioned and other objects and features of the invention will be more fully understood from the following detailed description thereof when read in conjunction with the drawings in which:

FIG. 1 is a perspective view of a typical connector and of the strain relief means both of which are shown in perspective and in disconnected relationship;

FIG. 2 shows connector means and two clamping members which form the strain relief means in connected relationship;

FIG. 3 shows the connector means with the two clamping members connected thereto but pivoted apart to show how they are inserted into the connector.

DESCRIPTION OF THE INVENTION

Referring now to FIG. 1 there is shown a portion of a typical connector with six apertures formed therein and identified by reference characters 115 and 117. Conductors (not shown) extend out of these apertures 115 and 117 from connections within the connector 102. The apertures 105 and 106 are formed in extensions 103 and 104 and are positioned on either side of the aperture groupings 115 and 117. The extensions
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103 and 104 with the apertures 105 and 106 form a pair of stirrup-like elements into which the foot-like members 111, 112, 113, and 114 fit, as shown in FIG. 2. The foot-like elements 111, 112, 113 and 114 are part of a pair of clamping elements 100 and 101. More specifically foot-like elements 111 and 112 are attached to the legs 107 and 108 of clamping member 100 and foot-like elements 113 and 114 are attached to legs 109 and 110 of clamping member 101. The two clamping members 100 and 101 are oriented with respect to each other in the manner shown in FIG. 1. It can be seen that the foot-like elements 111 and 112 of clamping element 100 point from the foot-like elements 113 and 114 of clamping element 101.

The pair of legs 107 and 120 of clamping member 100 are joined together by a cross member 165. Similarly, the pair of legs 109 and 110 of clamping member 101 are joined together by a cross-member 116. Each of the cross connecting members 165 and 116 has a concave arcuate section formed in the perimeter thereof. More specifically, an arcuate concave section 125 is formed in cross member 165 and a concave arcuate section 126 is formed in cross member 116.

When the two clamping members 100 and 101 are positioned together in the manner shown in FIG. 2, the two concave arcuate sections 125 and 126 form a generally circularly shaped aperture through which the conductors pass. The aforementioned aperture is variable in size and can be made smaller, if needed, in order to grip the conductors passing therethrough and provide the strain relief function needed.

It will be observed that arcuate concave sections 125 and 126 are each formed in a particular manner to optimize the conductor gripping capability as the two clamping members 100 and 101 are brought together. More specifically, the surface 134, which defines a portion of arcuate section 126, approaches a beveled surface 135 on the outside of surface 140 in clamping element 100 when the clamping elements 100 and 101 are pivoted together in the assembled position, as shown in FIG. 2. In a similar manner the surface 132, which defines a portion of arcuate section 125 of clamping element 100 approaches the beveled surface 133 of clamping means 101 and on the outside of surface 139.

Since a portion of surface 132 of clamping element 100 falls outside the surface 139 of clamping element 101 and further since the surface 140 of clamping element 100 fall inside the portion 134 of element 101, the two clamping means 100 and 101 become interlocked when in a closed position in such a manner as to prevent axial movement, i.e., movement along the major axis of legs 107-110 with respect to each other, and also to add structural strength to the assembled strain relief structure.

Referring now specifically to FIG. 2, the clamping elements 100 and 101 are shown with their two pairs of legs 107, 108, 109, and 110 inserted through the apertures 105 and 106 in connector portion 102. The flanges 150, 151 of clamping element 100 and the flanges 152, 153 of clamping element 101 are shown abutting up against the surface of connector portion 102.

The foot-like members 111, 112, 113 and 114 extend through the two apertures 105, 106 of connector portion 102. It is apparent that to insert the said foot-like elements 111, 112, 113 and 114 into the apertures 105 and 106 it is necessary to have the two clamping means 100 and 101 pivoted apart from each other as shown generally in FIG. 3. Once both clamping elements 100 and 101, i.e., the foot-like members are inserted through the apertures 105, 106, the clamping elements 100 and 101 can be brought together in the position shown in FIG. 2. In the closed position of FIG. 2 the conductors 149 are shown as passing through the aperture 148 formed by the two clamping elements 100 and 101.

A pair of thread forming screws 154 and 156 are inserted through slotted apertures 129 and 130 of clamping elements 100 and 101, respectively, and down into threadable apertures 127 and 128 respectively of clamping elements 101 and 100.

