Jan. 15, 1957 M. D. BERGAN 2,777,895

DEAD END CONNECTORS

Filed July 22, 1952

Fig. 1.

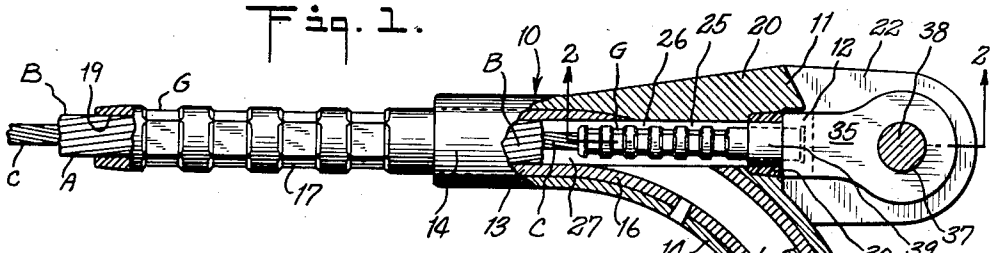


Fig. 2.

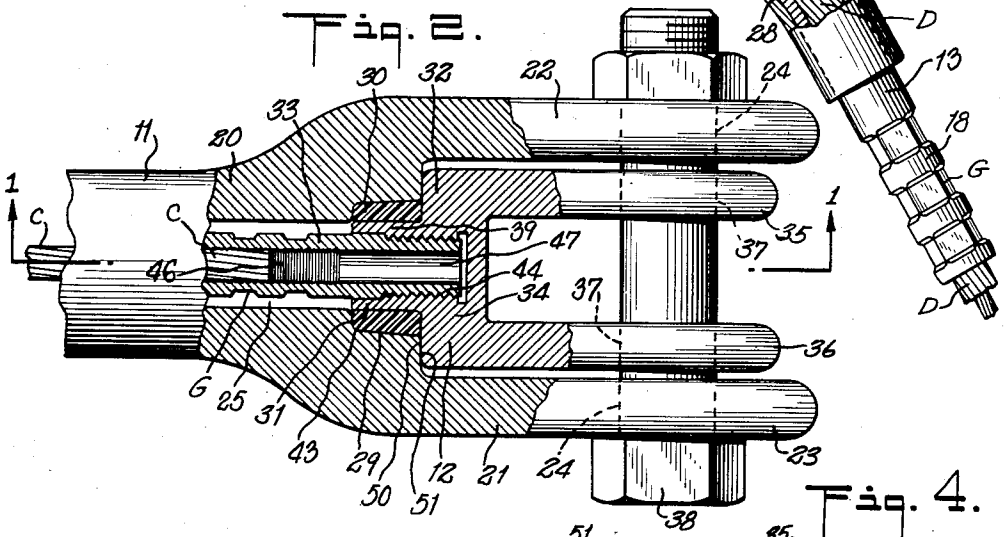


Fig. 3.

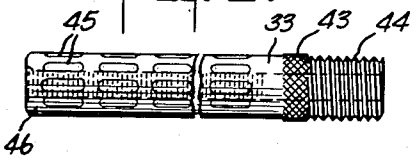


Fig. 4.

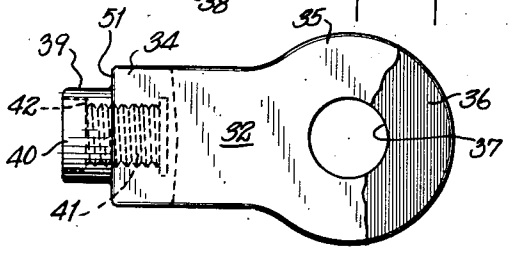
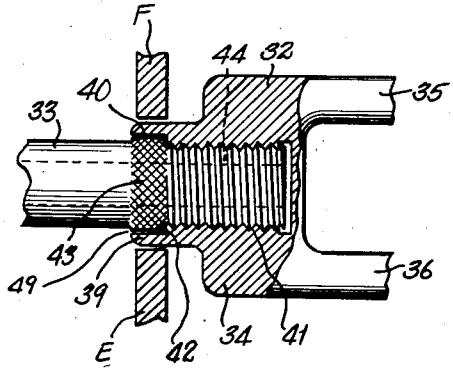


Fig. 5.



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DEAD END CONNECTORS

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7 Claims. (Cl. 174—94)

The invention relates in general to an electric connector for suspending a cable from a support, sometimes called a dead end fitting, and particularly relates to the part thereof which forms an anchoring means for securing a steel core of such a cable to a support.

