United States Patent

Robinson et al.

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[54] **ELECTRICAL TERMINAL STRUCTURE WITH WEDGED CONDUCTOR**

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[73] Assignee: **General Cable Corporation,** New York, N.Y.

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[52] **U.S. Cl.** .....**339/198 R,** 339/95 R, 339/242, 339/272 R

[51] **Int. Cl.** **H01r 9/00**

[58] **Field of Search**.....339/19, 22, 198, 242, 95, 96, 339/97, 263, 270, 272

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[57] **ABSTRACT**

A terminating structure in which a tight mechanical grip on a conductor is achieved by wedging the conductor in a hole which is at a slight angle to the vertical tapped hole for a set screw. The screw may be self tapping. The holes are preferably in the front of the terminating structure and in a position where the conductors can be inserted in a straight or almost straight position without having to bend the conductor. The structure can be fabricated from a stamped blank of metal.

14 Claims, 10 Drawing Figures

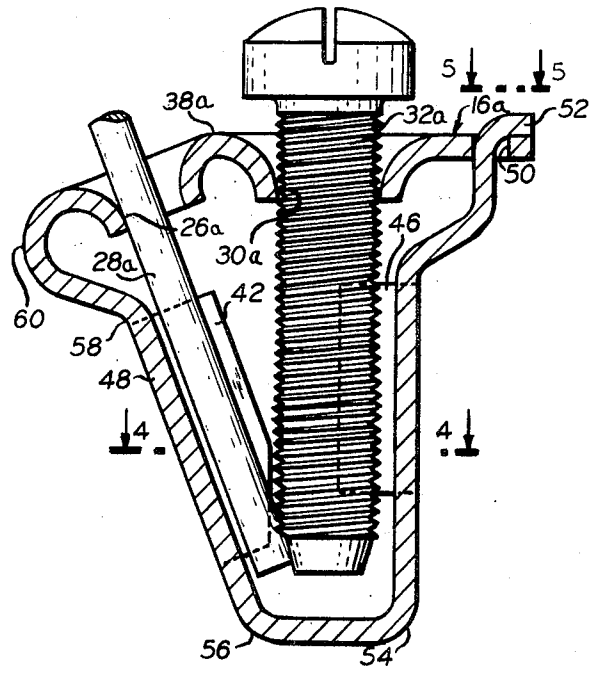


FIG. 1.

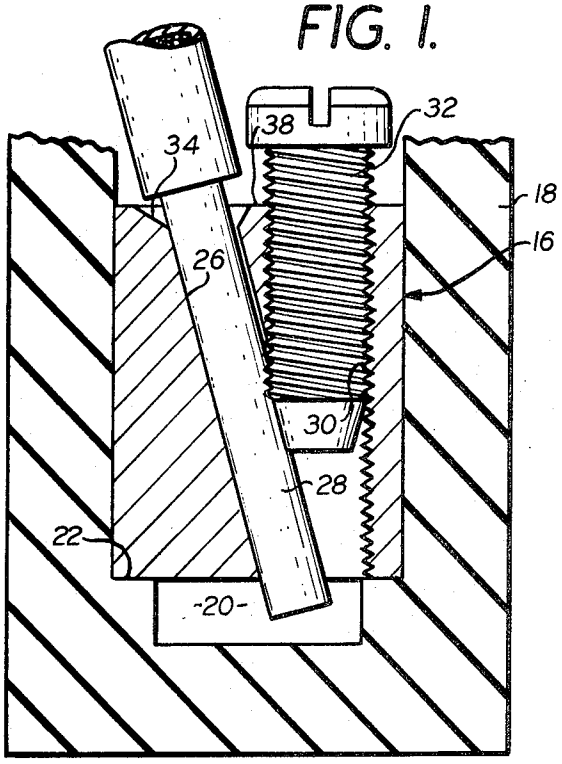


FIG. 2.

