Oct. 25, 1949. G. C. THOMAS, JR 2,485,676

CABLE CONNECTOR

Filed July 30, 1947

Fig. 1.

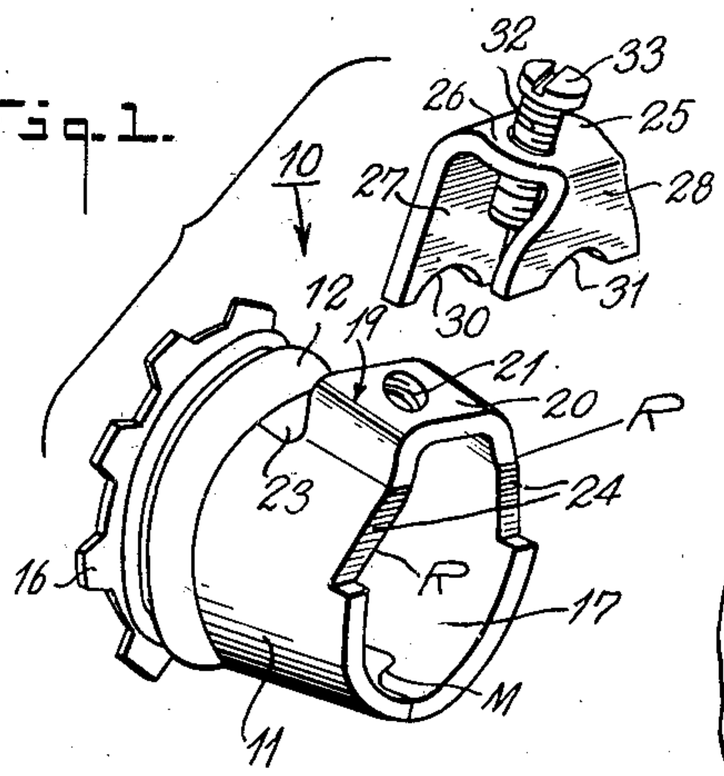
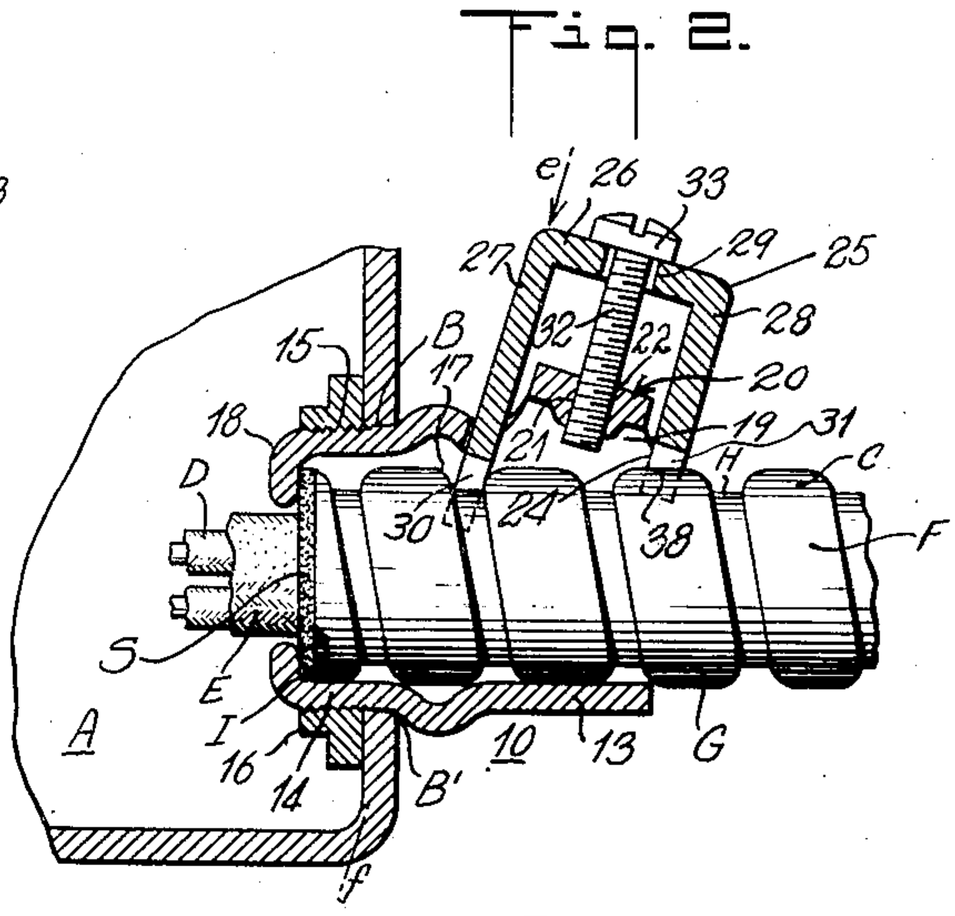


