Aug. 20, 1968 W. A. COCHRUM 3,398,393

DEVICE FOR CLAMPING WIRES TO TERMINALS

Filed Sept. 9, 1966

Fig. 1

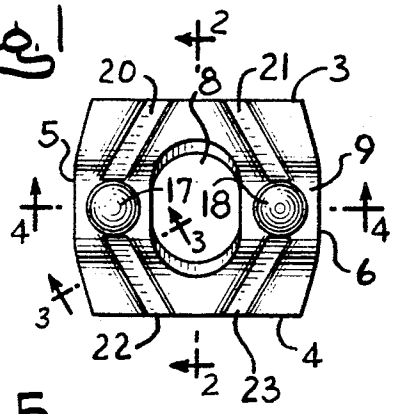


Fig. 2

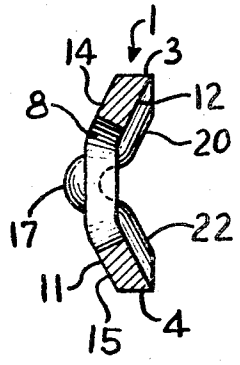


Fig. 5

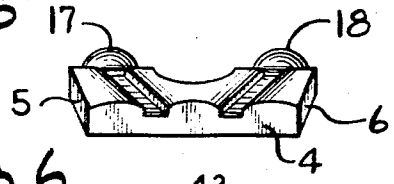


Fig. 3

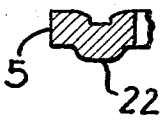


Fig. 6

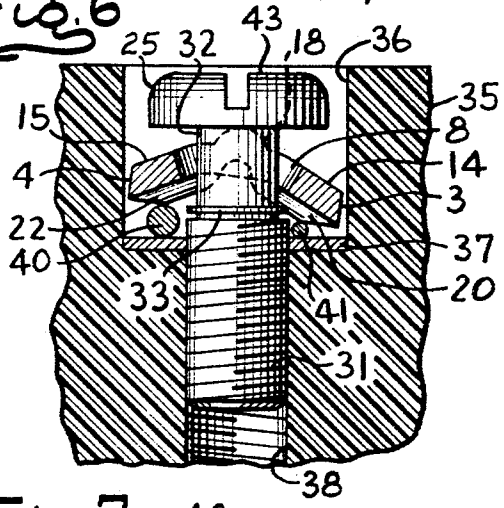


Fig. 4

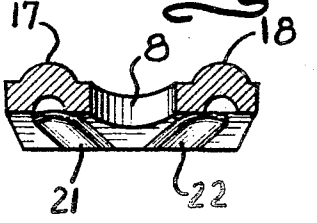
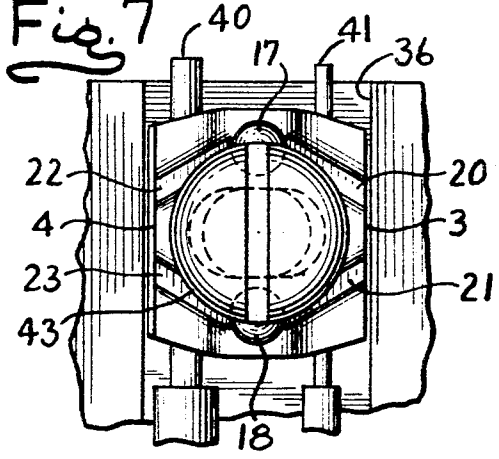


Fig. 7



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DEVICE FOR CLAMPING WIRES TO TERMINALS

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This invention relates to improvements in devices for clamping electrical conductors to terminals.

