United States Patent [19]

Remy

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[45] **July 24, 1973**

[54] **ELECTRICAL CONTACT DEVICE**

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[52] **U.S. Cl.** **174/115**, 174/28, 174/29, 200/61.23, 200/85, 340/272

[51] **Int. Cl.** **H01b 7/22**

[58] **Field of Search** ..... 174/28, 29, 102 R, 174/113 R, 115; 200/61.41, 61.24, 61.23, 85, 86; 340/272

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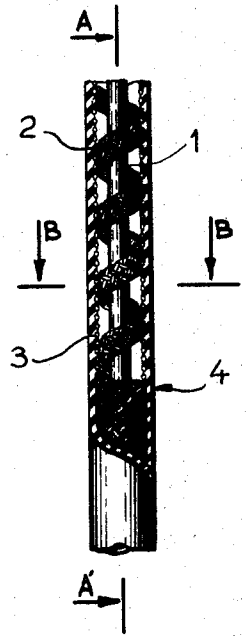
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Assistant Examiner—A. T. Grimley
Attorney—Raymond A. Robic

[57] **ABSTRACT**

A linear electrical contact device comprising a central conductor, a tubular braid of metallic threads, and a tubular braid of interwoven insulating threads separating the central conductor and the tubular braid of metallic threads. The tubular braid of intermoven insulating threads forms a cord helically wound around the central conductor and is thermo-welded to the central conductor so as to be permanently secured thereto. The contact device can be used in combination with a vehicle window slide to activate when an object is caught in the window as the window is rolled up.

4 Claims, 4 Drawing Figures



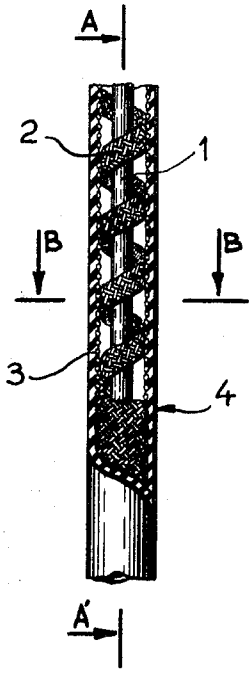


FIG. 1

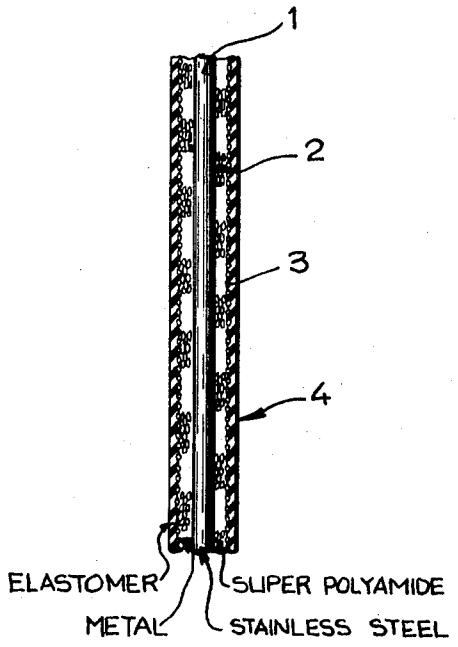


FIG. 2

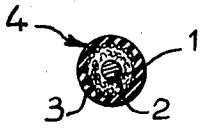


FIG. 3

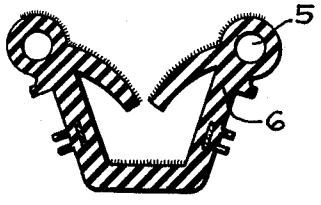


FIG. 4

ELECTRICAL CONTACT DEVICE

This invention relates to a linear electrical contact device of the type comprising two conductors arranged generally parallel and separated by insulating elements, which allow the conductors to be brought into contact by pressure applied at any position along the length of the device for, for example, closing an electrical circuit when the pressure is exerted and opening the circuit as soon as the pressure is released.