Fig. 2.



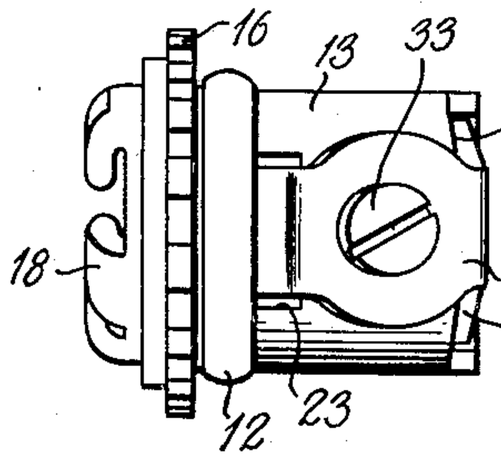


Fig. 3.

Fig. 4.

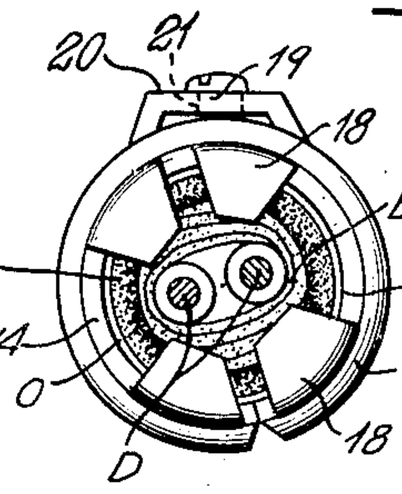
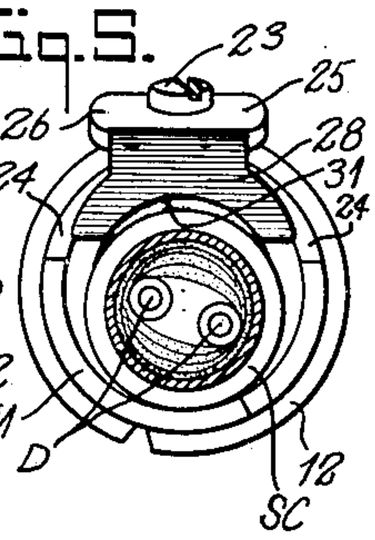


Fig. 5.



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2,485,676

CABLE CONNECTOR

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6 Claims. (Cl. 285—6.5)

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The invention relates, in general, to cable anchoring connectors for securing electric cables in place wherever such anchoring means are needed, and specifically relates to connectors for use with electric outlet box assemblies employed in securing to such box assemblies cables, particularly metal armoured spirally wrapped cables of different sizes. The present disclosure constitutes a development of the cable connectors disclosed in my patents: Re. 18,634—October 18, 1932, and Re. 18,773—March 21, 1933.