Devices of the type with which the present invention is concerned comprise a screw for threading into the terminal and a captive clamp through which the screw projects for holding one or more wires against the terminal. The clamp may have one or more ribs for engagement with the wire or wires. Difficulty has been encountered, however, when it is desired to clamp to the terminal two wires of widely different diameters on opposite sides of the screw. For this purpose, some clamps have been made of a shallow generally V-shape and are assembled with the screw so that the convex side of the clamp body is presented toward the screw head and the concave side, from which the wire-engaging ribs project, presented away from the screwhead. In this way, the screw may be threaded into the terminal and apply pressure to the clamp near the ridge on the convex side that is formed at the apex of the V. Because of the different diameter wires, the clamp will tilt relative to the screw in order to apply clamping pressure to both wires. However, as the clamp tilts, the pressure applied by the screw tends to move from the ridge or V apex toward the larger diameter wire and away from the smaller diameter wire. The greater the difference in wire diameters, the greater will be the tilt of the clamp and the farther will be the force lines applied to the clamp from the smaller diameter wire. This tends to reduce the clamping force on the smaller diameter wire.

It is an object of the present invention to provide a terminal clamp assembly of the general type stated in which the convex side of the clamp is constructed so that the pressure applied by the screw to the clamp is maintained close to the center or apex region of the clamp despite substantial tilting of the clamp when wires with difference in diameter are clamped to the terminal. This provides a better distribution of forces on the wires and results in an increased force on the smaller diameter wire as compared to clamps of the prior art. In the preferred form of the present invention the mid region of the clamp on each side of the hole therein is provided with beads against which the screwhead pressure is applied, the beads serving as a fulcrum about which the clamp may tilt so that in all tilted positions the forces on the clamp will be applied at the beads and hence about midway between those sides of the clamp that are adjacent to the walls of the terminal slot.

It is a further object of the present invention to provide a clamp of the type stated which is capable of being readily oriented prior to assembly with the screw blank. After the clamps are manufactured, they are placed in notches in a thin rotatable plate and supported below by a bearing plate. Some of the clamps are properly oriented, while others are not properly oriented because they are inverted. The plate rotates causing the clamps to pass under a spring that flips over the improperly oriented clamps but does not flip over the properly oriented ones. This is due to the fact that the clamps that are properly oriented are supported on their convex sides, which is the side on which they are unstable and hence will flip over. It has been found that the aforementioned beads upon which the improperly oriented clamps are at least partially supported enhance the instability of the supported clamps and make it easy for them to be flipped over when the spring passes across an edge of the clamp that is transverse to the apex region.

The attainment of the above and further objects of the present invention will be apparent from the following description taken in conjunction with the accompanying drawing forming a part thereof.

In the drawing:

FIG. 1 is a top plan view of a clamp constructed in accordance with and embodying the present invention;

FIG. 2 is a sectional view taken along line 2—2 of FIG. 1;

FIG. 3 is a fragmentary sectional view taken along lines 3—3 of FIG. 1;

FIG. 4 is a sectional view taken along line 4—4 of FIG. 1;

FIG. 5 is a side elevational view of the clamp shown at FIG. 1;

FIG. 6 is a sectional view of the terminal clamp assembly of the present invention shown in operative position securing two wires to an electrical terminal, the sectional view being taken through the longitudinal axis of the screw; and

FIG. 7 is a top plan view of the structure of FIG. 6.

Referring now in more detail and by reference characters to the drawing, which illustrates a preferred embodiment of the present invention, 1 designates a clamp having a plate-like body with substantially parallel opposed edges 3, 4 and a pair of non-parallel edges 5, 6. The clamp 1 also has an elongated hole 8 extending therethrough with the longer dimension of the hole running between the edges 3, 4 and the shorter dimension of the hole running between the edges 5, 6. Provided on the clamp 1 is a generally flat ridge or central region 9 that extends from one edge 5 to the other edge 6, generally parallel to the edges 3, 4, but is interrupted by the hole 8. On either side of the region 9 the clamp 1 is bent to provide a generally convex side 11 and a generally concave side 12 and thereby form clamping portions 14, 15 on either side of the region 9, and for purposes presently more fully appearing. The clamping portions 14, 15 may be bent relative to the central region 9 of the order of twenty-five degrees so that the clamping portions, if extended to intersection, would form an angle of the order of one hundred thirty degrees. The hole 8 at the two ends thereof that are nearest to the edges 3, 4 is tapered from the convex side 11 to the concave side 12 as a result of bending the body to form the clamping portions 14, 15.

