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(54) Spark plug connector.

(57) A spark plug connector including a high tension lead (11) terminated at one end with a terminal (12) for receiving a corresponding terminal of a spark plug, an elongate, flexible, electrically insulating sleeve (13) within which are housed an end region of said high tension lead (11) and the terminal (12) attached thereto, the lead (11) extending from one end region (17) of said sleeve (13), and the opposite end region (14) of the sleeve (13) being open to receive, in use, the terminal region of the spark plug for mating engagement with said terminal of said lead. The connector further includes a rigid, electrically insulating body (19) within which said one end region (17) of said sleeve (13) is supported, said one region (17) of the sleeve (13) having at least one laterally outwardly extending, integral protrusion (18) exposed by way of a respective window in the wall of the rigid body (19). The invention further resides in a method of manufacturing such a connector.

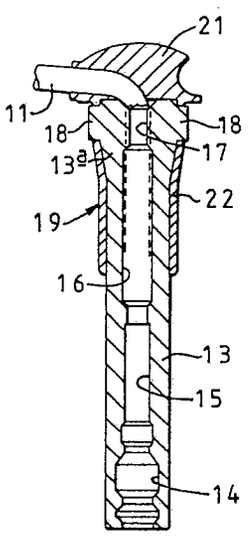

FIG 5

EP 0 324 552 A1

Description

SPARK PLUG CONNECTOR

This invention relates to spark plug connectors for use with the spark plugs of an internal combustion engine, and to a method of manufacturing such connectors.

Certain internal combustion engine designs incorporate a well which may be of the order of 100mm in depth, and at the base of which the spark plugs are located. Problems encountered with such a design include the difficulty of engagement of a connector with, and disengagement of the connector from, the spark plug, adequate insulation between the conductive components of the connector and the walls of the well, and the secure fixing of the connector in position against vibration in use. British patent application No. 2165000A discloses a spark plug connector for use in an internal combustion engine where the spark plugs are disposed at the bases of respective wells. The connector disclosed in 2165000A is disadvantageous in that it is an assembly of four separately formed components and as such is expensive and time consuming to produce. The region at which the connector is gripped to effect insertion or removal is formed from a soft rubber to provide sealing but by virtue of this softness handling of the connector may be impaired. It is an object of the present invention to provide a spark plug connector wherein these and other allied problems are overcome.

A spark plug connector in accordance with a first aspect of the present invention comprises a high tension lead terminated at one end with a terminal for receiving a corresponding terminal of a spark plug, an elongate, flexible, electrically insulating sleeve within which are housed an end region of said high tension lead and the terminal attached thereto, the lead extending from one end region of said sleeve, and the opposite end region of the sleeve being open to receive, in use, the terminal region of the spark plug for mating engagement with said terminal of said lead and, a rigid, electrically insulating body within which said one end region of said sleeve is supported, said one end region of said sleeve having at least one laterally outwardly extending, integral protrusion exposed by way of a respective window in the wall of the rigid body.

Preferably said rigid body is moulded around said one end region of said sleeve after insertion of said lead in to said sleeve.

Preferably said lead is bent, as it exits from said sleeve, to lie generally at right angles to the length of the sleeve, and is maintained in such orientation relative to the sleeve by the body.

Desirably said one end region of said sleeve includes a plurality of angularly spaced, radially outwardly extending, integral protrusions, said protrusions extending radially outwardly through respective windows in said rigid body.

Preferably said rigid body is shaped to facilitate manual gripping of the connector.

In accordance with a second aspect of the present invention there is provided a method of manufacturing a spark plug connector comprising the steps of introducing a terminated end of a high tension lead into an elongate, flexible, electrically insulating sleeve so that the terminated end of the lead is received within the sleeve and the lead extends from one end region of the sleeve, the opposite end region of the sleeve being open to receive, in use, a mating terminal region of a spark plug, and, moulding a rigid, electrically insulating body around said one end region of said sleeve said one end region of the sleeve having at least one integral laterally outwardly extending protrusion around which said rigid body is moulded so that the protrusion extends through the body.

Preferably the method includes the step of displacing the lead, where it extends from the sleeve, prior to moulding the body, so that the projecting portion of the lead lies substantially at right angles to the sleeve, and then arranging the moulding of said body such that said moulded body holds the lead in the chosen orientation.

Conveniently the step of moulding the body is such that the body is moulded around a plurality of radial protrusions integral with the sleeve, whereby the protrusions extend through the moulded body.

One example of the invention is illustrated in the accompanying drawings wherein,

Figure 1 is a side elevational view of a spark plug connector,

Figure 2 is a plan view of the connector shown in Figure 1,

Figure 3 is a sectional view on the line 3-3 in Figure 1,

Figure 4 is a front elevational view of the connector of Figure 1,

Figure 5 is a sectional view on the line 5-5 in Figure 4, and

Figure 6 is a side elevational view of the portion of the high tension lead and the terminal carried thereby, which is received within the flexible sleeve of the connector.