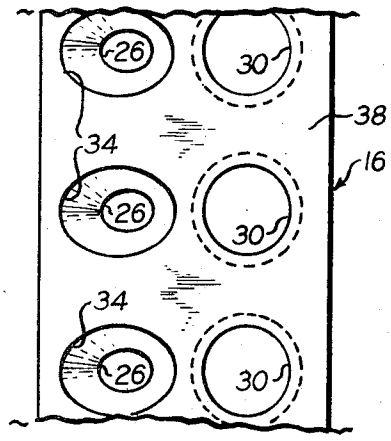


FIG. 6.

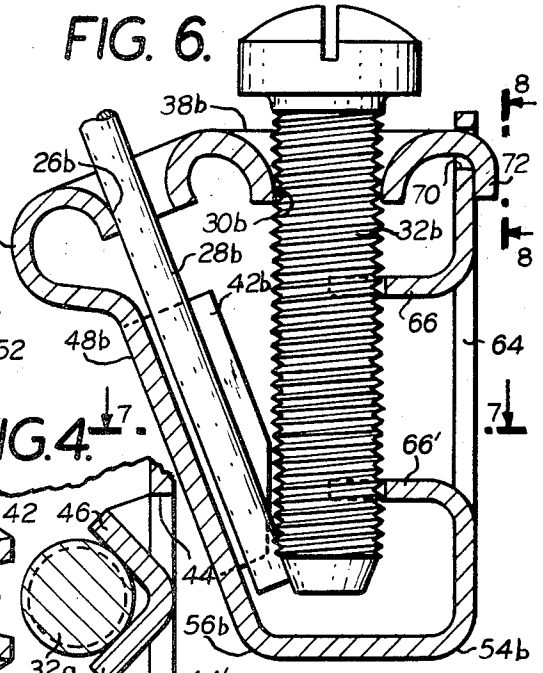


FIG. 3.

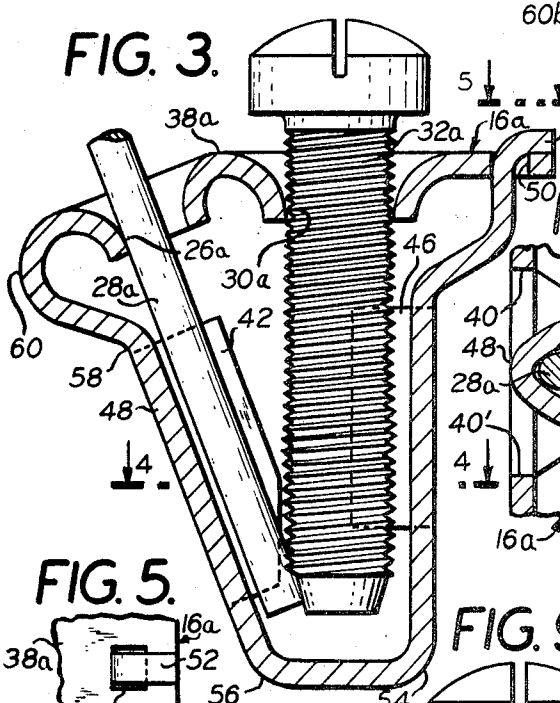


FIG. 4.

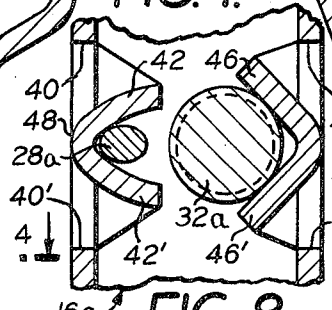


FIG. 5.

FIG. 8.

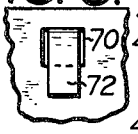


FIG. 7.

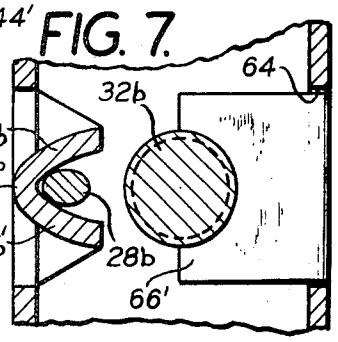


FIG. 9.