Formed in the central region 9 on either side of the hole 8 are raised axial beads 17, 18, the beads being located such that the line beween their centers passes through the center of the hole 8. The beads 17, 18 are upwardly struck from the concave side 12. The surface of each bead is preferably arcuate and may approximate a surface portion of a sphere. Struck axially outwardly from the concave side 12 and at the clamping portions 14, 15 are clamping ribs 20, 21, 22, 23 which preferably extend from adjacent to the beads 17, 18 to the edges 3, 4 and with the ribs on each clamping portion 14, 15 converging toward each other.

By way of example but not of limitation, for a clamp having a distance between the edges 3, 4 of about .30 inch and a maximum dimension across the non-parallel edges 5, 6 of about .36 inch, the central region may have a width of about .10 inch and each bead may have a width at its base of about 1/16 inch and a height of about .015 to .020 inch. For purposes of clarity of illustration, the height of the beads is somewhat exaggerated in the drawing herein.

After a number of clamps have been manufactured, they may each be assembled with a screw 25 to make up

the terminal clamp assembly. The clamps are deposited in the usual manner in a thin rotatable plate and supported below on a bearing plate, both of which form part of a conventional apparatus for assembling screws with washers. Since this apparatus is known in the art it is not illustrated herein. Suffice it to say, however, that as the plate rotates the clamps pass under a spring that flips over those clamps that are supported on the convex side so that they become properly oriented, namely supported at the edges 3, 4. A clamp supported on the concave side will be usually resting on the two beads 17, 18 and on the convex side of one of the clamping portions 14, 15. Depending upon the orientation of the clamp about the axis of the hole 8, the spring passes over the edges 5, 6 or over the edges 3, 4. If the spring passes first over the edge 3 and then over the edge 4, the release from the edge 4 will easily flip the clamp over because it is highly unstable in a direction perpendicular to the edges 3, 4. The clamp is less stable in the direction parallel to the edges 3, 4, and difficulty has been encountered in flipping over V-shaped clamps where the spring engages one of the edges that is transverse to the apex or ridge of the V. The beads 17, 18 have been found to enhance the instability of the clamp in the direction parallel to the edges 3, 4 and thus allow it to be flipped over easily.

The screw blank is then inserted through the hole 8 and the screw shank roll-threaded over a portion of its length to form a thread 31 and an unthreaded part 32. During the roll-threading operation an annular flange 33 is rolled out of the blank diameter immediately adjacent to the thread 31. This flange 33 may have a diameter that is the same or slightly greater than the maximum lengthwise dimension of the hole 8 at the concave side and thus prevents the clamp 1 from being withdrawn past the thread 31.

In use, the clamp assembly may be used to secure one or more wires to a terminal 35 having a slot 36, the bottom of which has a conductive strip 37. A threaded hole 38 is provided in the terminal 35 for receiving the thread 31 on the screw 25. In the manner of use illustrated herein, two wires, a large wire 40 and a small wire 41, are shown clamped in place on opposite sides of the screw 25. As the screw is threaded into the hole 38, it may be necessary to turn the clamp 1 so that its edges 3, 4 are adjacent to the edges of the slot 36. To aid in proper orientation of the clamp 1, the maximum width across the edges 5, 6 may be greater than the distance between the side walls of the slot 36. Further threading of the screw into the hole 38 causes one pair of ribs 22, 23 on the clamping portion 15 to engage the large wire 40 and the pair of ribs 20, 21 on the clamping portion 14 to engage the small wire 41. When the clamp 1 abuts the wires 40, 41, the retaining flange 35 will move away from the hole 8 upon further turning of the screw 25. The elongated tapered hole 8 allows the clamp to tilt relative to the longitudinal axis of the screw so that two ribs will engage each wire 40, 41, even though there may be a substantial difference between the diameters of the wire. Upon further turning of the screw, the flat underside of the screwhead 43 applies pressure to the beads 17, 18 and this pressure is transmitted through the clamp 1 to the ribs and hence to the wires 40, 41. By having each wire clamped at two places, the pressure on each wire is distributed rather than concentrated in one point. This reduces the possibility of cutting a wire.