The present disclosure constitutes a development and improvement in the similar two-part core-anchoring means disclosed in my Patent No. 2,669,600 for "Dead End Connector," issued February 16, 1954.

It is understood that in this art where two suspensories each with a clevis-forming end mounted on a single bolt, with one suspensory secured to the cable considered as a whole to support an end thereof, and the other suspensory secured to the steel core of such a cable to support an end thereof, it is a preferred practice to make the cable-supporting suspensory of a metal like aluminum without giving any particular attention to its tensile strength but to make the steel core suspensory of steel and particularly designed by virtue of its tensile strength to support the steel core and therethrough to support the cable substantially without possibility of elongating the core suspensory.

In a dead end fitting forming part of the prior art there is disclosed a metal sleeve as part of the steel core suspensory and which sleeve has one end open to receive an end of the steel core of the cable and the other end of the sleeve terminates in and is integral with a clevis. Making the sleeve and clevis of one piece and thus rigidly connected with these parts in preferred coaxial relation is of advantage in that it tends to defeat possibility of the steel core being twisted in the cable in the act of bolting the clevis to the cable support. However, in such anchoring means it is a usual practice to braze the sleeve and clevis with the result that the sleeve is softened by the incidental heat action and tends to lose its tensile strength.

In the above-identified application it is suggested that the steel core anchorage be formed of two parts, a U-shaped steel clevis and a long bolt-like steel sleeve, which is of advantage in that it permits the clevis and sleeve to be made of different types of steel, each selected to best suit the requirements of the crimpable sleeve element and the rugged, rigid, strong clevis element. However, in the application disclosure the sleeve is passed loosely through an opening in the crotch of the clevis which forms a swivel connection. It is thus possible in practice that the sleeve may either rotate about its own axis or may rock transversely of its length about the swivel thus formed between the sleeve and the crotch of the clevis. Any possibility of the clevis and sleeve having any relative movement is objectionable, particularly in the possibility that the sleeve may cant and thus become off-centered as it is being crimped, or subsequently, while being inserted into the main body of the dead end fitting.

Accordingly, the primary object of the invention is to provide as a separable part of a dead end fitting a rigid

and in effect one-piece unitary insert which will form an all-steel anchorage for the steel core; which parts can be formed of different types of steel if desired and which can be formed without any necessity of abrading or otherwise softening or weakening the preselected physical characteristic of the sleeve element.

Broadly, this objective is attained by forming the clevis as a casting or forging of any desired type of steel; providing the sleeve as a cold-drawn, steel, seamless mechanical tube; and mechanically connecting them together without employing heat, specifically by providing the sleeve with a threaded end fixedly screwed into a socket provided therefor in the crotch of the clevis.

The present disclosure also features the crimping of the initially separable tubing and clevis to connect these parts integrally into a single unit independent of the balance of the fitting in which it is mounted.

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 electric connector 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 drawings:

Fig. 1 is a view partly in side elevation and partly in section along the longitudinal medial plane of a dead end fitting in part taken on the line 1—1 of Fig. 2 and provided with a cable whose steel core is secured to a support by a suspensory forming a preferred embodiment of the invention;

Fig. 2 is an enlarged view partly in plan and partly in a horizontal section on the line 2—2 of Fig. 1, with both Figs. 1 and 2 showing the parts in their final operative position;

Fig. 3 is a view in elevation of a stock part for forming the tubing at the left of the steel core suspensory of the preceding figures with a mid-portion broken away to save space;

Fig. 4 is a view in elevation of a stock part for forming the clevis at the right end of the steel core suspensory of Figs. 1 and 2; and

Fig. 5 is a detail of the stock parts of Figs. 3 and 4 secured together and about to be crimped to form the unit herein featured.

Referring to the disclosure of Figs. 1 and 2, there is shown a dead end fitting or connector **10** which, considered as a whole, is of a Greek gamma or piston-like form and comprises two major units, a main unit or suspensory **11** for securing a cable A, considered as a whole, to a support (not shown) and a supplementary suspension **12** particularly constituting the novel feature of the disclosure and operative for securing a steel core C of the cable A to the same support.

The main suspensory includes two parts, one forming a long, tubular, thin-walled splicing tube **13** formed of pure aluminum bent into elbow form, and the other part forming a rugged casting **14** shrunk onto the tube **13**.

