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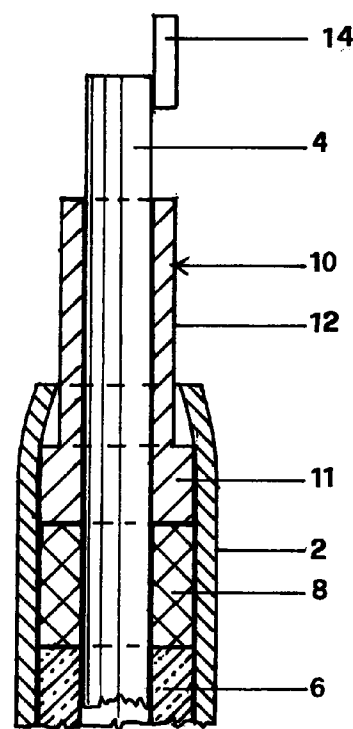
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(54) **Method for constructing armoured resistance elements, and resistance element obtained by the method**

(57) A method for constructing armoured resistance elements comprising the following steps:

- inserting a resistive conductor (4), provided at its ends with conducting terminals, into a metal sheath (2),
- fixing said conductor within said sheath by means of a granular insulating material (6), characterised by applying to each end of said sheath an elastically deformable plug (10) of dielectric material provided with a passage hole for the metal conductor, said plug partly projecting from said end, the ends of said sheath then being subjected to swaging.

**FIG.4**



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## Description

This invention relates to a method for constructing armoured resistance elements, and a resistance element obtained by the method.

Methods for constructing armoured resistance elements are known. These methods generally involve inserting into a metal sheath a resistive conductor with its end conductor terminals projecting from said sheath, fixing the conductor with insulating material (granular MgO), then rolling the sheath to reduce its diameter and compact the insulating material. After annealing the resistance element to improve its bendability, a silicone oil is applied to the end of the insulating material. Two insulating spacers preferably of steatite are then applied to the ends of the sheath.

These known resistance elements have however the drawback that with the passage of time, if left unused, they no longer provide a seal in that moisture can enter through gaps between the outer surface of the spacers and the sheath, to attack the magnesium oxide, which is hygroscopic and hence loses its dielectric characteristics.

On the other hand, the solution of firstly applying the two spacers and then annealing the resistance element does not enable the sheath to be completely annealed (ie along its entire length) because the two spacers would burn, so prejudicing the bendability of the element.

The object of the invention is to eliminate these drawbacks by providing a method for constructing a resistance element which prior to its use maintains its hermetic seal with time.

According to the invention this object and further ones are attained through a method for constructing armoured resistance elements as described in claim 1.

A preferred embodiment of the present invention is described in detail hereinafter with reference to the accompanying drawings, on which:

- Figure 1 is a longitudinal section through a resistance element on termination of the dielectric material insertion stage;  
 Figure 2 shows it in the same view as Figure 1 but provided with the insulating element;  
 Figure 3 shows it after swaging; and  
 Figure 4 is an enlarged view of the end part of the resistance element.

As can be seen from the figures, the method for constructing armoured resistance elements according to the invention comprises inserting into a steel sheath 2 a conductor 4 of ferro-nickel alloy so that both its ends project from the sheath.

Said conductor is maintained fixed within said sheath by an insulating material 6, preferably granular magnesium oxide. The sheath is then rolled to reduce its diameter and compact the magnesium oxide. It is

then annealed in an oxidizing furnace to improve the bendability of the sheath.

On termination of this operation, both ends of the insulating material 6 are impregnated with a dielectric fluid 8 in the form of silicone oil. On this layer there is then applied a mushroom-shaped teflon plug 10 having a head 11 which adheres to the silicone oil 8, and a shank 12 which emerges from the end of the sheath 2. The sheath prepared in this manner is then swaged at its ends so that these assume a frusto-conical form to contact the shank 12 of the plug 10. A traditional terminal 14 is then welded to the ends of the metal conductor.

From the foregoing it is apparent that, by virtue of the swaging operation, the resistance element obtained by the method of the invention has the advantage of considerable resistance and sealing towards moisture during storage, and the ability to "transpire" during operation.

## Claims

1. A method for constructing armoured resistance elements comprising the following steps:
  - inserting a resistive conductor (4), provided at its ends with conducting terminals, into a metal sheath (2),
  - fixing said conductor within said sheath by means of a granular insulating material (6), characterised by applying to each end of said sheath an elastically deformable plug (10) of dielectric material provided with a passage hole for the metal conductor, said plug partly projecting from said end, the ends of said sheath then being subjected to swaging.
2. A method as claimed in claim 1, characterised by effecting the following steps before applying the plugs of dielectric material:
  - rolling the sheath to reduce its diameter and compact the insulating material,
  - annealing the resistance element,
  - applying to the ends of the sheath an insulating oil (8) to impregnate the granular insulating material.
3. A method as claimed in claim 1, characterised by applying a substantially mushroom-shaped plug (10).
4. A resistance element obtained by the method of claims 1 to 3, characterised by comprising:
  - a sheath (2),
  - a resistive conductor (4), provided at its ends with conducting terminals with their ends projecting from the sheath,

- an insulating support (6) which fixes said conductor within said sheath,
- end plugs (10) traversed by said conductor and partly projecting from said sheath.

