

Oct. 15, 1968

R. E. LAWLOR

3,406,372

NON-SHEARING WIRE-CLAMPING ELECTRICAL CONNECTOR

Filed Dec. 1, 1966

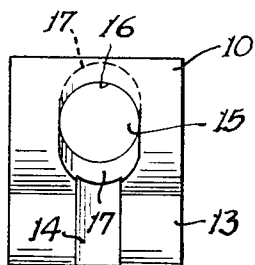


FIG. 4

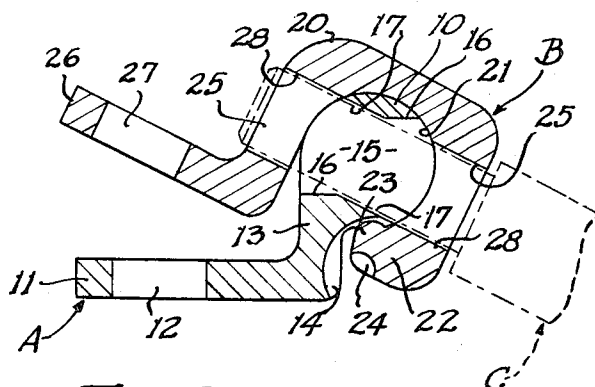


FIG. 3

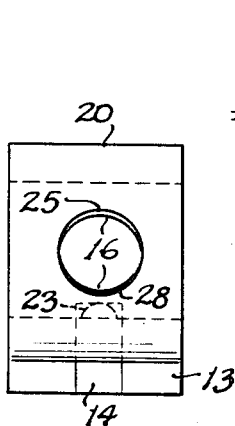


FIG. 5

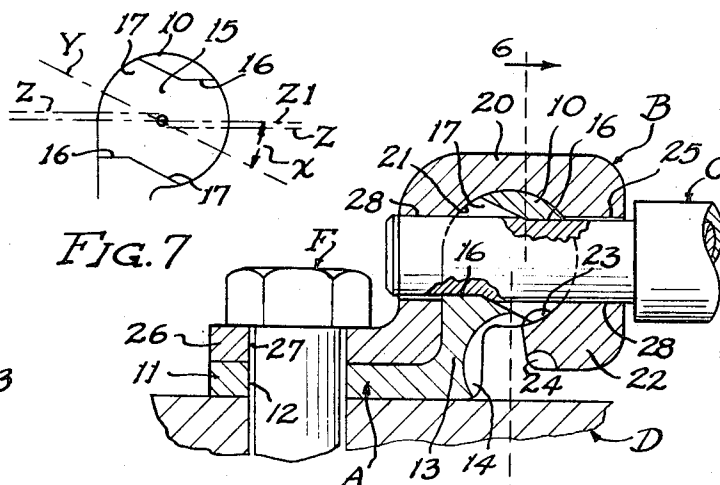


FIG. 2

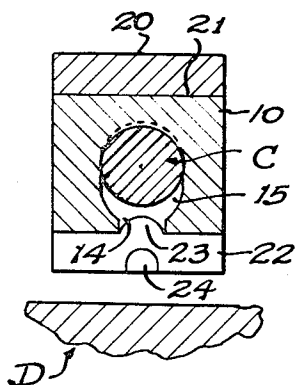


FIG. 6

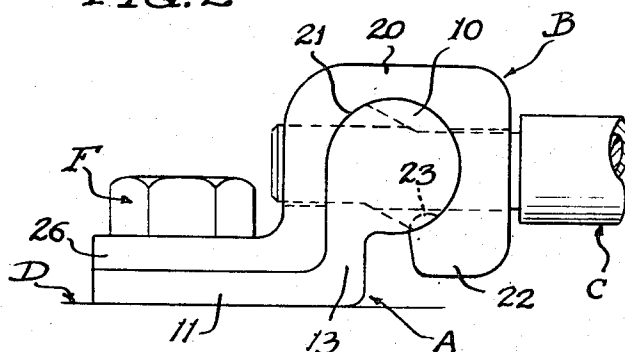


FIG. 1

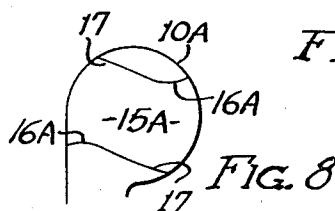


FIG. 8

INVENTOR.

BY ROBERT E. LAWLOR

Lynn H. Latta
ATTORNEY

1

2

3,406,372 NON-SHEARING WIRE-CLAMPING ELECTRICAL CONNECTOR

Robert E. Lawlor, Ridgecrest, Calif., assignor to Electro-Clamp Corporation, Beverly Hills, Calif., a corporation of California

Filed Dec. 1, 1966, Ser. No. 598,425

5 Claims. (Cl. 339-95)

ABSTRACT OF THE DISCLOSURE

This invention provides an electrical connector of the type having relatively rotatable jaws adapted to clamp a conductor wire between them so as to provide a good electrical connection, and wherein shearing action of the jaws upon the wire is avoided. An excellent conductive connection is established by pressing broad faces of the jaws against the wire with only a very slight indenting action, but with heavy pressure applied over substantial areas to develop the excellent conductive connection. This is attained by providing a cylindrical internal jaw having an X-shaped throat flaring from minimum width at the center to maximum width at each end and defining jaw faces which, when moved into full clamping engagement with the wire, are substantially parallel to the axis thereof.