Referring to the drawings the spark plug connector comprises a conventional high tension electrical lead 11 conveniently incorporating radio frequency suppression, the lead comprising an electrical conductive core in a multi-layer electrically insulating sheath, and being terminated at one end with a resilient, tubular, metal terminal 12. The lead 11 extends into one end of the terminal 12, the terminal 12 being crimped around the lead and being electrically connected to the core thereof. The other end of the terminal is open to receive, as a push fit, the terminal post of a spark plug.

The terminated end region of the lead 11 is received within an elongate, flexible, electrically insulating sleeve 13 formed from silicon-rubber. In the example shown in the drawings the sleeve 13 is 120mm in length but it will be understood that the length of the sleeve 13 is determined by the depth of the spark plug well of the engine with which the connector is to be utilized. The internal bore of the

sleeve 13 is shaped at one end 14 to receive and grip the terminal end region of a spark plug. Adjacent the region 14 the bore of the sleeve includes a region 15 which in use grips the terminal 12 and the associated region of the lead 11 inserted into the sleeve. Next the bore includes a region 16 through which the lead 11 extends as a close fit, and finally the bore terminates, at its end remote from the region 14, in a region 17 which grips the lead 11. The open end of the region 17 is chamferred to permit the projecting portion of the lead 11 to be bent to lie at an angle to the length of the sleeve 13. It will be recognised that the lead 11 extends from the end of the sleeve 13 remote from the bore portion 14, the terminal 12 being within the bore of the sleeve 13 so that in use the terminal end region of a spark plug must be introduced into the portion 14 of the bore of the sleeve to matingly engage the terminal 12.

Externally the sleeve 13 is of plain cylindrical form throughout the majority of its length, but adjacent the end where the lead 11 protrudes the sleeve includes a short tapering region 13a and four integral, equiangularly spaced, radially outwardly extending protrusions 18.

The final component of the spark plug connector illustrated in the drawings is a rigid, moulded synthetic resin, electrically insulating body 19 at one end of the sleeve 13. The connector is manufactured by cutting an appropriate length of high tension lead 11 and terminating it at one end with a terminal 12. The terminated end of the lead is then introduced into a respective preformed sleeve 13 so that the terminal 12 seats within the region 15 of the bore of the sleeve, the remainder of the lead extending within the bore and issuing therefrom at the open end of the region 17. The end of the sleeve 13 carrying the protrusions 18 is then introduced into a mould and the projecting portion of the lead 11 is bent to lie at a chosen, predetermined, angle to the length of the sleeve. In the example illustrated in the drawings the lead extends substantially at right angles to the sleeve 13, and in practice the angle subtended between the axis of the sleeve 13 and the projecting length of the lead 11 is 95°. The body 19 is then moulded around the end region of the sleeve 13 and the projecting portion of the lead 11. The material of the body conveniently is polybutylene terephthalate and when the body 19 hardens it retains the chosen angular orientation of the sleeve 13 and the projecting portion of the lead 11.

The shaping of the mould which is utilized in moulding the body 19 around the end region of the sleeve 13 is such that the body 19 includes, at its free end, a finger grip portion 21 for facilitating manual gripping and manipulation of the connector in use, and an integral collar 22 which tightly encircles the tapering portion 13a and the ajoining region of the sleeve 13 to provide rigid support for the sleeve 13 at its end which will be uppermost in use. Moreover, the wall of the mould is engaged by the free ends of the protrusions 18 so that during moulding the material of the body flows around the sides, but not the ends, of the protrusions and thus the body 19 is formed with windows through which the protrusions 18 project. It will be noted that the collar 22 of the body 19 equiangularly spaced apertures 23 through which the sleeve 13 is exposed. The apertures 23 are provided by four projections on the mould wall which locate and support the sleeve 13 during moulding of the body 19.

The free end surfaces of the protrusions 18 define parts of a common imaginary cylinder the diameter of which matches the diameter of the respective spark plug well of the associated internal combustion engine. Thus during insertion of the connector into its respective well the collar 22 of the body 19, and in particular the tapering portion thereof, centralizes the connector within the well so that the open end of the sleeve aligns with and receives the terminal end region of the spark plug, and the protrusions 18 engage the wall of the spark plug well so as to locate the connector within the well.

In some engine designs there may be very little head-room above the open end of the spark plug well or wells, and thus the body 19 ensures that the projecting portion of the respective lead 11 project at an appropriate angle. The rigid body 19 supports the flexible sleeve 13 during insertion and removal of the connector and its shaping facilitates manual handling of the connector. The electrically insulating nature of the sleeve 13 ensures that the terminal 12 is adquately electrically insulated from the wall of the spark plug well of the engine.

