United States Patent [19]

Eklund

[11] **3,838,206**

[45] **Sept. 24, 1974**

[54] **WIRE CONNECTOR FOR TWO ELECTRIC WIRES, WHICH MAY POSSIBLE BE CONNECTED TO ELECTRIC DETONATORS**

[75] Inventor: **Kjell Eklund**, Orebro, Sweden

[73] Assignee: **Nitro Nobel AB**, Gyttorp, Sweden

[22] Filed: **Apr. 23, 1973**

[21] Appl. No.: **353,489**

[30] **Foreign Application Priority Data**

May 12, 1972 Sweden 6276/72

[52] **U.S. Cl.** ..... **174/87**, 102/28 R

[51] **Int. Cl.** **H01r 7/06**

[58] **Field of Search** 102/28; 339/213, 221, 244, 339/276; 174/87

Primary Examiner—Verlin R. Pendegrass

Attorney, Agent, or Firm—Hane, Baxley & Spiecens

[57] **ABSTRACT**

There is disclosed a connector for conductively connecting the stripped ends of two insulated conductor wires without requiring the use of tools or insulation material such as insulation tape. The connector comprises an outer sleeve into which is fitted a shorter inner sleeve. The stripped end of one of the conductors is inserted between the inner sleeve and the outer sleeve and secured to the inner sleeve. The inner sleeve is secured against axial displacement within the outer sleeve and rotation relative thereto. The stripped end of the second conductor is inserted into the inner sleeve and the stripped ends of both conductors are of a length such that they protrude from the inner sleeve into the outer sleeve. These protruding end portions are joined by helically twisting the wire ends by axially rotating the sleeve assembly while holding the conductor wires protruding from the outer sleeve.