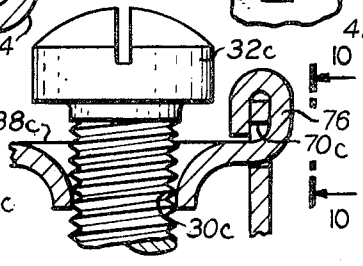
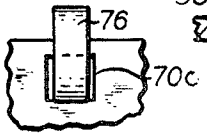


FIG. 10.



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ELECTRICAL TERMINAL STRUCTURE WITH WEDGED CONDUCTOR

BACKGROUND AND SUMMARY OF THE INVENTION

This invention relates to a new and improved type of electrical terminating structure. Its main feature is that the conductor is inserted in the front of the terminating structure and in an almost straight position without having to make any bends. This becomes particularly convenient when making electrical terminations where space is at a premium such as in junction boxes or in crowded electrical panels and switchboards.

With present types of terminating structures having a tunnel type of terminating means, the conductor is usually bent at a right angle before inserting it in a hole or under a tab near the bottom of the terminating structure. Often the hole or tab must be probed for when the conductor entry locations are not readily accessible because of crowded conditions. With other types of terminating bars, the conductor is bent in a loop before it is clamped by the head of a binding screw.

In this new type of terminating structure, a tight mechanical grip on the conductor is achieved by wedging the conductor in a hole which is at a slight angle to the vertical tapped hole for the tightening screw. The bar may be of copper, brass or aluminum. When using an aluminum bar it may be plated with a suitable metal for corrosion prevention and for improved electrical performance especially for terminating aluminum conductors. The terminating structure may be fabricated from rolled stock or it may be die cast. The holes may be drilled, punched or cast. The tightening screws may be brass or steel. A steel screw may be of a self tapping type when using an aluminum structure.

Included in the scope of this invention is a structure which is fabricated from a stamped strip or bland; preferably one of brass. The strip is bent to a configuration that has the same basic features as for the machined terminal structure. Variations to achieve the basic construction can be employed. For example:

a. The tightening screw may be held by a rivetted tapped insert rather than in a pierced threaded hole.

b. The side supports for the conductor and for the tightening screw may be of separate bent strips, which are either welded or rivetted in position rather than an integral part of the terminal structure.

Other objects, features and advantages of the invention will appear or be pointed out as the description proceeds.

BRIEF DESCRIPTION OF DRAWING

In the drawing, forming a part hereof, in which like reference characters indicate corresponding parts in all the views;

FIG. 1 is a sectional view showing a terminating structure made in accordance with this invention and located in an enclosing housing or container made of electrical insulating material;

FIG. 2 is a fragmentary top plan view of the terminating structure shown in FIG. 1 with the conductor and set screw removed;

FIG. 3 is a view similar to FIG. 1 but showing a modified form of the invention in which the terminating structure is a hollow housing which can be made from a metal stamping and without any container;

FIG. 4 is a fragmentary sectional view taken on the line 4—4 of FIG. 3;

FIG. 5 is a fragmentary detailed view taken on the line 5—5 of FIG. 3;

FIG. 6 is a view similar to FIG. 3 but showing still another modified form of the invention;

FIGS. 7 and 8 are fragmentary views taken on the lines 7—7 and 8—8, respectively, of FIG. 6;

FIG. 9 is a fragmentary detailed view showing a modified construction for connecting together the edges of the stamping shown in FIG. 6; and

FIG. 10 is a fragmentary detailed view taken on the line 10—10 of figure 9.

DESCRIPTION OF PREFERRED EMBODIMENT

FIG. 1 shows a terminating structure 16 which is located in a housing or container 18 preferably made of electrical insulating material. The housing or container 18 is open at one side which for purposes of the description can be considered the front of the container 18 though this front is located at the top of the drawing in FIG. 1. The opening exposes the front surface of the terminating structure 16. There is a well 20 in the back or bottom wall of the container 18. A shoulder 22 extending around the circumference of the well 20 provides a stop which limits the extent to which the terminating structure 16 can be inserted into the container.