It is known in the prior art to provide such connectors, and which usually include a mounting shell of tubular form with different types of fastening means for securing the same to the outlet box, and which tubular shells are provided at the inner ends of their bores with a bushing forming a stop incompletely closing the bore and acting to limit the insertion of the cable into the same. Through the shell element and its stop of such known structure extends one or more electric conductors forming the core element of an armoured cable with an end of its usual corrugated armour, or other shield or shroud, abutting the stop and thus limiting the intrusion of the cable as a whole when inserted manually into position in the connector. It is also suggested as shown by my patents above identified to provide a clamp of inverted U-shaped form whose cable engaging legs extend through a side of the connector shell to engage the cable lengthwise thereof and on opposite sides of its top or crown portion, and in such way as to clamp the cable in place without crushing the same. In these known devices the clamping legs of the U-clamps usually extend at an angle to the length of the cable and are free to rock outwardly at least to a limited extent, so that in the event of an outward pull on the cable the advanced edges of the clamping legs will be drawn down into the cable and thus burr, squeeze and press into the cable to resist the cable from being pulled accidently from the box.

While it has been usual to locate the metal armour of cables in such pressing engagement with its limiting stop on the connector as may be obtained more or less, by the incidental manual pressure of the operator in making the installation, this form of connection has not insured a firm, non-wabbling bearing connection at the joint formed between the armour and its stop, and otherwise similar known forms of such connectors have not proven entirely satisfactory in actual practice.

One of the objects of the invention is to provide a positive and firm engagement of the cable armour with the inner bore of the connector irrespective of its location relative to the limiting stop on the connector and specifically to obtain a bearing engagement at the joint formed between the cable armour and its limiting stop on the connector in such manner as will cause the joint to become, or at least tend to become, tight and to maintain its tight engagement at all times and to do this with ordinary standard forms of armoured spirally wrapped cables not intentionally designed to withstand crushing strains such as are herein contemplated to develope the required tightness of fit at the joint.

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Broadly, I attained this objective in two ways: first, by resolving the force developed by a single screw energized clamping means into two components of unequal force, with the greater force component operative in a direction longitudinally of the length of the cable to effect the desired engagement at the joint, and with the lesser force component operating generally in a direction transversely of the length of the cable so as to obtain the usual lateral binding effect of the cable in the bore of the connector; and second, by applying the greater longitudinally directed force component to the more rugged upstanding side or wall of the corrugation of the cable armour, and thus at the more rugged point of reduced diameter of the corrugation, rather than to the more easily distortable crown portion, thus tending to maintain the cable in its initial cross sectional form even though forcibly shifted axially into a jammed engagement with its stop as herein featured.

I am enabled to do this by taking advantage of the fact that the metal armour now used on electric cables is formed of a spiral corrugation of low pitch and which forms between adjacent turns of the spiral one or more deep troughs defined largely by the side faces of the corrugations and which side faces are disposed substantially transverse of the length of the cable, and are thus admirably designed to receive clamping means, such as are herein featured and organized to bear on the faces of the relatively stiff corrugation side walls to shift the cable longitudinally into engagement with its associated stop without bending or otherwise distorting the corrugation so engaged and without necessarily bottoming in the trough.

The shiftable clamp element herein featured for engaging the cable armour is of an inverted U-shaped form with its legs extending transversely of the length of the cable and wherein

one of the legs of the clamp acts transversely of the length of the cable, bearing down on the top side of the crown portion of its armour to force the opposite or underside of the connector into engagement directly with an edge of the box hole in which the connector is fitted.

In the instant case the disclosure relates to cable connectors in which the cable can even be secured thereto independently of the outlet box and the assembly of connector and cable then subsequently secured as a unit in position secured to the box in any conventional manner.

Broadly, the objective to obtain mainly longitudinal pressure on the cable is obtained by fashioning the two legs of the U-clamp so that one of the legs, for instance, the forward leg, that is, the leg nearest the fixed stop, will intrude into one of the spiral troughs transversely thereof and thus when under load will engage the corrugation in advance thereof, either at the bottom of the trough or close thereto, more or less parallel to the corrugation wall on which it bears and in any case to bear mainly in the direction to force the cable considered as a whole axially towards the stop.