It will be recognised that the shaping of the body 19 can be varied to suit the intended application of the connector. Moreover, although it is preferred to form the body 19 as a one piece moulding it may, in certain circumstances, be chosen to mould the body 19 with an open free end so that the lead 11 can protrude axially, and to provide the body 19 with a snap-on cap which closes the end of the body, and deflects the lead 11 to a chosen angle. The snap-on cap could carry identifying indicia which of course may need to be different for different applications. In such circumstances a common body moulding would be provided and only the indicia on the snap-on cap would change.

Claims

1. A spark plug connector comprising a high tension lead (11) terminated at one end with a terminal (12) for receiving a corresponding terminal of a spark plug, an elongate, flexible, electrically insulating sleeve (13) within which are housed an end region of said high tension lead (11) and the terminal (12) attached thereto, the lead (11) extending from one end region (17) of said sleeve (13), and the opposite end region (14) of the sleeve (13) being open to receive, in use, the terminal region of the spark plug for mating engagement with said terminal (12) of said lead (11) the connector being characterized by a rigid, electrically insulating body (19) within which said one end region of said sleeve is supported, said one end region (17) of said sleeve (13) having at least one laterally outwardly extending, integral protrusion (18) exposed by way of a respective

window in the wall of the rigid body (19).

2. A connector as claimed in claim 1 characterized in that said rigid body (19) is moulded around said one end region (17) of said sleeve (13) after insertion of said lead (11) in to said sleeve (13).

3. A connector as claimed in claim 1 or claim 2 characterized in that said lead (11) is bent, as it exits from said sleeve (13), to lie generally at right angles to the length of the sleeve (13), and is maintained in such orientation relative to the sleeve (13) by the body (19).

4. A connector as claimed in any one of claims 1 to 3 characterized in that said one end region (17) of said sleeve (13) includes a plurality of angularly spaced, radially outwardly extending, integral protrusions (18), said protrusions (18) extending radially outwardly through respective windows in said rigid body (19).

5. A connector as claimed in any one of claims 1 to 4 characterized in that said rigid body (19) is shaped to facilitate manual gripping of the connector.

6. A method of manufacturing a spark plug connector comprising the steps of introducing a terminated end of a high tension lead (11) into an elongate, flexible, electrically insulating sleeve (13) so that the terminated end of the lead (11) is received within the sleeve (13) and the lead (11) extends from one end region (17) of the sleeve (13), the opposite end region (14) of the sleeve being open to receive, in use a mating terminal region of a spark plug, the method being characterized by moulding a rigid, electrically insulating body (19) around said one end region (17) of said sleeve (13), said one end region (17) of the sleeve (13) having at least one integral laterally outwardly extending protrusion (18) around which said rigid body (19) is moulded so that the protrusion (18) extends through the body (19).

7. A method as claimed in claim 6 characterized by the step of displacing the lead (11), where it extends from the sleeve (13), prior to moulding the body, (19) so that the projecting portion of the lead (11) lies substantially at right angles to the sleeve (13), and then arranging the moulding of said body (19) such that said moulded body (19) holds the lead (11) in the chosen orientation.

8. A method as claimed in claim 6 or claim 7 characterized in that the step of moulding the body (19) is such that the body (19) is moulded around a plurality of radial protrusions (18) integral with the sleeve (13), whereby the protrusions (18) extend through the moulded body (19).

9. A method as claimed in any one of claims 6 to 8 characterized in that the mould has a plurality of projections which engage and support the sleeve 13 during moulding of the body (19), the projections leaving apertures (23) in the body (19).