In the front (top) wall of the structure 16, there are two holes or openings including an unthreaded opening 26 for receiving a conductor 28 of a power cable, and a threaded opening 30 into which a set screw 32 fits. The opening 26 has a countersink 34 at its upper end to facilitate the original entry of the conductor 28 into the opening 26. At the front surface of the structure 16, the openings 26 and 30 are spaced from one another; but they converge as they extend into the structure 16 and toward the rearward (bottom) surface of the structure 16. The openings 26 and 30 meet within the structure and when a conductor 28 is inserted as shown, the set screw 32 engages and clamps the conductor 28 tightly against the wall of the opening 26 which is opposite the set screw 32.

With a steel set screw and a soft conductor 28 such as aluminum, the threads of the set screw cut into the surface of the conductor 28 so that the conductor is not only held in the structure 16 by friction but is also locked in the structure by the threads of the set screw 32.

In the construction shown in FIG. 1, the well 20 is located in a position at the back of the structure 16 so that the conductor 28 can extend some distance beyond the structure 16, the depth of the well 20 determining the extent to which the conductor can extend beyond the structure 16. By having the housing or container 18 made of electrical insulating material, the terminating structure 16 is protected from accidental contact on all sides except the front where the conductor 28 extends into the structure 16 and where the set screw 32 extends into the structure to clamp the conductor.

The structure 16 can be of any desired length and FIG. 2 is a view of the front surface, indicated by the reference character 38 of the structure 16. This view shows three openings 30 located at closely spaced regions along the length of the structure 16. There are three corresponding openings 26 for the openings 30; and it will be understood that the structure can be

made of any desired length with as many pairs of openings **26** and **30** as there are conductors to be terminated. The insulating wall of the container **18** extends lengthwise of the structure and if desired can extend across the both ends of the structure.

FIG. **3** shows another form of the invention in which a hollow terminating structure **16***a* is used in place of the solid structure **16** shown in FIG. **1**. The advantage of the construction shown in FIG. **3** is that it can be made from a metal stamping and can, therefore, be much lighter and less expensive than the structure shown in FIG. **1**. The principle of the construction shown in FIG. **3** is similar to that shown in FIG. **1** but certain modifications in the construction are necessary because of the hollow interior.

A front wall **38***a* in FIG. **3** has an opening **26***a* for receiving a conductor **28***a* of a power cable; and also has an opening **30***a* for receiving a set screw **32***a* which threads into the opening **30**a.

The terminating structure **16***a* can be formed from a strip of metal which is stamped to provide the openings **26***a* and **30***a;* and these opening are preferably made by displacing metal from the portion of the wall where the opening is to be formed so that instead of an opening of the thickness of the metal, there is a longer opening formed by what is in effect a drawing down of the metal so that what was the outside surface of the stamping becomes part of the inside surface of the opening **26***a* and **30***a*.

At the time that the openings **26***a* and **30***a* are stamped, other openings are stamped as shown in FIG. **4**. These include an opening **40** which is formed by displacing a strip or tab **42** from the wall of the stamping and a corresponding opening **40′** formed by displacing another strip or tab **42′**. At another location, openings **44** and **44′** are formed by displacing tabs **46** and **46′**.

The purpose of the tabs **42**, **42′**, **46** and **46′** will be apparent by comparing FIGS. **3** and **4**. The tabs **42** and **42′** form in effect side surfaces for the "opening" into which the conductor **28***a* extends. Thus contact with these tabs **42** and **42′** gives the conductor **28***a* a long surface for holding it in alignment with the opening **26***a* and for holding it out of contact with the wall **48** immediately behind it. Thus the conductor **28***a* is wedged into what amounts to a modified VEE bracket that holds the conductor **28***a* in a centered position and prevents it from rolling to either side when clamped by the set screw **32***a*.

Likewise the tabs **46** provide a pair of side walls against which the set screw **32***a* contacts to hold it centered in alignment with the opening **30***a* and to prevent it from shifting to either side when it contacts with the conductor **28***a* in the lower or backward part of the terminating structure **16***a*.