The bent tube includes a crotch **16** and two ends **17** and **18**, each end capable of being distorted into a crimping engagement with conductors in its bore **19**. The casting **14** includes a block-like main body **20** embracing the elbow at its bend and a bifurcated extension **21** projecting from the body and providing a pair of parallel ears **22** and **23** having aligned bolt holes **24**. The casting **14** is of one piece and in the illustrated instance is formed of an aluminum, high-strength alloy of the type known on the market as 195 Alcoa. The casting **14** is provided in its main body **20** with a main bore **25** extending horizontally and straight therethrough from

end to end to receive one end of the cable A and the bore is dimensioned to permit the cable A to be drawn therethrough. The crotch portion 16 of the tube 13 is drilled through on its outer convex side to provide a side opening 26 through the wall of the tube in the part thereof in line with the straight portion 27 of the bore 19 of the splicing tube 13.

The main body 20 of the casting is also provided with a slightly curved supplementary bore 28 depending in an arc at an obtuse angle from the main bore 25 and designed to receive the intruded end of a depending tap wire D.

The main unit or suspensory 11 as thus far described is similar in many respects to the corresponding unit in the above-identified application.

In the case herein disclosed the main bore 25 at the end adjacent the bifurcated extension 21 is enlarged to provide a pocket 29 of frusto-conical form in which is fitted a neoprene ring gasket 30 whose inner end bears endwise on a stop shoulder 31 forming the inner end of the pocket 29.

The supplementary suspension 12 particularly forming the novel feature of this disclosure comprises two separate preformed parts, a clevis 32 and a straight length of tubing 33. The clevis 32 is a casting of tough steel, hot-dipped galvanized and comprising a crotch-forming body 34 provided with a pair of apertured ears 35 and 36 projecting from the body 34 and disposed within and parallel to the ears 22 and 23. The ears 35 and 36 are provided with bolt holes 37 aligned with the bolt holes 24 and through which extends a steel bolt 38 by means of which the entire assembly, that is, the main and supplementary suspensories, is supported in place.

The end of the clevis opposite its apertured ears is of reduced diameter and forms a hub 39 exteriorly of cylindrical form. The hub end of the body 34 is drilled axially to provide an outer recess 40 of relatively large diameter and is counter-drilled and the counter-drilled portion tapped to provide a long, inner, threaded socket 41 as shown in Fig. 5. The difference in diameter between the tapped socket 41 and the untapped recess 40 forms a stop shoulder 42 facing outwardly.

The steel tubing 33 as best shown in Fig. 3 is formed from a length of cold-drawn, seamless mechanical tubing, finish anneal stock which can be purchased on the open market. In the case illustrated the tubing is S. A. E. 1025 cold-drawn steel. It is a feature of this disclosure that, except for such working as may be imposed thereon by the incidental machining and threading hereinafter mentioned, the tubing is in the condition particularly relative to tensile strength which it had when selected initially for its desired degree of strength and other physical characteristics.

The tube 33 adjacent its right end is knurled or otherwise roughened to form a band 43 as best shown in Fig. 3 and having a running fit in the recess 40. The right end of the tubing is externally threaded between the knurled band and the adjacent end of the tubing to provide threads 44 of some material length. The left end of the tubing is left with its original finish; is cadmium plated; and it may be provided with inked markings 45 to indicate areas of die compressions for use when the tubing is crimped onto a conductor thereon.

The stock tube as purchased on the open market is already drilled axially therethrough from end to end to form an initial bore 47 of relatively small diameter. In forming the finished tubing 33 a long tap of fine thread series and shallow in depth is run through the bore to produce serrations 46 on the inside wall of the tube which help to bite into the hard steel core wire C for gripping purposes.

It is a feature of this disclosure that the threaded end of the tubing 33 extend for a material distance into the rugged body 34 to provide a long bearing between the clevis and tubing and in this way assure the maintenance

of these parts permanently in their required prefixed coaxial relation.

In assembling the parts to make up the suspension 12, the externally threaded end of the tubing of Fig. 3 is screwed into the socket 41 until the knurled band 43 is located within the outer recess 40. The threaded end of the tubing 33 is screwed into the socket 41 until stopped by the engagement of the band 43 with the stop shoulder 42. The outer end of the hub 39 is then swaged or otherwise shrunk onto the knurled band sufficient to lock the tubing fixedly to the clevis.

