A solderless wire connector containing a slotted resilient metal contact plate in a folding self-locking ribbed and grooved insulating body having wire-retaining strain relief elements and including an angled wire-supporting surface.
SOLDERLESS CONNECTOR FOR INSULATED WIRES

This invention relates to wire connectors. In one particular aspect the invention relates to connectors suitable for quickly and easily connecting together the ends of two or more insulated wires in an environment requiring a minimum of storage space. The connector affords a convenient means for connecting together two or more wire ends using conventional hand-operated pliers or similar equipment. The wires are firmly retained within the connector, and an efficient and permanent electrically conductive metal-to-metal contact is provided.

In the drawing, which illustrates a connector designed for connecting together two wire ends:

FIG. 1 is a perspective view of the open connector, with one side partly cut away to show detail;

FIGS. 2 and 3 are schematic sectional elevations, taken approximately at a wire position, of the connector in partially and fully closed position respectively and containing wires to be connected; and

FIG. 4 is a plan view of the contact element.

The connector 10 consists generally of a slotted base 11 and a hingedly attached cover 12 containing a contact element 13. The inner surface of each of said base and cover is formed with two parallel longitudinal troughs or grooves dimensioned to receive the wire ends which are to be connected.

The grooves of the base 11 are in several segments. An outer part 14 parallel to the longitudinal axis of the base terminates in a raised outwardly facing sharp-edged collar 15 the surface of which is at an angle with the surface of the trough 14. A narrow fin 17 and the adjacent portion of the segment 18 of the grooved surface continue at the same angle. The end portion of the groove 18 forms an obtuse angle with the line of the collar, fin and adjacent portion and again approaches parallelism with the longitudinal axis, as shown most clearly in FIGS. 2 and 3. The base is transversely deeply slotted to form a wide slot 16 divided into three segments by the two fins 17 and slightly longer than the width of the contact element 13. The outer sidewalls 31 of the base carry wedge-shaped bosses 19. A transverse ridge or rib 27 provides reinforcement adjacent the bottom of the slot 16.

The grooves 20 of the cover 12 are disposed parallel to the longitudinal axis, being interrupted near the outer end by inwardly facing sharp-edged collars 21 and more inwardly by the contact element 13, the cover being transversely slotted at slot 24 for accepting and retaining said element. Particularly for larger diameter wires, it is desirable that the inner end portions of the grooves 20 be shallow, as at 26a, to assist in properly positioning the wire end. The cover is supplied with a transverse reinforcing ridge or rib 28 adjacent the bottom of the slot 24. The sidewalks 22 of the cover are separated from the grooved and slotted inner portion by deep longitudinal grooves 29 shaped to receive the sidewalks 34 of the base and are spaced apart a distance sufficient to accommodate the sidewalks of the base 11 therebetween. The walls 22 are perforated near their outer ends with perforations 23 positioned and dimensioned to receive and retain the locking bosses 19 of the base when the two components are rotated into closed position about the connecting hinge 25.

The combination of base and cover is desirably produced by injection-molding techniques from hard tough resiliently flexible polymeric insulating material. Polypropylene is a preferred example of such material. It may be suitably pigmented or opacified, e.g. for identifying particular sizes or applications; or the clear polymer may be used, thereby permitting subsequent inspection of the wire ends and connection. Other additives or special purposes may be incorporated; flame retardants constitute one example.

The contact element 13, as illustrated in FIG. 4, consists of a thin plate of resilient metal such as phosphor bronze or cartridge brass, deeply slotted with two parallel slots 30 to form an inner lobe 32 and outer lobes 33 having a slight upward arc.

Similarly it has been previously employed in solderless wire connectors, see for example U.S. Pat. No. 3,388,370. The two slots are spaced in conformity with the position of the grooves 14, 20 and fins 17 so that the contact element will make resilient permanent contact with the conductors when forced over the wires in making a connection.

In a typical connector made, in accordance with the principles of the invention, for connecting together two 14-18 gauge, solid or stranded, vinyl- or polyethylene-coated copper wires, the contact element is made of 0.032-inch cartridge brass plate and has a length of 0.25 inch and a width of 0.31 inch. Each slot is 0.16-inch long and 0.27-inch wide. The connector body when closed measures 0.83-inch in length, 0.57-inch in width, and 0.40-inch in thickness.

In making a connection, the two insulated wire ends to be connected are placed side-by-side on the base 11 and each in line with the appropriate longitudinal groove, and with the ends against the inner end wall of the base, approximately as illustrated in FIG. 2. The wire ends are shown to lie along the angled portions of collar 15, fin 17 and segment 18 in a plane perpendicular to the plane of the contact element 13 as the latter first comes into contact with said wire ends. The cover member is folded over and against the wire ends and is pressed into the fully closed position shown in FIG. 3. Pressure is most conveniently applied with an ordinary hand-operated pliers, contact being made with the connector at ridges 27, 28 to produce a uniform closing action developing the requisite pressure between the pressure-applying jaws of the pliers. During closure, the contact element advances toward and over the wire along an arcuate path, rather than planarly as in the connector of U.S. Pat. No. 3,388,370, the extra width of the slot 16 being sufficient to permit entry of the extended tip of the element 13. As the cover is pressed further into place, the element grasps the wire 26 and tends to draw if forward toward the hinge or inner end of the base. Since the tip of the wire is initially in contact with the end surface, such force would ordinarily result in sliding of the element along the wire, with resultant damage to the connection. Instead, the wire end deforms into the free space offered by the obusely angled groove 18. At the same time, the wire-insulation deforms about, and is held by, the sharp-edged collar 15 to an extent sufficient to prevent all but a slight initial longitudinal advance of the wire, so that fully effective resilient contact of the element 13 with the metal conductor is achieved. As the connector is forced shut, the collar 21 is also pressed into the wire-insulation and thereafter serves as a strain relief member against any wire-removing stresses which may subsequently be applied. Finally, the resilient side members 22 of the cover 12 slide over and snap shut upon the locking bosses 29, thereby indicating that the connection has been completed. There is provided a highly effective permanent electrical connection between the two wire ends; the metallic components are completely covered and protected by the insulating body, the wires are firmly grasped and retained so as to avoid any subsequent loosening of the connection, the connector takes up a minimum of space, and the entire operation is quickly and easily performed by a hand operation using ordinary pliers and requiring no special tools or equipment.

We claim:

1. A solderless wire connector having a thin resilient slotted metal contact element transversely supported within and extending from the cover portion of a unitary insulating body comprising said cover portion and a base portion interconnected in longitudinal alignment by an intervening transverse hinge, each of said cover and base portions defined by integral wire-receiving troughs, said body portion being transversely slotted to provide a slot for accepting said contact element on closing said wire connector about said hinge, said slot being spanned at the center of each of said troughs by a narrow fin, the free edge of said fin being in line with the adjoining portion of a wire-receiving surface and said body portion further including means for supporting wire ends on said base portion in a position at right angles to said contact element at its point of initial contact with said wire ends, means for preventing longitudinal movement of wires after final closing of said wire connector, and means for retaining said wire connector in fully closed position.
2. The wire connector of claim 1 wherein said wire end supporting means comprises a longitudinally obtusely angled wire-receiving surface, said movement-preventing means includes a sharp-edged collar on said base and oppositely facing sharp-edged collar on said cover for each of said wires, said retaining means comprises a laterally outwardly extended boss at each side of said base and an overlapping resiliently flexible sidewall at each side of said cover and perforated in line with the corresponding boss, said cover is transversely ridged across the outer surface adjacent the position of said contact element and said base is similarly transversely ridged across the outer surface adjacent the position of said slot.