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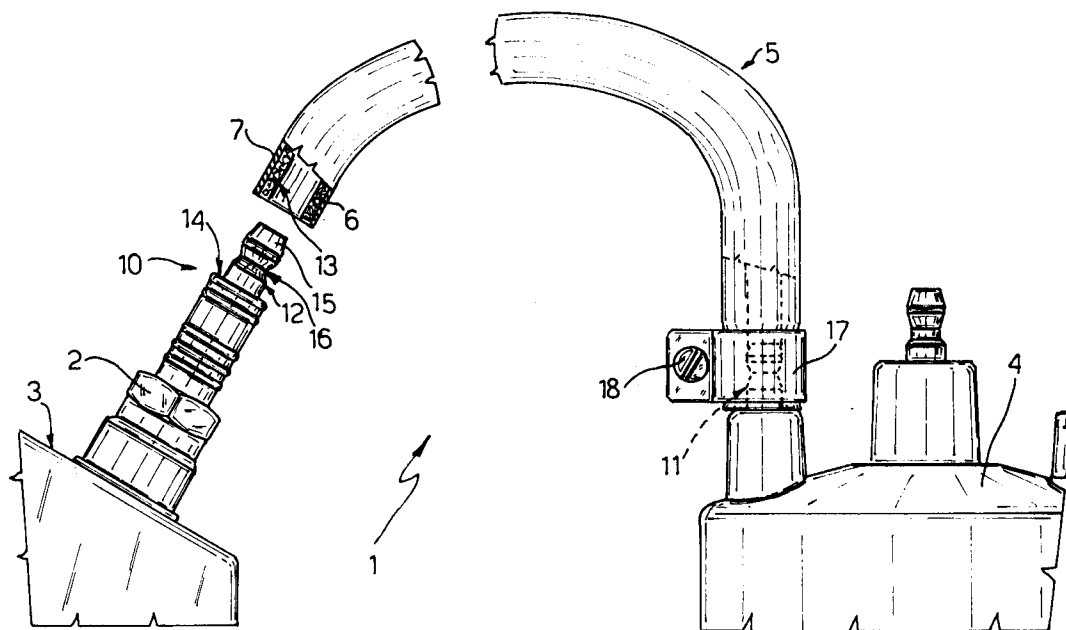
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I-10121 Torino (IT)(54) **Electrical connector.**

(57) An electrical connector (1), particularly for connecting a spark plug (2) of an engine (3) to a distributor (4), and comprising a cable (5) consisting of a tubular conductive element (6) and a pure silicon insulating sheath (7) co-extruded with the tubular element (6). The tubular element (6) is made of a composite material consisting of a matrix (8) of

flexible, electrically insulating material, and particles (9) of electrically conductive material dispersed in substantially uniform, random manner inside the matrix (8). The connector (1) also comprises two pin connectors (10, 11) on the spark plug (2) and distributor (4) respectively, which are inserted into respective end portions (13) of the tubular element (6).

**Fig.1****EP 0 566 764 A1**

The present invention relates to an electrical connector for connecting two components and particularly suitable for high-voltage applications.

One such application is the connection of the spark plugs of a controlled-ignition vehicle engine to the distributor, which is normally made using an insulated cable with a connector at each end cooperating with respective connectors on the spark plug and distributor.

In view of the relatively large number of components involved, normally six to eight, connections of the aforementioned type are invariably expensive in terms of both component manufacture and assembly.

It is an object of the present invention to provide a connector designed to overcome the aforementioned drawbacks.

According to the present invention, there is provided an electrical connector for connecting a first and second component, particularly suitable for high operating voltages, and comprising a cable consisting of a conductive element and an insulating sheath, and means for connecting the respective ends of said cable to respective said components; characterized by the fact that said conductive element is tubular and made of a composite material consisting of a matrix of flexible, electrically insulating material, and particles of electrically conductive material dispersed in substantially uniform, random manner inside said matrix; said connecting means comprising two pin connectors on said first and second components respectively, which are inserted inside respective end portions of said cable.