After the openings **26***a* and **30***a*, and the openings **40**, **40′**, **44** and **44′** have been formed in the stamping, together with other spaced openings **50** and spaced edge tabs **52**, the stamping is bent to form the terminating structure shown in FIG. **3**. It is bent at two corners **54** and **56** at the back (bottom) of the terminal structure and it is bent outward along a line **58** to increase the width of the front surface of the terminating structure. The stamping is also bent around an arc of about 135° along the line **60** and is then bent at a location between the openings **26***a* and **30***a* to bring the edge with the openings **50** adjacent to the opposite edge with the edge tabs **52**. The edge tabs **52** are inserted through the openings **50** and then bent over as shown in FIG. **5**, to hold the various parts of the terminating structure in the intended relation shown in FIG. **3**.

FIGS. **6**, **7** and **8** show a construction which is similar to that shown in FIGS. **3**, **4** and **5** except that an opening **64** in one wall produces tabs **66** and **66′** which extend in different planes to the tabs **46** and **46′** of FIGS. **3** and **4**. The purpose of the tabs **66** and **66′** is essentially the same but they have the advantage that they can be used to hold the set screw **32***b* further away from the adjacent wall of the terminating structure and thereby bring the set screw closer to the opposite wall against which the conductor **28***b* is clamped. This permits the terminating structure to be used with a conductor of smaller diameter than could be used in the construction of FIG. **3**. It also permits the tabs **66** and **66′** to be threaded, if desired.

Another difference in the construction shown in FIG. **6**, as compared to that of FIG. **3** is that there are openings **70** formed in a different wall of the stamping as compared to that of FIG. **3** and there are tabs **72** formed along the opposite edge of the stamping for insertion through the edge openings **70** as shown in FIG. **6**.

The terminating structures shown in FIGS. **3** – **8** are similar to the one shown in FIGS. **1** and **2** in that they have substantial longitudinal extent with as many conductor-receiving openings **26***a* or **26***b* as desired and a corresponding number of openings **30***a* and **30***b* for receiving screws to clamp the conductors in the terminating structures. There may be as many holes or openings **50** and **70** along the edge of the stamping as there are set screw holes or there may be more or fewer depending upon the stiffness of the material and upon how many points of connection between the edges that are necessary to maintain the shape of the terminating structure. In place of the tabs **52** and **72** for anchoring the opposite edge of the stamping at the openings **50** and **70**, other means can be employed for connecting the edges together at the corner where the original free edges of the stamping are brought together after bending the terminating structure at enough places to form a closed product or closed perimeter. These means include various seaming processes, welding, soldering or any other well known method of connecting edges of metal parts together.

FIG. **9** shows a construction similar to FIG. **6** but with longer tabs **76** in place of the tabs **72** of FIG. **6**. These longer tabs **76** extend through openings **70***c* and because of the greater length of these tabs **76** they can be bent around the front and down the opposite side of the wall through which the openings **70***c* are punched. This provides a somewhat stronger connection than that shown in FIG. **6**, but one that requires more material. Other parts in FIG. **9** corresponding with those in FIG. **6** are indicated by the same reference character with the letter *c* appended in place of the letter *b* of FIG. **6**.

The preferred embodiment of the invention has been illustrated and described, but changes and modifications can be made and some features can be used in different combinations without departing from the invention as defined in the claims.

What is claimed is:

1. A terminating structure comprising a body portion made of metal which is a good conductor of electricity, the structure having a plurality of spaced openings therein opening through the front surface thereof for receiving conductors that are to be connected with the structure, a surface within the terminating structure in alignment with and extending generally parallel to the longitudinal axis of the opening and forming in effect a continuation of a side of said opening for contact with the conductor and set screws extending through the front face of the terminating structure in directions to intersect the space occupied by the respective conductors that are in contact with the axially extending surfaces for clamping the conductors against said surfaces, characterized by each set screw having a tapered portion of its length near the lower end of the set screw with a tapered surface that wedges the conductor against the axially extending surface with which a side of the conductor contacts.

2. The terminating structure described in claim 1 characterized by there being a separate set screw for each of the openings, each set screw extending through a tapped opening having its longitudinal axis at an acute angle to the longitudinal axis of the opening into which the conductor extends, said acute angle being less than 22½°.