The screwhead 43 has a diameter at its underside that is greater than the center to center distance between the beads 17, 18. When pressure is applied to the beads 17, 18 causing the clamp 1 to tilt, the beads 17, 18 form a fulcrum for the tilting so that pressure from the screwhead 43 is applied to the beads in the various tilted positions. Furthermore, the fulcrum line will tend always to pass approximately through the longitudinal axis of the screw 25, that is, deviating from exact passage through said longitudinal axis by factors including the amount of variation of the beads from a true spherical surface and the relative offset of the center of the hole 8 from said longitudinal axis. As a result, the forces on the clamp do not tend to be laterally displaced significantly an increasing amount from the center of the clamp upon an increase of tilting of the clamp.

While in the form of the invention herein shown, the screwhead 45 applies pressure to the beads 17, 18 by direct engagement with the beads, it should be understood that a washer may be interposed between the screwhead and the beads so that pressure is applied to the beads by the screwhead through the washer.

In compliance with the requirements of the patent statutes, I have herein shown and described a preferred embodiment of the present invention. It should be understood, however, that the invention is not limited to the precise construction and method herein shown and described, the same being merely illustrative of the principles of the invention.

What is considered new and desired to be secured by Letters Patent is:

1. A clamp for a terminal assembly comprising a plate-like body having a hole extending therethrough, said body having a region that lies between two opposed edges of the body and extends generally from one of two other opposed edges to the other but is interrupted by said hole, said body being bent relative to said region to provide a generally convex side and a generally concave side and forming clamping portions on opposite sides of said region, said clamping portion defining generally an obtuse angle with respect to said region, said concave side at said clamping portions having ribs that extend to said first mentioned two opposed edges and said convex side at said region having raised axial beads on either side of said hole, each clamping portion having two ribs, one rib extending substantially from each bead.

2. A clamp according to claim 1 in which said hole tapers from the convex side to the concave side.

3. A terminal clamp assembly comprising a screw having a head, a clamp having a hole that receives the shank of said screw, said hole being of such size and shape relative to said shank as to permit tilting of the clamp relative to the axis of said shank, said shank having a thread, means for retaining the clamp against withdrawal from the screw past said thread, said clamp having a region that extends thereacross but is interrupted by said hole, said clamp being bent relative to said region to provide a generally convex side and a generally concave side and clamping portions on opposite sides of said region, the concave side at said clamping portions having ribs extending to two opposed edge portions of the clamp for engagement with a wire on either side of the screw and between the clamp and the terminal, the convex side of the clamp at said region having raised axial beads on each side of the hole for receiving forces applied by said screwhead, said beads forming a fulcrum for said clamp about which said clamp tilts to various positions relative to said screw to enable clamping pressure to be applied through said ribs to wires of different diameters on opposite sides of said screws, said fulcrum passing approximately through the longitudinal axis of said screw in said various tilted positions to confine the forces acting on the beads within a narrow range that extends between the beads and approximately through said longitudinal axis, each clamping portion having two ribs, one rib extending substantially from each bead.

4. A terminal clamp according to claim 3 in which said hole is tapered from said convex side toward said concave side and said means for retaining the clamp against withdrawal from the screw past said thread comprises a rib having a diameter at least as great as the outermost diameter of said hole at said concave side.

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