As suggested in Fig. 5, the parts thus screw-assembled are located with the free end of the hub 39 located between squeeze dies E and F of a crimping machine. Actuating the machine constricts the hub at least in its outer portion to cause a slight reduction in the internal diameter of the hub, first to take up any clearance 49 between the hub and band 43, and then to cause the hub to shrink and thus to bind itself onto the band and possibly also onto the adjacent threaded portion 44 of the tubing 33. In the operation any initially over-size of the band, due to the formation of pyramids of metal which may form incidental to the knurling operation, is reduced to the diameter of the balance of the tubing 33 as indicated in Fig. 4.

As the steel core suspension herein featured may be used with a form of cable suspension other than as herein shown, the steel suspension herein featured may be considered as an article of manufacture complete per se.

In securing the cable A in place in the fitting its insulating jacket is stripped back, if present, to expose an end of its conductor B and the end of the conductor is stripped back to expose an end of its steel core C. The exposed core end is inserted into the bore 47 sufficiently to insure its being crimped and it may even extend to the wall defining the bottom of the socket 47. The tubing 33 is then deformed into a crimping engagement with the inserted end of the core C, incidentally forming crimping indentations G as is usual in such operation. In this way the terminal is secured permanently to the end of the steel core C as it lies momentarily beyond the right end of the cable suspension 11.

The cable as a whole is then drawn back, right to left of Fig. 1, until the cylindrical hub 39 is fitted snugly within ther ing gasket 30 as shown in Figs. 1 and 2. Inserting the hub 39 within the long gasket 30 tends to center the tubing 33 in the bore 25.

It is also suggested that the main body 20 in the part between the legs 21 and 22 be cast and preferably machined flat and perpendicular to the axis of the bore 25 to provide a stop shoulder 50 in the part of the casting in line with and on opposite sides of the outer end of the gasket 30. Similarly the clevis 32 in its advance side may be cast or machined perpendicular to the axis of the tubing 33 to form a shoulder 51 designed to abut firmly against the stop shoulder 50 when the cable is drawn to the left as above described. With the shoulders in contact as shown in Fig. 2, the tubing 33 is coaxially centered in the bore 25.

Subsequently the ends 17 and 18 of the splicing sleeve 13 are crimped respectively onto the main cable A and onto the tap B with indents G as disclosed in the above-noted patent.

By means of the two-part anchorage for the steel core above described it is possible to form its clevis element 32 as a casting or pressing with that shape and mass of material which will best fit its requirements to function as a clevis and made of a form of steel best suited for transmitting tensional strains between the steel core and the bolt attached to the support. The selection of the best material for use in forming the clevis element is in no way influenced by the selection of the best material for use in forming the tube element 33, and this is particularly true when it is considered that the objective in so far as the element 33 is concerned is to provide a

malleable tube capable of being deformed into a crimping engagement with the steel core therein substantially without stretch and in effect to form a continuation of the rugged steel core up to the massive and thus rugged clevis **32**.

In general it is the intent to provide the supplemental suspension **12** of such strength in its component parts that collectively these parts are capable of providing a resistance to axial elongation which shall be substantially equal to the resistance to axial elongation offered by the steel core which it is intended to anchor.

While there may be some heat developed incidental to the crimping of the hub **39** onto the portion of the tubing therein as noted in Fig. 5, the areas and thus the mass of materials involved are relatively small, considered axially, and are remote from the air-cooled exposed portion which is subsequently involved in crimping the same onto the steel core therein.

I claim:

1. An article of manufacture constituting a separable element of a dead end fitting for anchoring the steel core of a conductor, said article comprising two parts, one part constituting a clevis pre-shaped to its desired configuration, and the other part forming a crimpable tubing having the tensile strength and relative non-conductive capacity characterizing S. A. E. 1025 cold-drawn seamless steel tubing, the clevis provided at one end with a ring-like hub and at its end which forms the hub provided with a socket whose outer portion forms an unthreaded recess and whose inner portion is threaded and the tubing at one end provided with an axially extending bore and with its other end externally threaded and screwed into the threaded portion of the socket, the portion of the tubing beyond its threaded end portion forming a knurled band of slightly greater diameter than the threaded portion located in the unthreaded recess and said hub being shrunk in squeezed engagement with the band to lock the clevis and tubing in permanently fixed relation in whatever position they may happen to be relatively rotated when secured together.