A preferred, non-limiting embodiment of the present invention will be described by way of example with reference to the accompanying drawings, in which:

Fig.1 shows a partially sectioned view of a connector in accordance with the teachings of the present invention;

Fig.2 shows an enlarged, partially sectioned view of an element on the Fig.1 connector;

Fig.3 shows a graph illustrating the behaviour of the material of which the Fig.2 element is made.

Number 1 in Fig.1 indicates an electrical connector for connecting the spark plug 2 of a vehicle engine 3 (shown partially) to the distributor 4 (also shown partially).

Connector 1 comprises a cable 5 consisting of a conductive element 6 and a coaxial insulating sheath 7.

Conductive element 6 is tubular and made of a composite material comprising a matrix 8 of flexible, electrically insulating material, and particles 9 of electrically conductive material dispersed in substantially uniform, random manner inside matrix 8.

Said material, which is known, may be of the type described in Italian Patent Application n.67862-A/87 entitled: "Electric resistor producible in a wide range of specific resistance values, and relative manufacturing process", filed on 13 October, 1987 by the present Applicant, and the content of which is incorporated herein purely by way of reference as required.

Fig.3 shows a graph of the supply voltage V (x axis) applied to the terminals of a conductor made of the above material, and the resulting current I (y axis) in the same conductor.

The continuous curve indicates the behaviour typical of the material, and comprises a first substantially straight portion A ranging from O to roughly 7000 V, in which the resistivity of the material is substantially constant; and a second sharply increasing portion B in which the resistivity of the material decreases alongside an increase in supply voltage. By way of comparison, dotted line C indicates the characteristic behaviour of a normal resistor, the resistance of which remains constant, and equal to that of portion A of the material in question, alongside an increase in supply voltage.

Sheath 7 is co-extruded with tubular conductive element 6 and conveniently made of pure silicon.

Connector 1 also comprises means for connecting cable 5 to spark plug 2 and distributor 4.

More specifically, said connecting means comprise a first pin connector 10, of the currently used type, on spark plug 2; and a second pin connector 11, identical to connector 10, on distributor 4.

Each of connectors 10 and 11 presents a substantially cylindrical portion 12 on to which a respective end portion 13 of cable 5 is fitted; and an annular shoulder 14, adjacent to portion 12, for axially arresting cable 5. Portion 12 presents a truncated-cone-shaped lead-in end 15 for assisting insertion inside the cavity of conductive element 6; and an intermediate, V-shaped annular groove 16 gripped flexibly by conductive element 6.

Connector 1 also comprises two metal clamps 17 (only one of which is shown in Fig.1) having respective tangential screws 18 for clamping ends 13 of cable 5 to respective connectors 10, 11.

In the application described, conductive element 5 is subjected to voltages of about 10-12000 V, so that the material operates in the low-resistance portion B of the Fig.3 operating curve. Moreover, by virtue of the nature of the material of which tubular conductive element 6 is made, the radial pressure exerted by connectors 10, 11 and clamps 17 on ends 13 of cable 5 compresses the material, thus bringing together and increasing the contact pressure of adjacent conductive particles 9, and so further reducing local resistance of the material.

The advantages of the connector according to the present invention will be clear from the foregoing description.

In particular, it is extremely cheap to produce, and entails no preassembly work, the cable simply being cut to size, fitted on to the respective spark plug and distributor connectors, and, if necessary, clamped in position.

The connection so formed provides for improved operation of the engine as compared with known connections, by virtue of the low resistance of conductive element 6 in the particular application described.

To those skilled in the art it will be clear that changes may be made to connector 1 as described and illustrated herein without, however, departing from the scope of the present invention.