3. The terminating structure described in claim 1 characterized by the set screw opening being spaced from the conductor-receiving opening at the surface of the structure, but the axes of the openings converging at an acute angle and intersecting one another within the structure, the acute angle between the axes of the set screw openings and the conductor openings being between 10° and 22½°.

4. The terminating structure described in claim 1 characterized by each set screw having threads on a portion of its outside surface in position to cut threads in a side of the conductor in the conductor-receiving opening.

5. The terminating structure described in claim 1 characterized by said structure being enclosed in a housing that is made of electrical insulating material and that is open on only one side, and the front surface of the structure being exposed from the open side of the housing, and both the conductor-receiving openings and openings for the set screws opening through said front surface, each conductor-receiving opening and its associated set screw opening being spaced from one another where they open through the front surface of the bar but converging as they extend into the bar.

6. The terminating structure described in claim 5 characterized by each set screw being substantially larger in cross-section than the conductor.

7. The terminating structure described in claim 5 characterized by the housing having a well beyond the back surface of the structure, a shoulder around the well limiting the extent to which the structure can be inserted into the housing, each of the openings for a conductor and its associated set screw coming together in said structure and opening through the back surface of said structure into communication with the well whereby the conductor can be extended beyond the back surface of the structure for a distance equal to the depth of the well.

8. The terminating structure described in claim 1 characterized by the structure being a hollow housing with a front wall through which the conductor-receiving openings open, and threaded openings in the housing for the set screws, each conductor contacting with its set screw within the hollow housing, an interior thrust surface of the housing including the axially-extending surface that contacts with one side of the conductor and that is spaced away from the screw, and an interior thrust surface of the housing that contacts with the side of the screw that is away from the conductor.

9. A terminating structure comprising a body portion made of metal which is a good conductor of electricity, a front surface of the body portion with a plurality of spaced openings in the structure and opening through the front surface thereof for receiving conductors that are to be connected with the structure, and set screws that clamp the conductors in the openings, characterized by the structure being a hollow housing with a front wall through which the conductor-receiving openings open, and threaded openings in the housing for the set screws, each conductor contacting with its set screw within the hollow housing, an interior thrust surface of the housing that contacts with one side of the conductor that is away from the screw, and an interior thrust surface of the housing that contacts with the side of the screw that is away from the conductor, and further characterized by the housing being a stamped strip which is bent along an axis extending lengthwise of the structure to provide a front wall, longitudinal side walls and a back wall, the thrust surfaces within the housing being strips that connect with opposite side walls of the housing and that hold the conductors and screws out of the plane of the side walls and in contact with each other.

10. The terminating structure described in claim 9 characterized by the strips being of one piece construction with the rest of said walls of the housing and being formed of material displaced inwardly at an angle from the sides of the housing.

11. The terminating structure described in claim 9 characterized by each of the strips having walls that converge toward the side of the housing in which said strip is connected, the convergence of the conductor contacting surfaces being toward axes that extend generally parallel to the direction of extent of the conductors, and the convergence of the screw contacting surfaces being toward axis that extend generally parallel to the direction of extent of the screws.

12. The terminating structure described in claim 9 characterized by some of the thrust surfaces being on tabs that connect with one wall of the housing and that are spaced from one another lengthwise of the front-to-back extent of the said wall and that are substantially normal at their inner end portions to the side wall with which they are connected, and their thrust surfaces being arcuate about an axis of curvature that is generally parallel to the side wall to which the tabs are connected.

13. The terminating structure described in claim 9 characterized by the housing being formed from a blank that is bent at the junctures of the front, side and back walls with one another, one of the junctures being at the longitudinal edges of the blank, and said edges being connected together by tabs at one edge projecting through openings in the opposite edge.

14. The terminating structure described in claim 9 characterized by the conductor-receiving openings and set screw openings being in the front wall of the housing, and the wall material being displaced inwardly around each of the openings to give the wall a greater effective thickness around the edges of the openings.

* * * * *