2. An article of manufacture constituting a separable part of a dead end fitting for anchoring the steel core of a conductor, said fitting provided at one end with a clevis and its other end forming an extension from the crotch of the clevis and provided at the extension end with a socket whose outer portion forms an unthreaded recess and whose inner portion is threaded and which provides a stop shoulder between the threaded and unthreaded portions, and a seamless tubing provided with an axially extending bore fashioned for receiving a steel core therein, the opposite end of the tubing being externally threaded and screwed into the threaded portion of the socket with the remainder of the tubing exposed for crimping onto the steel core, the portion of the tubing adjacent its threaded end portions forming a knurled band initially having a running fit in the enlarged unthreaded portion of the socket as the tubing is screwed into the threaded portion of the socket and engaging the stop shoulder.

3. An element of a dead end connector capable of sustaining high tensile load for use in anchoring a steel core of a conductor independently of the conductor, said element consisting of two separately formed units, one of said units being a steel casting forming a clevis at one end and provided at the other end thereof with a socket having two diameters whose outer portion of larger diameter forms an unthreaded recess and whose inner portion of less diameter is threaded, the other unit being a length of commercial steel tubing of uniform diameter with one end externally threaded and in screw engagement with the threaded portion of the socket, and said tubing provided with a band-like roughened portion having a freely sliding fit in said recess as the tubing is screwed into the socket, the opposite end of the tubing provided with a bore for receiving one end of the steel core, and said element capable of providing a resistance to axial elongation substantially equal to the resistance to axial elongation offered by the steel core which it is intended to anchor.

4. The element defined in claim 3, wherein the band-like portion of the clevis is shrunk onto whatever portion of the tubing which may happen to be therein to secure togeher the clevis and tubing in permanently fixed relation and thus defeat unthreading of the clevis and tubing from any position to which they may be screwed.

5. An element of a dead end connector for anchoring the steel core of a conductor, comprising two separate preformed parts, one part constituting a steel casting forming a clevis and provided at the crotch end of the clevis with a tubular projection provided with a threaded socket extending along the axis of the element, and the other part constituting a cold-rolled steel tubing having the tensile strength which characterizes cold-rolled steel tubing of S. A. E. 1025, having one end portion inserted into the socket for a material distance to defeat relative canting between the clevis and tubing and in threaded engagement therewith, and the end portion of the projection forming a ring-like hub shrunk onto the tube to defeat unthreading of the clevis and tubing.

6. An article of manufacture constituting a dead end connector for securing a steel core cable to a support, said connecter comprising two major parts, one of the major parts including a casting provided at one end with a bore fashioned to receive one end of the cable, and at its other end the casting forming a pair of parallel ears having aligned bolt holes, the other major part being formed of two initially separate parts, one of the parts being a steel casting forming a clevis provided at one end with a pair of apertured ears located between the first-mentioned parallel ears and having bolt holes for registering with the first-named aligned bolt holes in position to receive a bolt passed through all of the bolt holes and said clevis in the portion thereof between the root ends of its ears being thickened to form a rugged crotch portion provided with a reduced extension projecting therefrom axially into the bore of the first-named casting and provided in its crotch portion with an internally threaded opening and the other part being a preformed steel sleeve whose bore is fashioned to receive therein an end of the steel core of the cable, said sleeve being sufficiently malleable to permit the sleeve to be deformed into a crimping engagement with the steel core therein with one end of the tube externally threaded and screw threaded into the opening in the clevis, and forming a coupling means therebetween capable of providing relative movement between the clevis and sleeve.

7. A dead end fitting formed of two major and separate units in telescopic relation, the outer unit forming a main suspensory forming at one end a body having a main bore extending therethrough and forming at its other end an extension from the body forming a pair of apertured ears, the bore at the end of the body from which the ears extend being enlarged to form a pocket, a long gasket of tubular form fitting in the pocket and whose bore is concentric with said main bore, and the inner major unit formed of two separate parts, one of the parts constituting a clevis-forming casting with one end forming a pair of ears located between said apertured ears and having a rugged crotch-forming portion connecting the ears at their root ends, said crotch-forming portion provided with an extension forming a hub fitted in the gasket, and the crotch forming portion provided with a socket internally threaded and concentric with said main bore, the other part of the inner unit formed of a straight length of tubing having one end externally threaded and in screw-threaded engagement with the internal threads of the socket, said crotch forming portion and the body contacting externally of the gasket along abutting shoulders disposed in a plane at

right angles to the axis of the tubing and operative to assist in fixing the tubing coaxially in the bore.

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