It is known that recent industrial developments of such linear electrical contact devices, in requiring both a certain amount of miniaturization and a large amount of flexibility so as to permit their general use for the security of electrically operated devices such as car windows, have revealed frequent hazards due to accidental closures of the circuit operated by such contact devices.

It is the object of the present invention to overcome the above drawbacks and, more particularly, to eliminate the risks of accidental contacts between the two coaxial conductors which are slightly spaced, on one hand, by using an helicoidal spacer element having a great elasticity and, on the other hand, by using an helicoidal spacer element which is permanently secured to at least one of the conductors, so as to prevent any sliding thereof on such conductor, and, finally, by using a tubular braid of metallic threads which is impregnated with an elastomeric composition.

The novel characteristics of the invention as wells as others which are related thereto and the advantages of the present invention will be best understood by referring, by way of example, to the following description of a preferred embodiment of the invention and to the attached drawings in which:

FIG. 1 illustrates a partial longitudinal section of a portion of a cable forming an electrical contact device in accordance with the invention;

FIG. 2 illustrates a cross-section of the same cable taken along line A–A′ of FIG. 1;

FIG. 3 illustrates a cross-section taken along line B–B′ of FIG. 1; and

FIG. 4 illustrates a cross-section of the window-slide of a vehicle door adapted for insertion of a linear electrical contact device in at least one free edge thereof.

In FIGS. 1 to 3, there is shown a coaxial cable capable of detecting the pressure applied thereto and to ensure the closure or opening of an electrical circuit depending on whether or not the cable is subjected to a radial pressure. The cable or linear electrical contact device comprises a central conductor 1 spaced by an helically wound insulator 2 from a conductive tubular braid 3 impregnated with an outside elastomeric composition 4.

The helicoidal insulating spacer 2 is novel in that:

a. On one hand, it comprises a braid, lace or cord formed of small threads, preferably made of superpolyamide, interwoven tubularly so that the flattening thereof in the form on a band facilitates, by its own elasticity, the contact under the effect of a pressure as well as the separation when the pressure is removed from the coaxial conductors 1 and 3, and also the winding of such braid, lace or cord in an helicoidal form.

b. On the other hand, due to the non-negligeable electrical resistance of the central conductor 1, which is made of stainless steel including a nickel chrome composition, the "joule" effect resulting from the passage of an electrical current under low voltage which is of sufficient amplitude so as to cause a suitable heating of the central conductor 1 will cause the superpolyamide braid 2 contacting the central conductor to be brought to its melting point. This will very simply and economically cause the permanent adhesion of the superpolyamide braid on the central conductor 1, thus preventing all risks of subsequent sliding of the braid on the central conductor, even under low radius flexures.

In addition, the peripheral tubular conductive braid 3 is advantageously impregnated with an elastomeric composition 4 which is deposited thereon in any convenient way such as, for example by plunging it into a suitable bath, by conductive rollers, by pulverization using a pistol etc . . .

The elastomeric composition may be of the type commercially known as RHODORSYL RTV or RF4 sold by Rhone-Poulenc, which may be vulcanized at room temperature, or be made of a neoprene adhesive material having a resistance to crystallization, so as to maintain a maximum flexibility, and, for example, have the following composition in which the proportions are given in weight:

Polychloroprene resisting to crystallization such as the one known commercially as WD or WRT of Dupont de Nemours:	50 to 100
Polychloroprene having an average crystallization and a high viscosity, such as for example the one known commercially as WHV or WHV 100 of DUPONT DE NEMOURS:	0 to 50
Extra light calcinated magnesia:	4
Silicate of calcium (silene EF)	5 to 10
Zinc oxyde:	5
Phenolic antioxygene such as the one known commercially as Zalba of DUPONT DE NEMOURS:	2
Phenolic resin, such as the one known commercially as SP 560 of Schenectady of FRANCE:	15 to 20

The above composition will be used in solution, in an appropriate solvent system, at the rate of 20 to 40 percent of dry extract, providing respectively solutions for use either with a pistol or in a bath.