While it is the intent of the disclosure as above outlined to effect an end-wise or axial shifting of the portion of the cable intruded into the connector in the direction towards the stop, by dividing the actuating force of the movable element of the clutch into a relatively large force component engaging the side in distinction from the crown portion of one of the spiral corrugations, there is no objection to the other or rear leg which carries the materially lesser force bearing as a fulcrum on the relatively more easily distortable crown portion with what ever may be present of both transverse and longitudinal force components of said lesser force.

Accordingly, the present disclosure features in a coupling of the type described a clamp forming element of the inverted U-shaped type with legs of unequal length, the free edge of the longer leg fitting more or less in the armour trough and conforming to the configuration of the surface engaged thereby, and the free edge of the shorter leg conforming substantially to the curvature at the crown of the engaged corrugation and features the rocking of the clamp about its fulcrum provided by the shorter leg so as to obtain a leverage action on the cable mainly in the direction of its length.

It is, of course, desirable in this art to reduce manufacturing cost and accordingly the present disclosure features the forming of all of the parts of the connector, both sleeve and clamp, of relatively thin sheet metal, preferably bright cold rolled steel, stamped to form and bent into the desired finished design preferably by conventional practices following standard machine operations.

Various other objects and advantages of the invention will be in part obvious from an inspection of the accompanying drawings and in part will be more fully set forth in the following particular description of one form of device embodying the invention, and the invention also consists in certain new and novel features of construction and combination of parts hereinafter set forth and claimed.

In the accompanying drawing:

Fig. 1 is an exploded view showing the component parts of a connector constituting a preferred embodiment of the invention;

Fig. 2 is an axial sectional view taken through the device shown in Fig. 1, and shown in operative position securing a cable to the connector and securing the assembly of connector and cable to an outlet box;

Fig. 3 is a plan view looking down upon the connector shown in the preceeding figures with the shiftable clamping element in operative position and the cable omitted;

Fig. 4 is an end view of the connector and cable as viewed from the left side of Fig. 2 (omitting the outlet box) and showing a pair of wire conductors in an armoured insulation of conventional form and forming an armoured cable of relatively large diameter; and

Fig. 5 is an end view of the connector as viewed from the right side of Fig. 2 (also omitting the outlet box) showing a cable of relatively small diametric size substituted for the larger diameter cable of Figs. 2 and 4.

In the drawings there is disclosed in Fig. 1 the component elements of the connector herein featured and which connector is shown in operative position in Fig. 2 mounted in an outlet box A with one of its walls provided with one of its usual punched-out outlet openings B to receive the connector. The connector herein disclosed is designed to secure any one of several different size cables, such as the large diametered cable C to the box A. In the cables illustrated a pair of current carrying wires D are encased in insulation E and are in turn contained in a corrugated metal tube forming an armour F for the cable. The armour is of the conventional spiral grooved form comprising one or more spiral corrugations G forming a deep trough H between succeeding turns of the corrugation. The end of the cable to be inserted or intruded into the bore of the shell or tubular member of the connector is usually prepared by cutting back its armour to form a squared off flat abutment end I into which is fitted a flanged bushing S designed to fit squarely against a stop forming part of the connector shell herein featured.

Referring to the showings in Figs. 1–5 for a description of the preferred form of the invention, there is disclosed a metallic connector 10 comprising a shell or tubular member 11 of somewhat cylindrical form and a shiftable clutch element for engaging the armoured exterior of the cable inserted into the shell 11. The shell 11 is provided adjacent its midlength with an outwardly projecting annular corrugation 12 acting to form a stop for limiting the intrusion of the member 11 into the box hole B as is usual in so mounting such connectors. The end of the member 11 which projects outwardly, that is exteriorally, beyond the box A, forms a barrel 13 on one side of the corrugation 12 and the end portion which extends through the opening B and into the interior of the box A forms an extension 14 exteriorally threaded as shown at 15. The threaded extension 14 is provided with a flat nut 16 bearing against the inner wall of the box A to receive and clamp the box wall between the nut and corrugation, and in general the mounting of the connector to the box follows conventional practices in this respect. The bore 17 of the member 11 is cylindrical, of uniform cross sectional area from end-to-end and is partially closed at its inner end by means of a set of circumferentially spaced apart fingers 18 coacting to form a bushing through which the conductor containing core of the cable may extend. These

fingers form a stop for limiting the intrusion of the armoured portion of the cable and to form a closed joint with the abutment end of the bushing S.