Claims

1. An electrical connector for connecting a first and second component, particularly suitable for high operating voltages, and comprising a cable consisting of a conductive element and an insulating sheath, and means for connecting the respective ends of said cable to respective said components; characterized by the fact that said conductive element (6) is tubular and made of a composite material consisting of a matrix (8) of flexible, electrically insulating material, and particles (9) of electrically conductive material dispersed in substantially uniform, random manner inside said matrix (8); said connecting means comprising two pin connectors (10, 11) on said first and second components (2, 4) respectively, which are inserted inside respective end portions (13) of said cable (5).
2. A connector as claimed in Claim 1, characterized by the fact that said sheath (7) of said cable (5) is made of pure silicon.
3. A connector as claimed in Claim 1 or 2, characterized by the fact that said sheath (7) is co-extruded with said conductive element (6).
4. A connector as claimed in one of the foregoing Claims, characterized by the fact that it comprises means (17) for clamping said end portions (13) of said cable (5) to respective said pin connectors (10, 11).
5. A connector as claimed in Claim 4, characterized by the fact that said clamping means comprise at least one metal clamp (17) having a tangential clamping screw (18).

6. A connector as claimed in any one of the foregoing Claims, characterized by the fact that said pin connectors (10, 11) present a substantially cylindrical portion (12) on to which a respective said end portion (13) of said cable (5) is fitted; and an annular shoulder (14), adjacent to said portion (12), for axially arresting said cable (5); said portion (12) presenting a truncated-cone-shaped lead-in end (15), and an intermediate V-shaped annular groove (16).
7. A connector as claimed in any one of the foregoing Claims, characterized by the fact that said first component is a spark plug (2) of an internal combustion engine (3); and said second component is a distributor (4).