6 Claims, 6 Drawing Figures

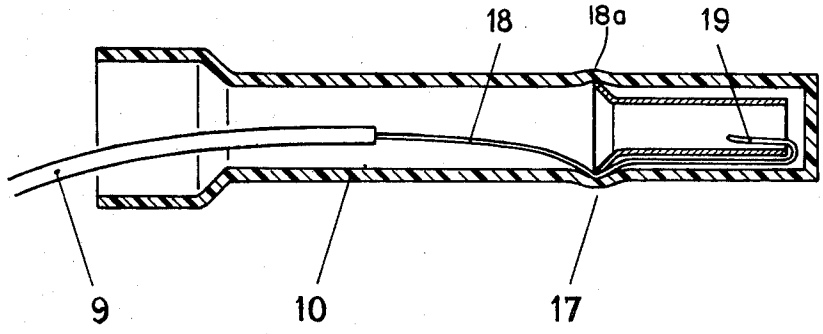


Fig. 1

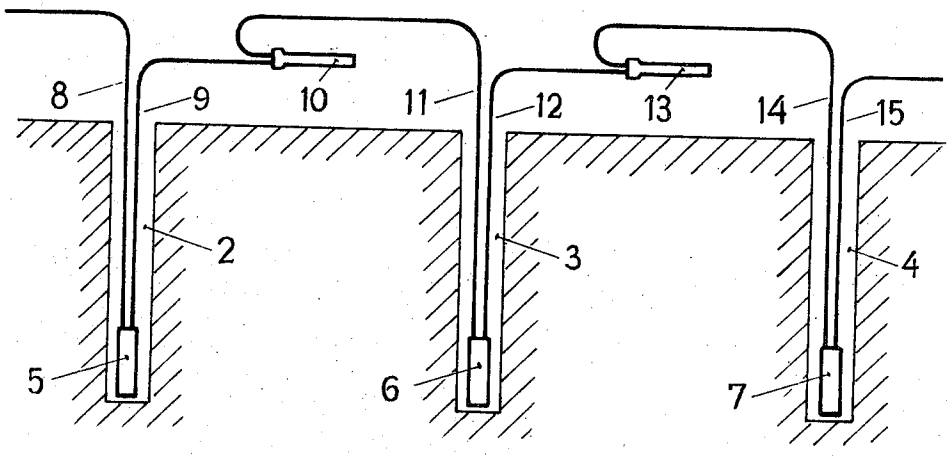


Fig. 2

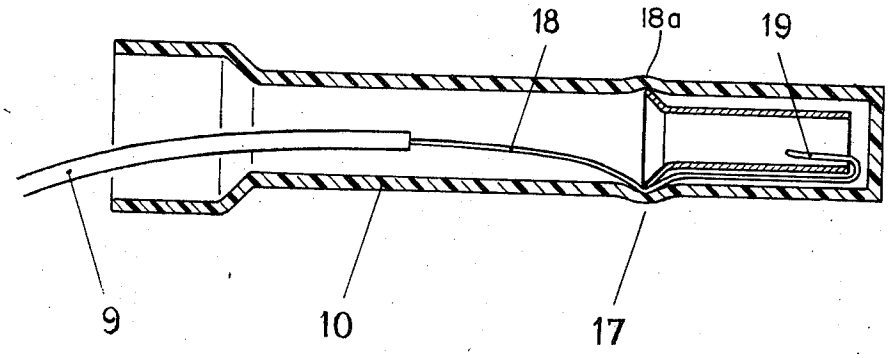


Fig. 3

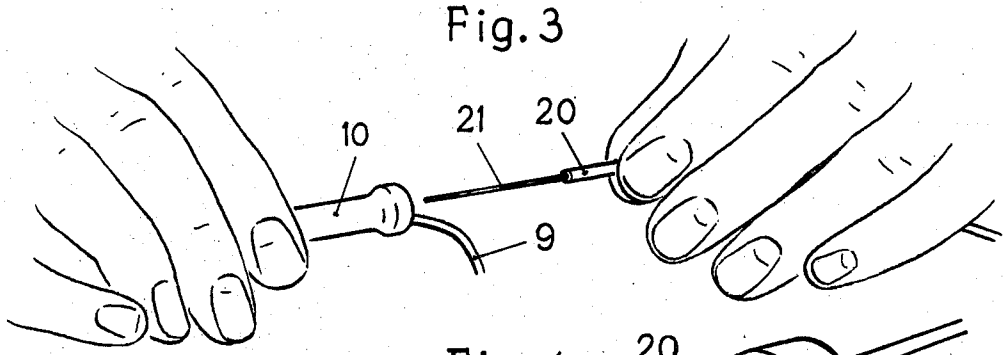


Fig. 4

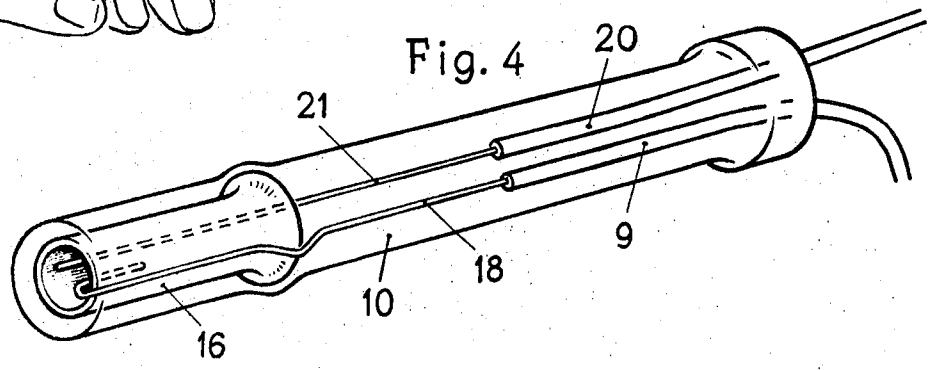


Fig. 5

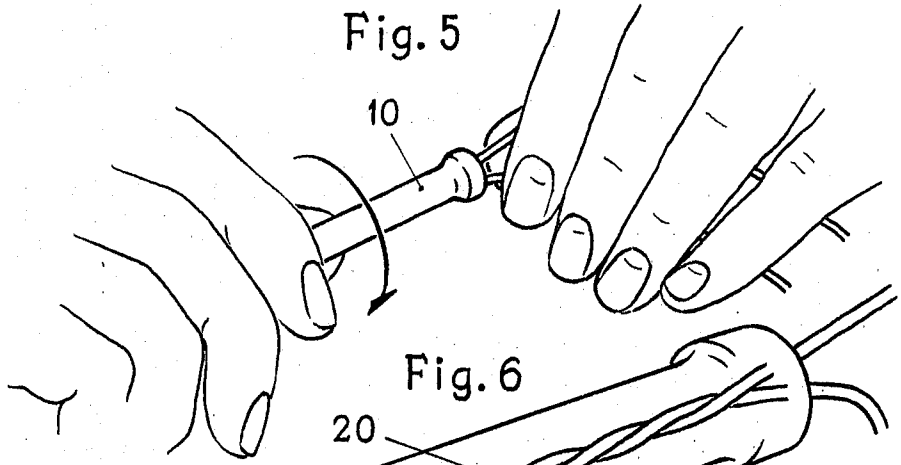
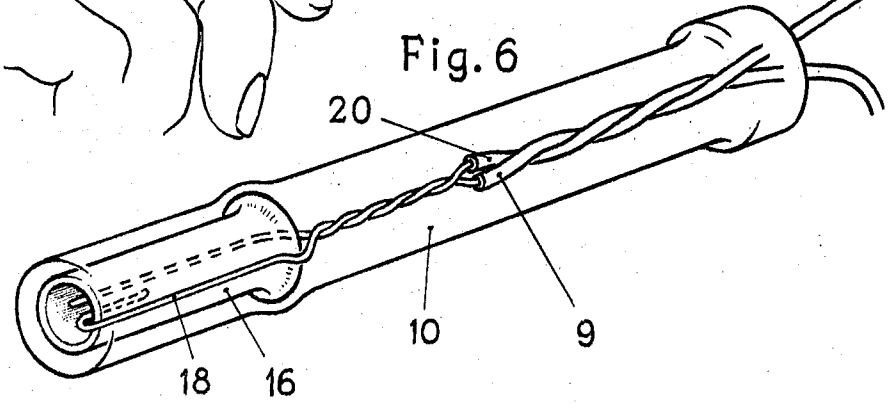