In FIG. 3 there is a detail showing how the foot-like members 111-114 of the two clamping elements 100 and 101 are inserted in apertures 105 and 106 provided therefor in connector 102. From the Figures, it can be seen that each of the foot-like elements has a rounded heel portion such as heel portion 158 of foot-like member 112 in FIG. 1. These rounded heel portions enable the insertion of the legs of the clamping elements 100 and 101 through apertures 105 and 106, and also enables the pivoting of clamping elements 100 and 101 with respect to each other after they are assembled within apertures 105 and 106. In fact, it is because the two clamping elements 100 and 101 can be pivoted with respect to one another, due to the rounded heels on said foot-like elements, that said clamping elements 100 and 101 can be inserted in apertures 105 and 106 of connector portion 102.

Once the foot-like elements are inserted through apertures 105 and 106, and the clamping elements 100 and 101 pivoted together as shown in FIG. 2, they cannot be removed from apertures 105 and 106 because of the foot-like elements which are now substantially at right angles at the back side of the plate 103.

The flanges 150, 151, 152 and 153 prevent the clamping elements 100 and 101 from further insertion into the apertures 105 and 106.

To remove the clamping elements 100, 101 from the connector 102 it is only necessary to remove the screws 154 and 156 and then to pivot the two clamping elements 100 and 101 apart as shown in FIG. 3. The clamping elements will then slide out of the apertures 105 and 106. To reinstall the strain relief structure the clamping portions 100 and 101 can later be reinserted into apertures 105 and 106, pivoted together and rejoined using screws 154 and 156.

It is to be understood that the form of the invention shown and described is but a preferred embodiment thereof and that various changes may be made in the configurations of the clamping elements, the type connector with which it is used and also in the configuration of the aperture means in the connector without departing from the spirit and scope of the invention.

What is claimed is:

1. Strain relief means for conductors secured within a connector comprising:
said connector constructed to define therein first, second and third aperture means, with said second aperture means being positioned in-between said first and third aperture means;
said conductors extending out through said second aperture means from their secured points within said connector;
first and second clamping elements each constructed to have a pair of legs with a foot-like member on each leg;
the two legs of each pair of legs being spaced apart a distance equal to the distance between said first and third aperture means to enable said foot-like members to be inserted into said first and third aperture means and to enable said clamping elements to be rotated about the junctions between their legs and the said foot-like members attached thereto;
said first and second clamping elements being so positioned that the said pair of legs attached thereto extend through said first and third aperture means, with the foot-like elements on one pair of legs extending in a direction opposite to the pair of foot-like elements on the other pair of legs to enable said first and second clamping elements to pivot away from each other about the junction between said legs and said foot-like elements;
said first and second clamping elements each being configured to form a variable size aperture therebetween when pivoted together;
said variable size aperture being variable to accommodate conductors of various cross-sectional areas passing therethrough; and
securing means for securing said clamping elements together in various degrees of proximity to provide for various sizes of said variable size aperture.

2. Strain relief means in accordance with claim 1 in which the configurations of said first and second clamping elements which form said variable size aperture are beveled to provide a narrowed surface around the perimeter of said variable size aperture means to enable better gripping of the conductors passing therethrough.

3. Strain relief means in accordance with claim 1 in which said securing means for securing said clamping elements together comprises:
a fourth aperture means formed in at least one of said clamping element;
a fifth aperture means formed in the other of said clamping element; and
screw means which passes through said fourth aperture means in said one of said clamping element and screws into said fifth aperture means in said other clamping element.

4. The combination of a connector for terminating conductor means and a strain relief means attached to said connector and also to said conductor means to relieve physical strain on the strain on the connection between said connector and said conductor means, and comprising:
first and second clamping means each comprising a pair of legs joined together at one end thereof by a cross member to form a generally U-shaped structure;
said connector having a first and a second pair of facing shoulder means positioned on an exterior wall thereof;
each of said legs comprising at its free end a foot-like coupling means with rounded heels;
each rounded heel of said first clamping means constructed to fit against one of the rounded heels of said second clamping means to form a pair of facing rounded heels in each of said first and second facing shoulder means, with the foot-like portions extending behind said facing shoulder means to enable pivoting of said first and second clamping means about the facing, rounded surfaces of said adjacent heel portions;
each of said cross members having that surface thereof which faces the other cross member configured to cooperate with the corresponding facing surface of said other cross member to form an aperture through which said conductor means passes.