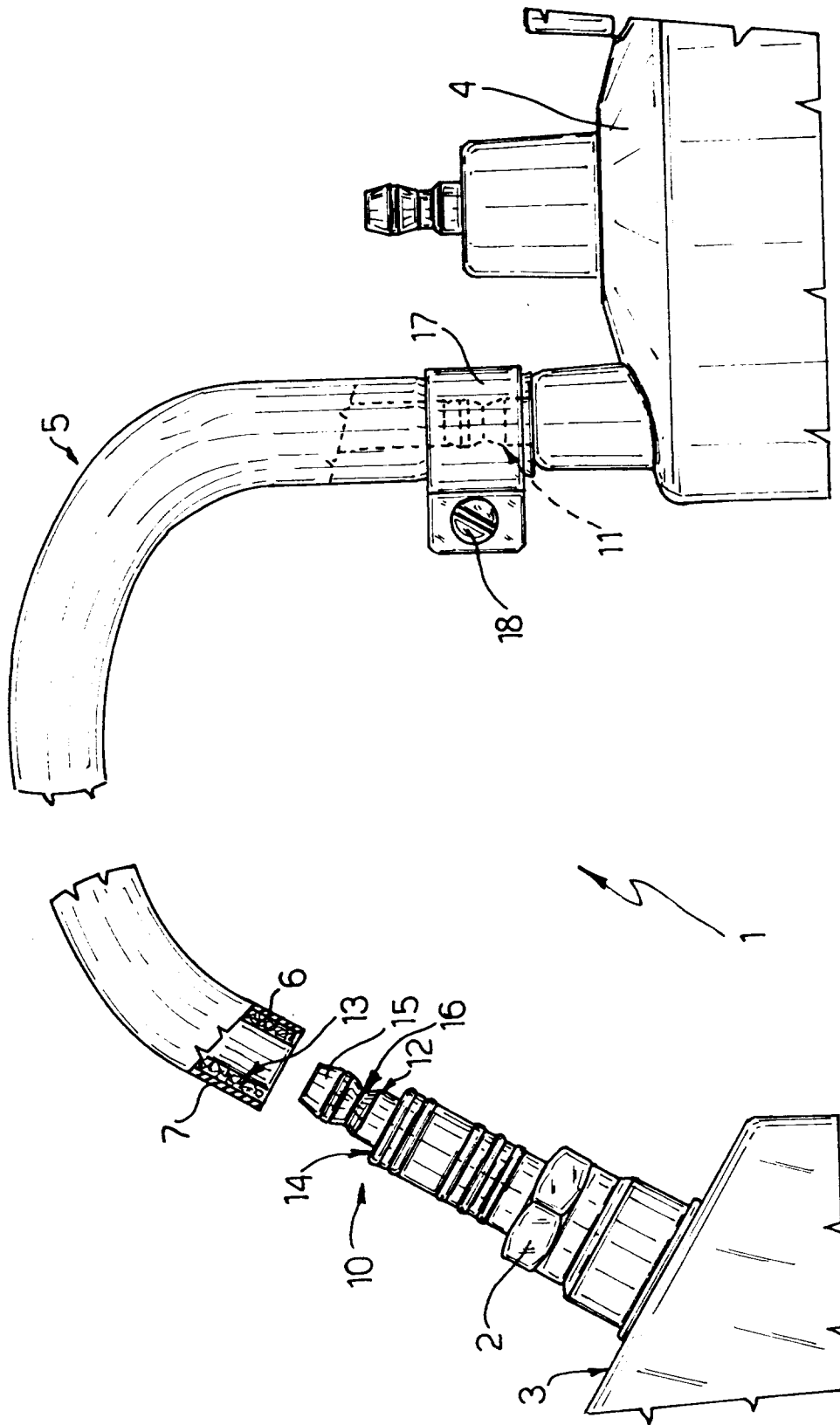
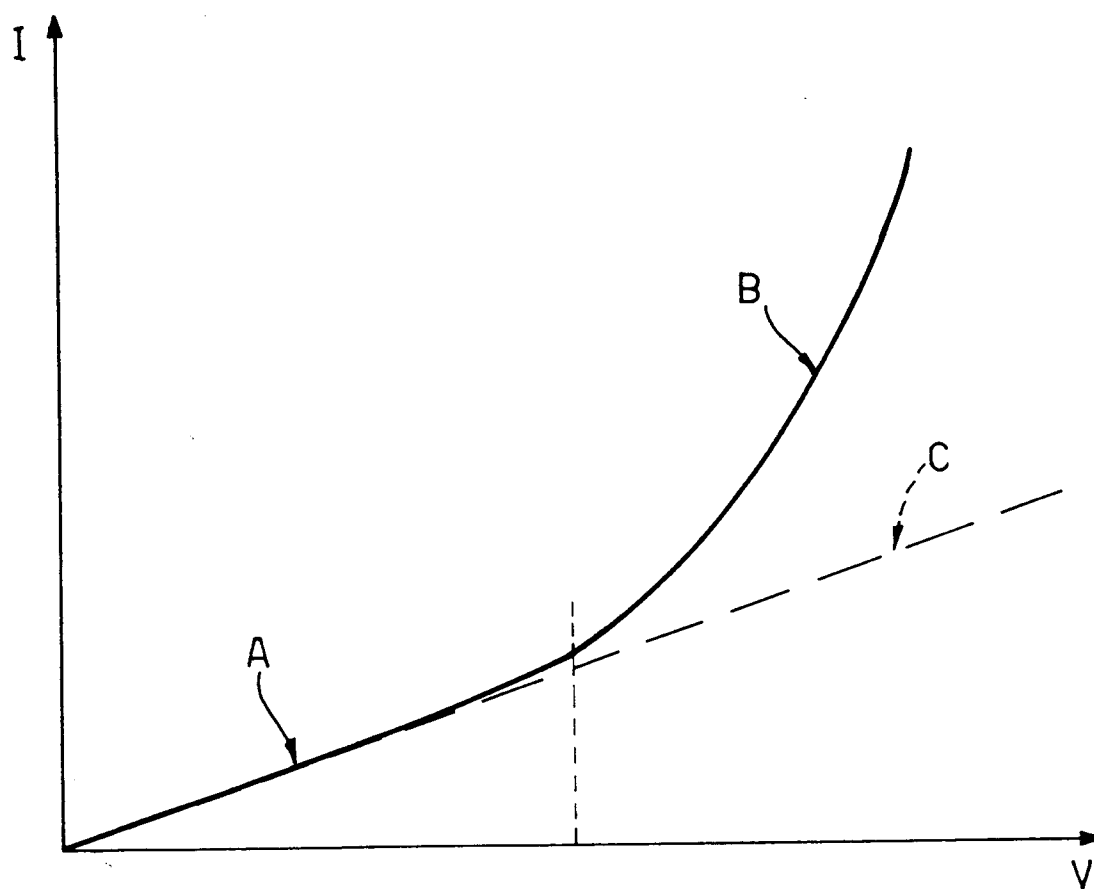
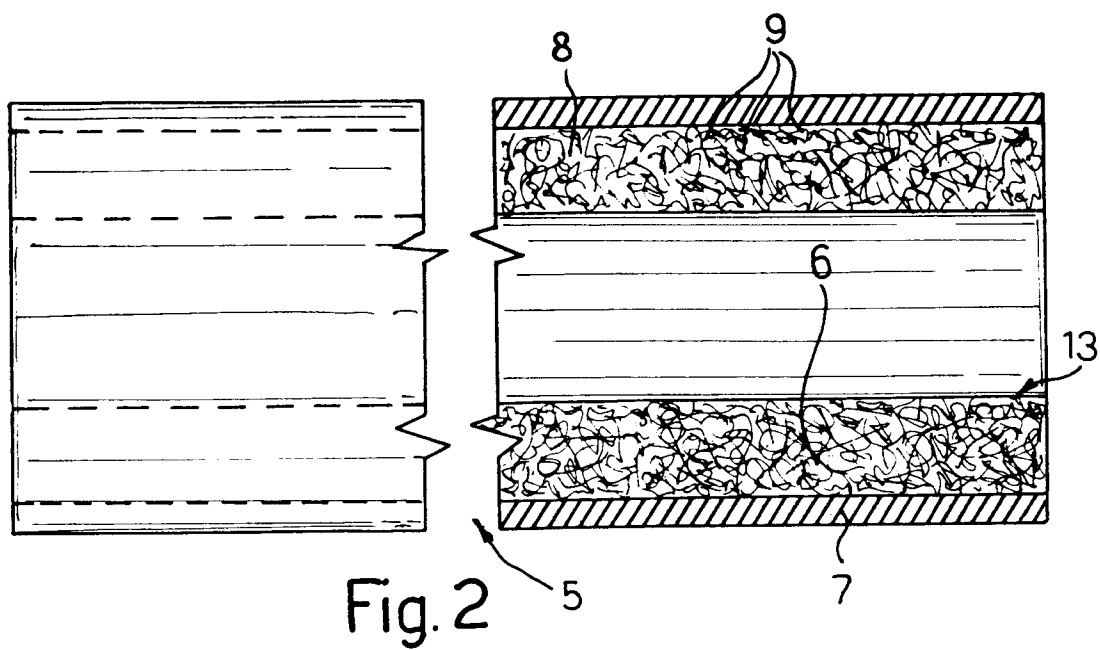


Fig. 1





European Patent
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EUROPEAN SEARCH REPORT

Application Number

EP 92 10 6954

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X	EP-A-0 359 533 (THE GATES RUBBER COMPANY LIMITED) * the whole document *	1-7	H01R11/18
A	US-A-3 991 397 (OWENS-CORNING FIBERGLAS CORPORATION) * column 1, line 14 - line 27 * * column 2, line 66 - column 3, line 2 *	1-2,7	
A,D	EP-A-0 311 813 (LEDA LOGARITHMIC ELECTRICAL DEVICES FOR AUTOMATION S.R.L.) * column 3, line 8 - line 45 *	1-2	
A	FR-A-2 456 896 (RASMUSSEN GMBH) * figure 5 *	1,5	
A	GB-A-2 177 769 (J.DEREK GUEST) * page 1, line 127 - page 2, line 5 *	1,5-6	
A	EP-A-0 174 776 (MINNESOTA MINING AND MANUFACTURING COMPANY) -----	1-2	
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			H01R F16L
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 17 DECEMBER 1992	Examiner S. Sibilla
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			