Fig. 6



WIRE CONNECTOR FOR TWO ELECTRIC WIRES, WHICH MAY POSSIBLE BE CONNECTED TO ELECTRIC DETONATORS

The present invention is related to a wire connector for achieving electric contact between two electric wires where adjoining connecting wires each may be connected to an electric detonator. The function of the wire connector is primarily to connect a greater number of electric detonators in series. Each electric detonator has one fuse wire and one wire, which is terminated at a wire connector. Known wire connectors are usually designed as cylindrical tubes or sleeves, which are sealed at one end and preferably made of plastic material. The wire connector sleeve is internally fitted with a tube of electrically conducting material such as aluminum and which inner tube more or less lines the internal surface of the wire connector sleeve. Inserted between the sleeve and the metal tube is one end of an electric wire, which preferably is insolated, whereas the length of wire inserted between the sleeve and the metal tube is stripped. The lower part of the wire passes the lower edge of the metal tube and is at its inner end U-bent and inserted back into the tube. The tube with thus located wire end is then pinched together in such a way that the inner peripheral surface of the lower end of the tube is divided into two sections, which are closely facing each other and squeezing the inserted wire end. The pinched metal tube is now of a more or less kidney-shaped character. The wire connector with thus fastended wire is now prepared to receive a second wire end from an adjoining detonator, which wire end is stripped and inserted into the tube. In order to achieve electric contact with the tube, the second inserted wire may be U-bent or provided with a tin plate, so that contact is obtained with the inner peripheral surface of the tube. The tin plate may be of rectangular shape and overfolded to thus fasten the inserted wire to the plate. This procedure of achieving electric contact has, however, led to contact unreliability. To avoid this unreliability one has tried to U-bend the lower part of the connecting sleeve, but in spite of this, certain contact difficulties have arisen with respect to high or varying transfer resistances.

The purpose of the present invention is to obtain a wire connector of above mentioned type, where the resulting electric contact between the wires is highly effective and where good electric contact between the connected electric wires is fully ensured.

The new wire connector is in general of the same design as the above described wire connector and has also an internal metal tube and an electric wire, which is fastened in the same manner as mentioned above. The novelty of this invention is that the metal tube only has a length sufficiently long to lock the one wire end. The length of the tube may for example be only one-fourth of known length and need not be of electrically conducting material. Above the metal tube the fastened wire is stripped for a length of, for example, approximately 2 cm. In accordance with the invention the wire end, which is to be connected, is in stripped condition inserted into the connector sleeve in such a way as to place the stripped length parallel to the length of stripped and fastened wire above the metal tube. In this situation the connector sleeve is turned around its own axis. Thus the inserted and stripped wire is going to be twisted around the length of the stripped and fastened wire, whereby satisfactory and reliable electric contact

is established at the same time as material savings are obtained by the fact that the metal tube only needs such a length as required to fasten one of the wires.

According to a modification of the present invention the wire end, which is inserted between the inner peripheral surface of the connector sleeve and the tube of electrically conducting material, may instead be inserted into the tube proper and anchored to its bottom. This means that both wire ends are inserted into the tube proper.

Characteristic properties of the present invention will also be evident when reviewing our claims below.

The present invention will more closely be disclosed in connection with attached drawings, where

FIG. 1 shows the methode of application for wire connectors according to the present invention, where

FIG. 2 shows a connector sleeve with a fastened wire end, where

FIG. 3 shows a connector sleeve according to FIG. 2, where the second wire end is being inserted, where

FIG. 4 shows the second wire end fully inserted into the connector sleeve, where

FIG. 5 shows the connector sleeve during the turning movement around its longitudinal axis, whereby the two wire ends are twisted around each other and where

FIG. 6 shows the twisted wire ends.