The upper side of the barrel 13 is die punched, to form an offset or embossment 19 constituting a support and guide for the clamping means hereinafter described. The top surface 20 of the embossment is flat and inclined towards the adjacent open end of the barrel 13 at a small angle (fifteen degrees) to the axis of the bore 17 and thus at a small angle to the axis of the cable C as best shown in Fig. 2. The embossment is provided centrally thereof with a screw hole 21 which extends therethrough perpendicular to the plane of the top surface 20 of the embossment. The portion so offset containing the screw hole 21 is punch drawn into a tubular form to give the screw hole some material depth and the bore of the resulting tube is tapped to provide it with screw threads 22. The barrel 13 in the upper side thereof, and between the embossment 19 and the corrugation 12, is provided with a long, straight narrow slot 23 extending for a material distance transversely of the length of the connector and thus of the cable intruded into the same. The slot 23 is thus outlined on one of its long sides by the corrugation 12 and on its opposite side by the embossment 19 both tending to give strength to the portion of the sheet metal so weakened by the providing of the slot. The outer end of the barrel is cut back on its upper side to form a pair of edges disposed in the same transverse and inclined plane and the two cut back edges coact to form an inwardly inclined guide face 24 for the short leg of the clutch element hereinafter described.

The connector also includes a shiftable clamp or clutch element 25 in the form of an inverted U. This clamp comprises a flat bight or crotch portion 26 overlapping the top surface 20, a relatively long plate-like front leg 27 and a relatively short plate-like rear leg 28 with the legs disposed in parallel planes inclined to the axis of the bore 17 as shown in Fig. 2. The crotch portion 26 is provided centrally thereof with a relatively large unthreaded loose screw hole 29. The free cable engaging edges at the bottom of the legs form cable engaging saddles and are each recessed to provide, in the case of the long leg 27 an arc 30 and in the case of the short leg 28, with an arc 31 fashioned to fit more or less the larger transverse curvature of the corrugation G at or adjacent its crown. The recessed cable-engaging edges form narrow trough-seeking prongs at their opposite ends.

The clamp element 25 is disposed in position straddling the embossment 19 with the long forward leg 27 intruded through the slot 23 into the bore 17 and into engagement with the cable C in the bore 17 as best shown in Fig. 2. In this way the front leg 27 is guided into position by the long transverse edges of the slot 23 formed by the corrugation 12 and embossment 19. The shorter rear leg 28, as screw pressure thereon is increased, is guided flatwise more or less along the guide surface or faces 24 as the clamping element is advanced forcefully into its final clamping position. A screw 32 is provided for advancing the clamping element 25 into its cable binding position. The screw has a wide bearing head 33 for bearing on the crotch portion 26 and has its shank passed loosely through the unthreaded screw hole 29 and into screw threaded engagement with the threaded screw hole 21.

It is a feature of this disclosure that the cable engaging edges 30—31 of the legs 27—28 of the clamping element, be spaced apart a linear distance which is greater than the pitch of the spiral groove H defined between the crown convolutions G of the spiral-armor and less than twice the pitch thereof. In the device illustrated the spacing is equivalent to a longitudinal distance equal to that of one and one-half convolution or turn of the spiral corrugation G. It is, of course, within the scope of the disclosure to more widely space apart the cable engaging lower edges of the U-shaped clamping element, simply provided that when one leg is in a trough the other leg is riding on or adjacent the crown portion of a corrugation turn spaced from the trough to permit such co-relation.