The prior art

Electrical connectors of the rotatable jaw, clamping type are disclosed in the following prior patents: Schuck et al., 3,118,720; Lawlor, 3,138,422; and Tracy, 3,169,818.

The Tracy connector utilizes a single clamping tooth on the female jaw unit and a single anvil face on the male jaw unit, but fails to achieve clamping between directly-opposed jaws and provides only a single pair of jaws whereas the invention contemplates two pairs of jaws, one pair at each cylindrical interface between the rotatably coupled jaw units.

In the Schuck and Lawlor connectors, the rotatable internal knuckle is provided with a straight diametral bore the ends of which intersect the cylindrical periphery of the knuckle to define acute-angular jaws which cut into the conductor wire with a shearing action as they are rotated to clamping position. This reduces the cross-sectional area of the wire to an extent such as to weaken it, and thus potential failure of the electrical connection is materially increased. The present invention provides an arrangement of relatively rotatable jaws adapted to slightly flatten the wire when closed to clamping position, but without reducing the cross-sectional area of the wire. Hence the wire is not weakened.

Description

The chief object of the invention is to achieve a connection of improved electrical conductivity in which the wire is clamped between relatively rotatable jaws without any shearing action and hence without being weakened by the clamping action of the jaws.

This and other objects will become apparent in the ensuing specification and appended drawings, wherein:

FIG. 1 is a side elevational view of an electrical connector embodying the invention, a conductor being shown clamped therein;

FIG. 2 is a medial longitudinal sectional view of the same;

FIG. 3 is a sectional view of the connector in an open position in which it will freely receive the conductor wire;

FIG. 4 is an end view of the male jaw unit;

FIG. 5 is an end view of the assembled connector;

FIG. 6 is a cross-sectional view of the connector and conductor assembly taken on line 6-6 of FIG. 2;

FIG. 7 is a schematic representation of the male jaw unit throat; and

FIG. 8 is a schematic representation of a modified form of the throat.

Referring now to the drawing in detail, I have shown therein, as an example of one form in which the invention may be embodied, an electrical connector comprising, in general, male and female jaw units A and B coupled for relative pivotal movement between an open position (FIG. 3) in which a conductor C can be freely inserted through the jaw units, and a closed position (FIG. 2) in which the conductor C is securely clamped between the jaw units A and B and a good electrical connection thereby established.

Jaw unit A comprises a cylindrical knuckle 10 formed integrally on one end of a tail 11 adapted to be mounted against a support D and having an aperture 12 through which a screw bolt or other fastener F can be extended into or through the support. An offset neck 13 joins the knuckle 10 to the tail 11, thus positioning the knuckle above the plane of the tail. A slot 14 is milled into the center of neck 13 beneath knuckle 10. Neck 13 is tangent to the side of knuckle 10 which faces tail 11, and thus the knuckle, is uniform (FIG. 4). The throat may be neck 13.

A throat 15 extends diametrically through the center of knuckle 10, for reception of conductor C. Throat 15 is X-shaped, in that its respective end portions flare outwardly to the respective sides of knuckle, from minimum depth at the axis of the knuckle to maximum circumferential depth at the cylindrical surface of the knuckle. The width of the throat parallel to the cylindrical axis of the knuckle, is uniform (FIG. 4). The throat may be formed by drilling a bore diametrically through the knuckle, on a diametral axis Y, and drilling two connecting bores on axes Z which are approximately radial and substantially opposed diametrically, but offset from a common diameter Z1 so as to define a pair of diametrically opposed clamping jaws 16 which are parallel to diameter Z1 but spaced therefrom by a distance less than the radius of the through bore on axis Y (and less than the radius of conductor receiving bores in jaw unit B). Thus the jaws 16 will intrude into the space occupied by the bared wire of conductor C when the connector is closed as in FIG. 2.

The connecting bores on axes Z intersect axis Y of the through bore at an angle X in the range of 27°-33°, with an optimum value of about 30°. This angle, which also is the angle subtended between the open and closed positions of jaw B, is about 6° larger than the angle of jaw-opening in the prior art connectors referred to above.

The through bore on axis Y defines diametrically-opposed clearance spaces 17 in the throat to receive the conductor C when the jaw units are in opened relation as in FIG. 3. The other bores define the diametrically opposite clamping jaws 16 which are pressed tightly against opposite sides of the conductor C when the jaw units are closed as in FIG. 1, the jaws 16 then being substantially parallel to the axis of conductor C. Consequently, although the conductor C may be slightly flattened by indentation of the jaws 16 into the conductor, its cross-sectional area will not be reduced, and there will be no shearing action of the jaws against the conductor C.