FIG. 1 shows a section of ground provided with three drillholes **2, 3** and **4.** Into each of the drillholes an electric detonator cartridge **5, 6** and **7** is inserted respectivly. Two electrically isolated conductors are extending from each electric detonator cartridge, namely the wires **8** and **9** from the cartridge **5,** the wires **11** and **12** from the detonator cartridge **6** and the wires **14** and **15** from the detonator cartridge **7.** The wire **9** is at its one end provided with a wire connector **10,** which will be described in more detail hereinafter. The wire **11** from the electric detonator cartridge **6** is inserted into said sleeve **10.** The wire **12** is thus also provided with a wire connector **13** of the same type as the wire connector **10.** Into the connector sleeve **13** the other end of the wire **14** is inserted. By means of the wire connectors any number of electric detonator cartridges can be interconnected in series. It should, however, be obvious that the wire connectors not necessarily have to be wired to electric detonators but may function as connecting members for various types of circuit components.

FIG. 2 shows an electric wire connector sleeve **10,** which is identical to the connector sleeve **13.** It consists preferably of an outer cover or sleeve of plastics material but may of course consist of other materials or combination of materials. At its bottom the connector sleeve is provided with a tube **16** preferably of electrically conducting material for example aluminum. The tube is at its left end expanded into a collar **17,** which collar may snap into an annular groove **10*a*** on the inside of the sleeve **10.** The sleeve is at its left end expanded such that the electric conductor **9** with its stripped end **18** easily may be inserted into the sleeve in such a way that the wire is located between the outer peripheral surface of the tube **16** and the inner peripheral surface of the sleeve or cover. The outermost end of the wire **19** is U-bent and inserted back into the tube **16** and is in some way or other joined to the tube for example by welding or by pressing the tube end to-

gether so that the peripheral inner surface of the tube is transformed into two parts facing each other. The wire end **19** is now sandwiched and squeezed. The function of the tube is thus to fasten the wire end **19** and the tube may be made of any material, which will perform this function. A conceivable material is even plastics. The wire **18** and the tube **16** are preferably inserted into the sleeve **10** simultaneously and in the process the wire is kept fastened to the right end of the tube **16.** It should also be obvious that the sleeve may be made out of a plastic tube, that is the right bottom part may be omitted. The wire **9** has a stripped length to the left of the tube **16.** The described sleeve **10** with inserted wire **9** is now ready to receive a second wire **20** with its stripped wire end **21.** FIG. **3** shows the wire **20** being inserted into the wire connector sleeve **10.**

FIG. **4** shows the wire **20** fully introduced, where it is clearly shown that the stripped sections **18** and **21** of the wires **9** and **20** are approximately of simular lengths. A turning movement to join the wires is now possible. When the wires are in the position shown in FIG. **4,** the sleeve **10** is turned around its longitudinal axis. On account of tha fact that the wire **9** is rigidly fastened to the sleeve **10** a twisting of the wires will occur when turning the sleeve around its longitudinal axis as is clearly indicated by FIG. **16.**

The described invention may be varied within wide limits, whereby the essential points are, that both of the wires are peeled at the sections where they are to be joined by twisting and that one of the wire ends is rigidly connected to the connector sleeve, which when turned causes the one wire to move around the second wire and thus to be twisted around and joined to the second wire.

The electrical wire connector may with great advantage be used pre-connected to one of the wires of an electric detonator whereby the second wire end before the use of the detonator is inserted into the connector sleeve and thus protected.

Before wiring the inserted wire end is withdrawn and in its place is that wire introduced, which is to be twisted onto the wire, which is fastened to the wire connector.

I claim:

1. A connector for conductively connecting stripped ends of two insulation covered conductor wires, said connector comprising: an outer sleeve and an inner sleeve of shorter length than the outer sleeve and nested therein in coaxial relationship, said inner sleeve being retained in the outer sleeve against axial displacement and rotation relative thereto, the stripped end of one of the conductors being inserted between the inner wall surface of the outer sleeve and the outer wall surface of the inner sleeve secured to the latter, the stripped end of said one conductor being inserted into the inner sleeve, the stripped ends of both conductors being of a length such that stripped portions of both conductors protrude from the inner sleeve and extend into the outer sleeve, said protruding stripped conductor portions being helically twisted together, thereby conductively joining the two conductors.

2. The connector according to claim **1** wherein the outer sleeve is made of insulation material and the inner sleeve is made of electrically conductive material.

3. The connector according to claim **2** wherein the outer sleeve is made of pliable plastics material and the inner sleeve is made of pliable metal.

4. The connector according to claim **1** wherein said outer sleeve has in its wall a peripheral outwardly protruding groove and the inner sleeve has in its wall a peripheral outwardly protruding collar, said collar being engaged with said groove.

5. The connector according to claim **4** wherein the stripped end of said one conductor terminates in a bent back portion, said bent back portion extending into the inner sleeve, thereby securing said conductor against axial displacement relative to said sleeve.

6. The connector according to claim **5** wherein the stripped end of said one conductor is clamped between said collar and the groove defining wall portions of said outer sleeve.

* * * * *