In this way, whenever the forward leg is in operative position in the trough H between any pair of adjacent turns, as illustrated in Fig. 2, the rear leg is in operative position engaging the crown portion of one of the corrugation turns spaced from the engaged trough with at least one complete turn therebetween. The rear leg 28 tends to close the bore 17 at its outer or right end as shown in Fig. 5 and this is particularly desired in the case where a cable is used of materially less diameter than the bore 17, such as the small cable SC. The arc 31 is designed to fit approximately the small size of cable as shown in Fig. 5. It is obviously within the scope of the disclosure to provide a set of clamping elements similar to that shown except that the arcs 30 and 31 are designed to fit more or less other size cables and that the rear leg 28 may be designed to more completely close the open end of the bore than is shown in Fig. 5.

In operation and assuming the parts have been assembled as indicated in either Figs 2 or 5 with the bushing S at the inner end of the cable armour bearing on the stop 18 more or less snugly by reason of manual pressure, the screw 32 is turned inwardly to place a load on the shiftable clutch element 25. Pressure will come first on the crotch portion 26 swinging the clutch element as a whole with a leverage effect tending relatively to bring the flat underside of the screw head 33 into flat parallel relation to the bearing surface provided by the outer face of the crotch portion 26 as shown in Fig. 2. The force of the leverage effect so produced will be transmitted mainly down the front leg 27 and against either the bottom of the engaged trough H or against one or both sides of the corrugation outlining the trough, depending upon the angle at which the leg 27 meets the associated trough.

The force component acting downwardly along leg 27 is angled through its bearing edge to press on the side of the corrugation to force it and with it the entire cable towards the left, that is in the direction towards the stop 18.

Considering the lesser force as applied by the rear leg 28 at the point of its application to the armour corrugation, it is seen that it can also be regarded as having two force components, a relatively weak force acting directly downwardly, that is radially of the cable C, to force the lower side of the cable firmly into engagement with the tubular member 11 following conventional practice in this respect, and a relatively powerful force component acting longitudinally of the

cable and from right to left, to press the armour F operating through its gasket S firmly into engagement with the stop provided by the fingers 18 and thus firmly close the joint at its abutment end I as shown in Fig. 2.

As the axis of thrust imposed on the shiftable clutch element 25 by the screw 32 is much nearer the fulcrum 38 than was the case in considering the force directed along the front leg 27, it follows that the leverage action or turning torque along the rear leg 28 is much less than along the front leg 27, and thus the rear leg exerts such light pressure on the armour transversely of its length that no appreciable crushing action on the armour is evident. The proportioning of the leverage effect to the two legs may be varied as desired by shifting the screw hole to the right or left of the showing in Fig. 2. There will, of course, be some force acting along the short leg 28 under any condition to shift the cable radially and due to the angled arrangement of the parts there will also be some pressure acting longitudinally of the cable and in the same direction, as the front leg is acting. However, the greater axially directed force on the cable obviously will come from the front leg 27. It is noted that the main component of the force transmitted along the long forward leg 27 and indicated by the line *e—f* in Fig. 2 meets and is resisted by the solid rugged abutment provided by the rugged wall of the box A at the lower edge B' of the opening B.

As the screw reaches the limit of its advance the crotch portion 26 and the surface 20 come into substantial parallelism as indicated in Fig. 2, and in this way the rotary effect of clutch action incidental to the intrusion of the legs into the armour will be restrained and limited.

I claim:

1. A cable connector including a tubular member provided with means for mounting it in position and designed to receive a cable in its bore, one side of the member provided with a clamp support, a clamp of inverted U-form having a crotch portion extending lengthwise of the member and straddling said support, and said clamp having downturned legs of unequal length fashioned to engage one side of the cable at two longitudinally spaced-apart points and a screw reacting between the clamp and support and operable along a thrust line extending at an acute angle to the axis of the member.