It may also be mentioned that an improvement of the retification of the film may be obtained by adding 2 to 10 percent of an isocyanate of the type known commercially as Desmodur R or F of BAYER, but to a disadvantage in the stability in pot. This isocyanate is added immediately before use.

Due to the impregnation of the braid of metallic threads with an elastomeric composition 4, the tubular assembly so formed becomes much more homogeneous and much more appropriate for supporting elastic deformations, even repeated, and at the same time for returning to its initial shape after removal of the applied pressure. The elimination of the risks of sliding of the helicoidal winding 2 by thermal welding of such helicoidal winding on the central conductor 1 permits to realize low radius flexures of the linear contact device without incurring accidental contacts between the two coaxial conductors 1 and 3.

It may also be mentioned that the impregnation of the elastomeric composition 4 is also novel and advantageous in that it renders the whole assembly waterproof, thus also reducing the risk of deterioration of the contacts between the two coaxial conductors 1 and 3. In addition, this facilitates the sliding of the linear contact device into an additional protective sheath, or in the tubular housing 5 of at least one edge of an elastic

profile 6 used as a vehicle window guide slide, such as shown in FIG. 4. Such an arrangement may be used to stop the operation of the electrical device actuating the window when an obstacle such as a child head is caught between the window and the frame of the door. It is to be understood that other means of fastening the linear contact device are also possible.

It is also be understood that the invention is not to be limited to the embodiment disclosed above, by way of example, but that various modifications may be made to such embodiment using equivalent devices.

As an example of equivalent devices, it may be mentioned the substitution of the "joule" effect to weld the hellical member 2 to the central conductor by a high frequency heating process wherein the linear contact device is passed through induction windings. This would facilitate the continuous fabrication of the device and obviate to use of electrical feeding contacts to permit the thermal welding of the insulating braid 2 onto one of the conductors. In addition, the elastomeric composition 4 could be replaced by a vinyl plastic which would be jelled by such high frequency heating or in an oven.

The embodiment of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A linear electrical contact device comprising a central conductor, a tubular conductor surrounding said central conductor and consisting of a braid of metallic threads, and a tubular braid of interwoven insulating threads separating said conductors and forming a cord helically wound on said central conductor, said cord being secured to at least one conductor so as to prevent sliding thereof with respect to said one conductor, said tubular braid of metallic threads being impregnated with a composition ensuring an homogeneous, waterproof and flexible contact device.

2. A contact device as defined in claim 1, wherein said central conductor is made of stainless steel having a certain resistance and wherein said cord is made of interwoven superpolyamide threads, said cord being secured to said central conductor by passing current through the central conductor which will cause thermal welding of the cord onto the central conductor.

3. The combination of an extruded profile used in a vehicle window slide and having an edge with a tubular housing, with a linear electrical contact device inserted in said tubular housing, said linear electrical contact device comprising a central conductor, a tubular conductor surrounding said central conductor and consisting of a braid of metallic threads, and a tubular braid of interwoven insulating threads separating said conductors and forming a cord helically wound on said central conductor, said cord being secured to at least one conductor so as to prevent sliding thereof with respect to said one conductor, said tubular braid of metallic threads being impregnated with a composition ensuring an homogeneous, waterproof and flexible contact device.

4. A contact device as defined in claim 3, wherein said central conductor is made of stainless steel having a certain resistance and wherein said cord is made of interwoven superpolyamide threads, said cord being secured to said central conductor by passing current through the central conductor which will cause thermal welding of the cord onto the central conductor.

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UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,748,373 Dated July 24, 1973

Inventor(s) Roger Remy

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

On the cover sheet insert -- [30] Foreign Application Priority Data Mar. 17, 1972 France 7209312 --.

Signed and sealed this 27th day of August 1974.

(SEAL)
Attest:

McCOY M. GIBSON, JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents

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