MODIFICATIONS OF WIRE CONNECTORS

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Filed: Nov. 9, 1970
Appl. No.: 87,715

Foreign Application Priority Data
Nov. 15, 1969 Great Britain..............55,677/69

U.S. Cl...............................174/84 C, 29/628, 174/90,
339/97 C, 339/276 R
Int. Cl...............................H02g 15/08
Field of Search....................174/84 C, 94 R, 90; 339/95 R,
339/97 C, 276 R, 276 T; 29/628

ABSTRACT
A clip for use in jointing wires particularly of multi-wire cables
the clip being trough like in form of having tangs in its
sidewalls in addition to wire engaging means in its base.

6 Claims, 4 Drawing Figures
MODIFICATIONS OF WIRE CONNECTORS

BACKGROUND OF THE INVENTION

This invention relates to wire connectors and more particularly to metallic crimping clips for joining together the individual and corresponding wires of first and second conductor cables.

In the past separate wires of, for example, telephone cables to which this invention is particularly directed, have been manually joined by twisting together the twisted joint with an insulating sleeve. A number of metallic crimping clips have recently been disclosed for use in conjunction with particular joining machines to provide improved joints, both electrically and mechanically, over such manual joints.

SUMMARY OF THE INVENTION

By the present invention there is provided a crimping clip for joining together first and second lengths of insulated wire to make electrical connection between the wires, the clip consisting of a substantially trough-shaped electrically conductive member adapted to receive, along the length thereof, the first and second wires, the said member having a base and first and second upstanding sidewalls, the base containing at least one wire engaging means, characterized in that the sidewalls are formed at a number of places with inwardly projecting tangs.

The wire engaging means in the base may include at least one pair of tongue portions cut from the base and bendable towards, and lying close to, the sidewalls of the clip, the transverse edges of the at least one opening from which the tongue portions are bendable curving upwardly and being resiliently yieldable.

Upwardly projecting tangs may be provided in the base of the clip, either on their own or in combination with the upwardly curved edges.

The tangs in the sidewalls of the clip are so positioned that, when crimped, they cooperate with the tangs in the base but do not lie directly above them. The tangs in the base may be arrayed in two longitudinally extending rows, and some, e.g., half of each row may be of reduced height compared with the remainder of the tangs in that row. The tangs in the sidewalls which are positioned to cooperate with the tangs in the base which are of reduced height, may also be of reduced height.

The clip may be slit to permit resilient movement of one tang independently of a second tang in a plane perpendicular to the plane of the base. The base may be slit adjacent both ends of the longitudinal axis thereof to provide first and second substantially triangular projections raiseable adjacent to each end so that their axes are perpendicular to, and transverse of, the base of the trough-shaped member.

The first and second sidewalls may be provided with embossments adjacent to and engaging upwardly bent tongue portions. The trough-shaped member may be positioned inside an insulating cover. The cover may be pressed through the holes left by the piercing of the clip to form the tangs. Further holes may be provided in the clip to receive the insulation which is pressed through the holes.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a plan view of an uncrimped clip; FIG. 2 is a longitudinal section along the line II—II of FIG. 1; FIG. 3 is a scrap transverse section along the line III—III of FIG. 2, and, FIG. 4 is a transverse section along the line IV—IV of FIG. 1.

DESCRIPTION OF PREFERRED EMBODIMENTS

The crimping clip comprises a substantially trough-shaped member 1 of resilient metal such as hard brass or Phosphor bronze, coated with tin and backed with an insulating cover 2 of polyvinyl chloride or similar plastics material. The insulating cover is not shown in FIGS. 1 and 2 for reasons of clarity.

The cover 2 is wrapped around the longitudinal edges of the clip as at 3. The member 1 includes a base 4, which is slightly convex towards the open side of the trough, bounded by first and second upstanding sidewalls 5, 6.

Each of the sidewalls 5 and 6 is provided with internal embossments 9 corresponding in position with the upturned tongue portions 7, 8 and formed by pressing in the outer surface of the wall by an appropriate amount.