5. The combination of claim 4 in which the said surfaces of said cross members which form said aperture are beveled to provide a narrowed surface around the perimeter of said aperture to enable better gripping of the conductor means passing therethrough.

6. The combination of claim 4 in which said securing means for securing said clamping means together comprises:
a second aperture means in at least one of said clamping means;
a third aperture means in the other of said clamping means; and
screw means which passes through said second aperture means in said one of said clamping means and screws into the third aperture means in said other clamping means.

7. Strain relief means for conductor means secured within a connector comprising:
a plate-like means on said connector defining first and second openings therein;
said conductor means extending out from said connector at a point between said first and second openings;
first and second clamping elements each having a pair of legs with a foot-like member attached to a first end of each leg;
a cross member joining together the other ends of each pair of legs;
the legs of each pair of legs being spaced apart a distance equal to the distance between said first and second openings to enable the foot-like members attached thereto to be inserted into said first and second openings whereby said clamping element can be rotated about the junctions between said legs and said foot-like members attached thereto;
each of said clamping elements being positioned with the legs of the pair of legs attached thereto extending through said first and second openings and with the foot-like members on each of the two pairs of legs having rounded heels thereon and extending in opposite directions to enable said first and second clamping elements to pivot away from each other and about the junction between the legs attached thereto and foot-like members attached thereon;
said first and second clamping elements each being configured to form a variable size aperture between said cross members when pivoted together;
said variable size aperture being variable in size to accommodate various cross-sectional areas of the secured conductor means which passes through said variable size aperture; and
securing means for securing said first and second clamping elements together in various degrees of proximity to provide for various sizes of said variable size aperture.

8. Strain relief means in accordance with claim 7 in which the configurations of said cross members of said first and second clamping elements defining said variable size aperture means are beveled to provide a nar-
rowed surface around said variable sized aperture means to enable better gripping of the conductor means passing therethrough.

9. Strain relief means in accordance with claim 7 in which said securing means comprises:

at least one of said clamping element having an aperture means therein;
the other of said clamping element having a bore formed therein;
screw means which passes through said aperture means in said one of said clamping element and screws into the bore in said other clamping element.

10. Strain relief means for conductors secured within a connector comprising:

a plate-like means on said connector defining first second and third apertures therein, with said second aperture being positioned between said first and third aperture;
said conductors extending out through said second aperture from secured points within said connector;
first and second clamping elements each having a pair of legs with a foot-like member attached to each leg;
each leg of each pair of legs being spaced apart a distance equal to the distance between said first and third apertures to enable the foot-like members attached thereto to be inserted into said first and third apertures, whereby said clamping element can be rotated about the junctions between said legs and the foot-like members attached thereto;
each of said clamping elements being positioned with the legs of the pair of legs thereon extending through said first and third apertures and with the foot-like member on each of the two pairs of legs extending in opposite directions to enable said first and second clamping means to pivot away from each other and towards each other about the junctions between the legs and attached foot-like members thereon;
said first and second clamping means each being configured, when pivoted together, to form a variable size aperture therebetween and to grip said conductors within said variable size aperture.

11. Strain relief means for conductors extending outwardly from a connector and comprising first and second aperture means formed in said connector;
first and second clamping means each having a generally U-shaped configuration with the two vertical open-ended portions of the U comprising legs whose open extremities

each of said legs having a foot-like element attached to its open extremity and positioned substantially normal thereto, with the foot-like elements on each pair of legs being similarly space-oriented and each lying in a plane normal to a line joining together similar points on said legs;
each of said clamping means each having their pair of legs extending through said aperture means so that said foot-like elements are extended entirely through said aperture means and, when the two clamping elements are pivoted together, form a locking means to prevent withdrawal of said clamping means from said aperture means; are positioned spatially apart a distance equal to the distance between the said two apertures means in the said connector, and a cross member joining together the pair of legs at one end thereof; and
the cross member of each clamping means configured to define an arcuately shaped concave edge which faces towards a similar arcuately shaped edge in the other clamping means to form a third aperture means in which said conductors are gripped when said clamping means are inserted in said first and second aperture means and pivoted towards each other.

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