2. In a device of the class described, the combination of a tubular shell provided with means for supporting it in position, said shell provided at one end with a stop projecting into its bore to limit the insertion of a cable therein, said shell provided on one side thereof with an outwardly offset embossment inclined to the axis of the shell and provided adjacent to the embossment with a slot extending transversely thereof, means for forcing a cable in the bore axially into engagement with the stop and transversely into engagement with the opposite side of the shell, said means including a clamp element of inverted U-shape having its crotch portion overlapping said embossment and having its legs extending in substantially parallel relation transversely of the shell and into the bore and with the leg nearest the stop extending through the slot, the cable-engaging edges of the legs being arcuately recessed and said forcing means including a screw extending at an obtuse angle to the axis of the shell, inclined towards the stop, passed loosely through the

crotch portion and threaded into the embossment.

3. In a device of the class described, the combination of a tubular member provided with a bore for receiving a cable inserted therein and means for clamping the cable in the bore, said means including a clamp support outwardly offset from said member with its top surface disposed in a plane extending at an angle to the axis of the bore and provided with a threaded screw hole extending therethrough perpendicular to its plane, and said clamping means also including a clamp of inverted U-form having a crotch portion inclined in the same general direction as the clamp support and provided with an unthreaded screw hole, said clamp longitudinally straddling the clamp support and having a pair of legs of unequal length, and a headed screw passed loosely through the unthreaded screw hole, in threaded engagement with the threaded screw hole in the clamp support and acting when its head is forced into bearing engagement with the crotch portion to force the legs in a direction with one component extending longitudinally of the axis of the bore and the other extending transversely of the axis of the bore, the free cable-engaging end portions of the legs being both inclined in the same direction, disposed substantially parallel to each other and substantially at the same angle to the axis of the bore of the tubular member.

4. An electric connector including a tubular member provided with means for mounting it in place and with an open end for the insertion of a cable therein, a side of the member provided with a transversely extending slot, and provided between the slot and the end with an offset support having a flat outer face inclined towards the axis of the member at its open end, the edges of the member forming the open end being cut back to form a guide face inclined to the axis of the member and extending approximately at right angles to said flat outer face of the support, and a clamping member of inverted U-form, straddling the support, and a screw reacting between the clamping member and the support to advance the clamping member into clamping position engaging the cable, said clamping member having legs of unequal length, with the longer leg extending through the slot and with the shorter leg guided along the guide surface.

5. In a device of the class described, the combination of a tubular member provided with a transversely extending slot, a cable within the bore of the member and provided with an armour having a spiral corrugation, a clamp element for securing the cable to the member, said element being in the form of an inverted U, having legs of unequal length, the free edges of both of its legs extending transversely and spaced apart lengthwise of the cable a distance different from the pitch of the corrugation and engaging the armour at two longitudinally spaced-apart points, and a screw inclined to the axis of the member and reacting between the element and the member.

6. In a cable connector including a tubular member provided with means for mounting it in position and having an end open for insertion therein of cables of different diameters, one side of the member adjacent the open end provided with a clamp support and said member provided with a transversely extending slot on the side of

the support opposite the open end, said slot having a length materially less than the internal diameter of the bore of said member, a clamp element for securing a cable to the member, said clamp element being of an inverted U-form having a crotch portion extending lengthwise of the member and straddling said support, and said clamp element also having a pair of legs each having a transversely extending free edge for engaging the cable at two longitudinally space-apart points, one of the legs extending through the slot and the other leg having a width at its cable-engaging edge slightly less than but not materially less than the internal diameter of the bore, and at least partially overlapping the open end of the member in the part thereof not occupied by the cable, both of the cable-engaging edges being recessed centrally thereof to provide saddles for

extending arc-like across the cable and providing trough-seeking prongs at opposite ends of the saddles, and a screw reacting between the clamp support and the clamp element, located in a longitudinal plane which substantially bisects the saddles and acting along a thrust line forming an acute angle with the axis of the tubular member.

GEORGE C. THOMAS, JR.

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