The base 4 of the member has a pair of cruciform slits 41, 42 and the base is formed to provide a series of upwardly projecting tangs 10, 11, 12, and 13 arrayed around the cruciform slits, which permit each of the tangs 10 to 13 a degree of individual freedom to move plane perpendicular to the plane of the base 4, and in two rows symmetrically positioned about the central longitudinal axis of the base as shown in FIG. 1. Half of each row of tangs is of reduced height compared with the other half, the tangs 11 and 12 are initially up to the same height as the tangs 10 and 13, and are then reduced in height by being planed.

The cruciform slits form four tongues each containing a tang and allowing each tang an individual spring action. Four triangular portions 14, 15, 16, and 17 are formed symmetrically about the central longitudinal axial plane of the member 1 by cutting the sloping sides of the triangular portions in the base 4 so that they point away from the central transverse axis and bending the triangular portions so formed upwards about the base of the portions and towards the center of the base 4. The planes of the triangular portions then lie perpendicular to the base plane and to the planes of the sidewalls 5 and 6.

The apertures formed in the base portion on the upward bending of the tongue portions 7 and 8 have slightly upturned edges 18, 19 which form deflectable lips.

The upstanding walls 5 and 6 are pierced to form a series of tangs 20, 21, 22, and 23. Thus, as shown, the piercings in the base and in the sidewalls provide inwardly projecting tangs spaced apart on the base and in the sidewalls in alternating relation, the tangs in the sidewalls, when the clip is crimped, lying proximate to the tangs in the base but not directly above them.

The tangs 21 and 22 are planished to reduce their height to less than that of the tangs 20 and 23. As can be clearly seen in FIG. 3, the tangs which are not planished have a series of sharp points 24. When seen in plan view, the tangs in the sidewalls can be seen to be staggered with respect to the tangs in the base. The reason for this will be detailed below. Also formed in the walls 5 and 6 are 17 to hold the cover in position and stop it sliding axially. In addition, the cover is pressed into the holes 25 and 26 for the same reason and also to stop the clip sliding upwards out of engagement with the tongues of the cover material pressed into the triangular apertures.

The insulating cover 2 is pressed into the apertures left by the formation of two of the triangular portions 14, 15, 16, and 17 to hold the cover in position and stop it sliding axially. In addition, the cover is pressed into the holes 25 and 26 for the same reason and also to stop the clip sliding upwards out of engagement with the tongues of the cover material pressed into the triangular apertures.

Clips according to the invention can be crimped in a crimping machine as described in U.S. Pat. No. 3,529,342. To use a clip to join two wires together, the wires are laid out parallel to each other and longitudinally along the length of the clip. One wire is positioned between the triangular portions 14, 15, 16, and 17 and the tangs 21 and 23, and the other wire is positioned between the triangular portions 14, 15, 16, and 17 and the tangs 20 and 22. The clip is then crimped by bending the sidewalls 5 and 6 inwardly.

As the upstanding sidewalls 5, 6 are bent over during compression of the clip, the tongue portions 7, 8 backed by the embossments 9 engage with the respective wires, the wires then being trapped between the tongue portions and the associated deflectable lips 18, 19. The embossments 9 ensure that the tongue portions penetrate the gap between the deflectable lips 18, 19 and that there is sufficient contact movement between the deflectable lips and the wires to allow a good tearing action by the lips on the insulating cover of the wire. This tearing action strips off the insulating cover at the points of contact with the deflectable lips and scraps clean...
the wires in preparation for the final contact. On completion of the compression of the clip, the wire is shorn of its insulation at the two points where the wire is trapped between the tongue portions 7 and 8 which are retained in the fully closed position by the embossments 9, and the deflectable lips 18 and 19; by this arrangement the presence of insulation at those points, which might induce creep and relaxation, is substantially avoided.

The deflectable lips 18 and 19 are dimensioned to produce a spring restraint which maintains contact pressure against the effects of creep and relaxation. Further, these deflectable lips also yield as cantilevers to close the gaps between the tongue portions and the deflectable lips, the distances between the edges adjusting themselves according to the diameter of the wire which is trapped.