It is to be understood that the jaws 16 and clearance spaces 17 of the throat 15 need not necessarily be formed by bores as described above. For example, throat 15A of FIG. 8 can be die-cast into knuckle 10A or formed by other known techniques. Correspondingly, the surfaces

of jaws 16 and clearance spaces 17 need not be truly segmental-cylindrical surfaces, and the jaws 16 need not be truly parallel to common diameter 21 but can be rounded in directions generally parallel to that axis at 16A as in FIG. 8, so long as the general proportions described above in connection with FIG. 7, are observed.

Female jaw unit B comprises a C-shaped head 20 defining a cylindrical socket 21 in which knuckle 10 is pivotally coupled, for tilting movement of jaw unit B from the open position shown in FIG. 3 to the closed position shown in FIG. 1. Head 20 has the general form of a U channel, modified by a reentrant lip 22 which retains the knuckle captive within head 20. A locking projection 23 is staked from lip 22 at 24, into the slot 14, to lock the jaw units to one another, preventing axial displacement. Head 20 is formed integrally on one end of a tail 26 which is arranged in opposed relation to tail 11 and is provided with a fastener aperture 27 adapted to register with aperture 12 so that a fastener F can be extended through both apertures and function to hold the jaw units A and B in closed relation.

Head 20 is provided with diametrically opposed cylindrical bores 25 aligned on a common diameter of cylindrical socket 21 intersecting the center of throat 15 in the assembled connector. Diametrically opposite jaws 28 are defined by opposite sides of the bores 25. When the connector is open, the bores 25 are aligned with the clearance spaces 17 of throat 15 so that a conductor C can freely be passed through bores 25 and throat 15. When the connector is closed, the bores 25 are aligned with the portions of throat 15 defined by jaws 16, and the latter are substantially aligned with adjacent sides of bores 25, but protrude inwardly therefrom slightly past these adjacent sides of bores 25 so as to establish pressure contact with conductor C.

To operate the connector, it is opened up as in FIG. 3 and a conductor C is then inserted through the bores 25 and throat 15, being received in the clearance spaces 17 thereof which are aligned with respective sides of bores 25 when the conductor is fully opened. The jaw units A and B are then closed to bring their tails 11 and 26 into abutting relation, causing the conductor C to be clamped between the jaws 16 and the opposed walls of bores 25, as above described. The connector is then secured to a support D by a fastener F which secures the clamping action by holding the jaws in the closed position.

I claim:

1. A conductor-clamping electrical connector of the type comprising male and female jaw units having respective mounting tails adapted to be secured against a support, said male jaw unit including a transverse cylindrical knuckle having a generally diametrical conductor-receiving throat and said female jaw unit including a C-

shaped head defining a cylindrical socket receiving said knuckle for relative angular movement of said jaw units between an open, conductor-receiving condition and a closed, conductor-clamping condition, said head having opposed conductor-receiving bores on a diameter of said socket, said connector embodying the following improvement: said throat being of X-shape such as to define therein diametrically-opposite jaws and diametrically opposite clearance spaces parallel to respective axes subtending respective acute angles adjacent said socket axis, said clearance spaces being disposed so as to register with adjacent sides of said opposed bores in said open position of the connector in which a conductor is receivable in said clearance spaces, and said jaws being of substantial length radially of the socket axis and disposed so as to assume conductor-clamping positions in substantial parallelism to the common axis of said bores in said closed position of the connector, and so as to clamp respective portions of said conductor against opposed sides of said bores with a non-shearing clamping action.

2. A connector as defined in claim 1, wherein said clamping jaws have segmental-cylindrical clamping faces.

3. A connector as defined in claim 1, wherein said clamping jaws have clamping faces of convex contour generally parallel to a common axis extending diametrically of said knuckle.

4. A connector as defined in claim 1, wherein said clamping jaws are generally parallel to a common axis extending diametrically of said knuckle and are spaced from said common axis a distance less than the radius of said clearance spaces from a common axis to which they are parallel, and less than the radius of said bores, whereby said jaws will project past the adjacent sides of said bores for compressive engagement with said conductor in said closed position of the connector.

5. A connector as defined in claim 1, wherein said male jaw unit includes an offset neck joining said knuckle to its tail, said neck having a slot in a side thereof opposed to a free end of said socket head and below said knuckle, and said free end having a projection staked radially inwardly therefrom and received in said slot to couple said head to said knuckle for relative rotary movement between open and closed positions.

References Cited

UNITED STATES PATENTS

2,700,807	2/1955	Petersen	24—132 X
3,118,720	1/1964	Shuck et al.	339—266
3,138,422	6/1964	Lawlor	339—266
3,169,818	2/1965	Tracy	339—266
3,351,889	11/1967	Lawlor et al.	339—97

MARVIN A. CHAMPION, *Primary Examiner*.

P. TEITELBAUM, *Assistant Examiner*.