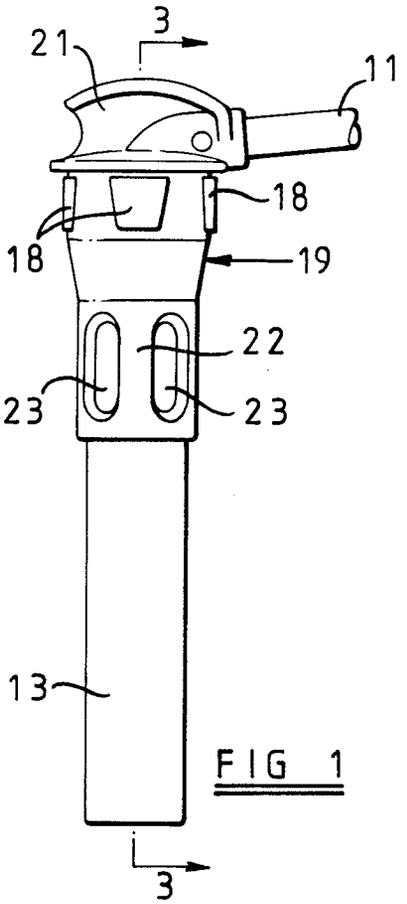

FIG 1

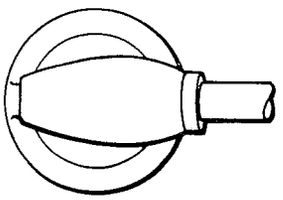

FIG 2

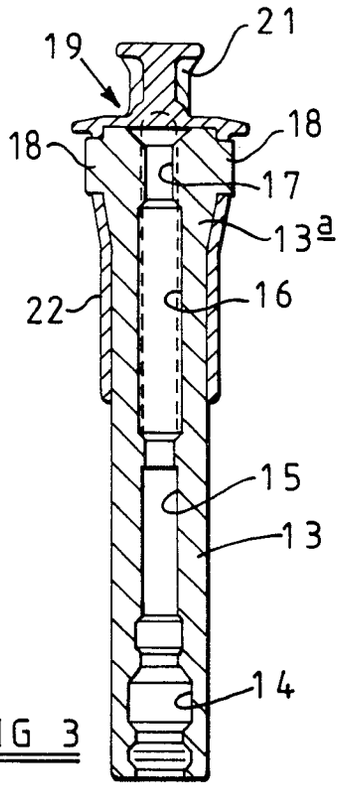

FIG 3

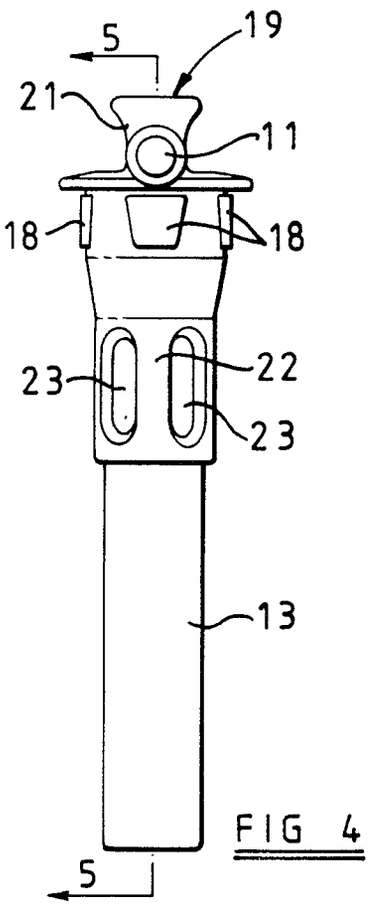

FIG 4

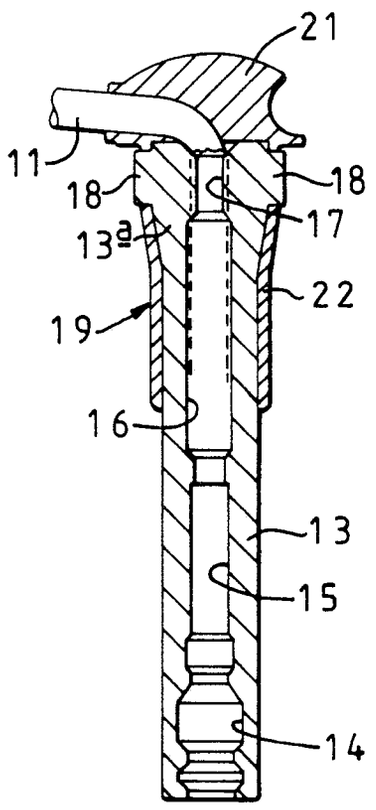

FIG 5

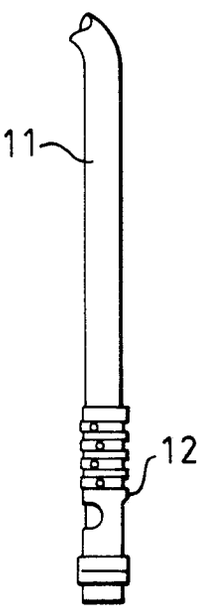

FIG 6

European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 89 30 0113

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.4)
A	DE-A-3619823 (YAMANASHI) * page 7, line 6 - line 17; figure 2 *	1, 3, 5.	H01T13/04
A	US-A-3914003 (LOY) * column 2, line 41 - line 45; figure 2 *	4, 8.	
D,A	GB-A-2165000 (YOSHIKI)		

TECHNICAL FIELDS SEARCHED (Int. Cl.4)

H01T

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	11 APRIL 1989	BIJN E.A.

CATEGORY OF CITED DOCUMENTS

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