The tongs 20, when the clip has been compressed, lie between the tongs 10, so that the wire is forced to zig-zag between the tongs. The sharp points, for example the points 24, pierce the insulation and make a mechanical and electrical contact with the wire. The tangs 13 and 23 behave in a similar manner to the tongs 10 and 20. The tongs 11 and 21, and in the same way, the tongs 12, and 22, also lie in alternate positions in the compressed clip, so that the wire, being forced to adopt a zig-zag path through the clip, is gripped by the tangs. However, the insulation is not pierced, and the gripping action aids in holding the wire in the clip without any appreciable weakening of the wire itself. The wire which lies along the tangs 11 and 13 is severed to the right of the clip (as seen in FIG. 1); and the wire which lies along the tongs 10 and 12 is severed to the left of the clip (as seen in FIG. 1).

In addition to ensuring that the wires to be joined are set in the clip in the correct positions, the triangular portions 14, 15, 16, and 17 assist in the trapping of the wires in the cramped clip by penetrating the insulation and making contact with the wires.

When the clip is crimped in a crimping machine as described in the U.S. Pat. No. 3,529,342, the sidewalks 5, 6 are bent towards the base 4, to compress the clip about the wires, between a die and moving punch arrangement. The punch compresses the clip against a substantially flat-ended die, shaped to confine the bends in the sidewalks 5, 6 of the clip to very near the base 4 thus minimizing any relaxation after crimping. It is important, therefore, that the material is not thinned at the junction of the sidewalks and the base during the manufacture of the clip. With such an arrangement the clip is heavily compressed near the base 4 so that the material throughout the section yields and the tensile stress from bending is neutralized. The compression of the clip is augmented by the upward convexity of the base portion which causes the sidewalks 5, 6 to make contact via the wires with the base portion before completion of the compression of the clip.

Completion of compression of the clip results in the base portion being temporarily flattened out with the sidewalks 5, 6 lying approximately parallel to the base portion. On releasing the compression on the clip, the resilient of the metal allows the partial re-assertion of the upward convexity of the base portion and consequent improvement of the grip on the wires.

Additionally, the punch itself may contain a concavity, or the die a protuberance, by which higher crimping force may be delivered to the sidewalks 5, 6 and the base 4 of the clip near their junction, than at the free ends of the sidewalks. Thus the force applied to the free ends of the sidewalks, is partially relieved, reducing the tendency to crush the wires and the free ends of the sidewalks, whilst sustaining a force on the wires by cantilever action after the crimping pressure is released.

The preferred clips of the present invention may be used with aluminum wires as well as with copper wires. It will be appreciated that the tangs in the sidewalks 5, 6 may be used in conjunction with the tongs in the base only, or with the deflectable lip and tongues only, or with a combination of both of these.

I claim:

1. A crimping clip for joining together first and second lengths of insulated wire to make electrical connection between the wires, the clip comprising a substantially trough-shaped electrically conductive member adapted to receive, along the length thereof, the first and second wires, the said member having a base and first and second upstanding sidewalks, the base containing at least one wire engaging means, characterized in that the sidewalks and the base have piercings at a number of places providing inwardly projecting tangs spaced apart on the base and in the sidewalks, the tongs on the sidewalks, when the clip is crimped, lying proximate to the tongs in the base but not directly above them.

2. A clip as claimed in claim 1 and further characterized in that the tangs in the base are arrayed in two longitudinally extended rows, and some tangs of each row are of reduced height compared with the remainder of the tangs in that row.

3. A clip as claimed in claim 2 and further characterized in that the tangs in the sidewalks, which are positioned to cooperate with the tangs in the base which are of reduced height, are also of reduced height.

4. A clip as claimed in claim 1 and further characterized in that the base of the clip is slit to permit one tang in the base to move resiliently in a plane perpendicular to the plane of the base and independently of a second tang in the base.

5. A clip as claimed in claim 1 and further characterized in that an insulating cover is provided to surround the clip and is pressed through the holes left by the piercing of the clip to form the tangs.

6. A clip as claimed in claim 5 and further characterized in that further holes are provided in the clip to receive the insulation cover when pressed through the holes.