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5. A resistance element as claimed in claim 4, characterised in that the plugs are of mushroom shape.

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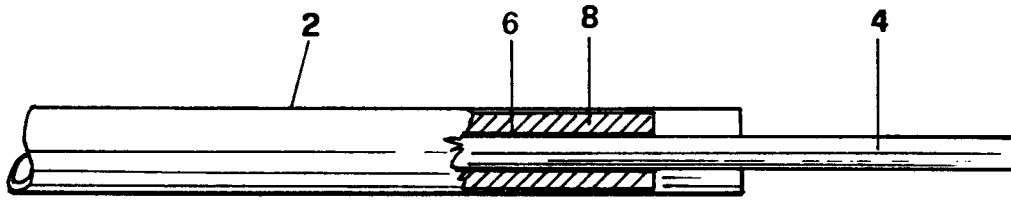


FIG.1

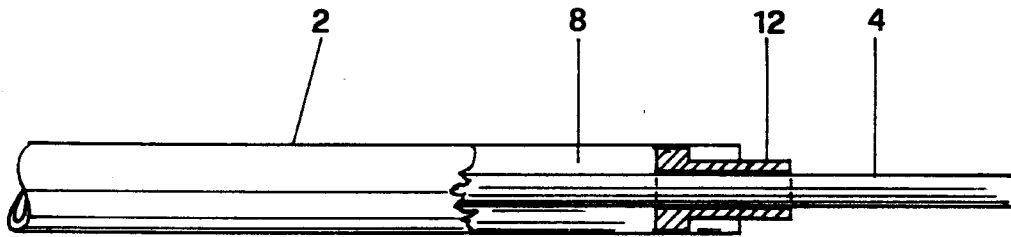


FIG.2

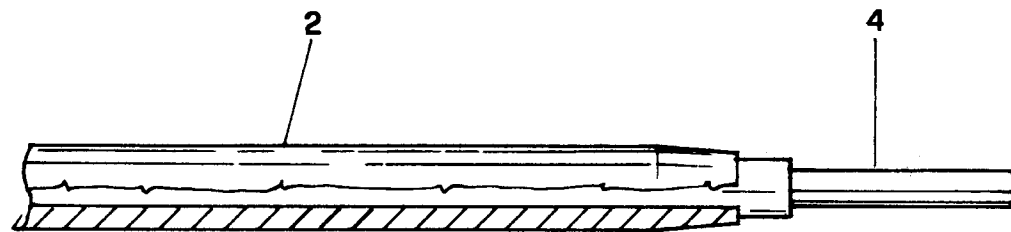


FIG.3

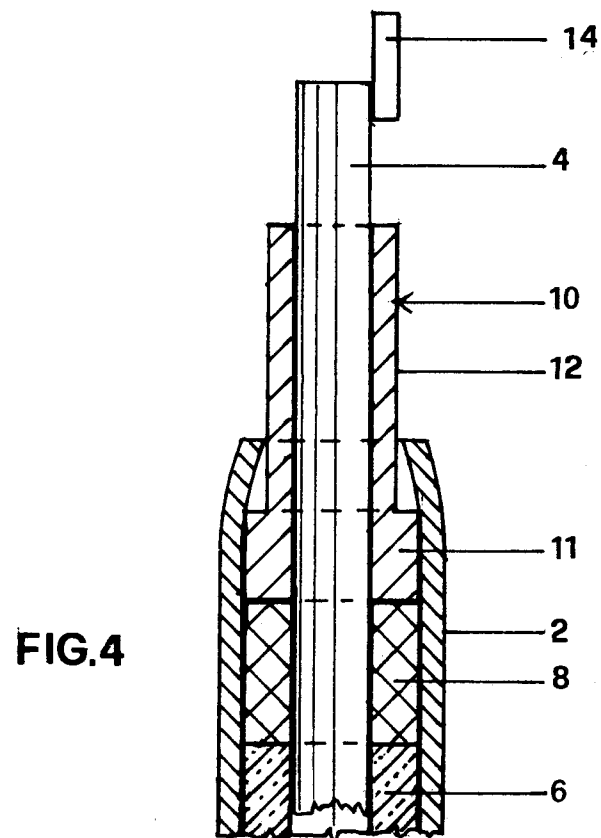


FIG.4



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# EUROPEAN SEARCH REPORT

Application Number  
EP 98 10 0433

| 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.6) |
| X                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | EP 0 010 275 A (ELPAG AG CHUR) 30 April 1980<br>* the whole document *<br>---                                       | 1,3-5                            | H01C1/03<br>H05B3/48                         |
| X                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | EP 0 157 182 A (ELPAG AG CHUR) 9 October 1985<br>* figures 5-13 *<br>* page 7, line 26 - page 8, line 9 *<br>---    | 1,3-5                            |                                              |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | US 4 314 401 A (SAKU ISAMU) 9 February 1982<br>* figures 7-10 *<br>* column 2, line 40 - column 3, line 42 *<br>--- | 1,2                              |                                              |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | DE 42 35 727 A (LICENTIA GMBH) 28 April 1994<br>* abstract; claims; figures *<br>---                                | 1,4                              |                                              |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | GB 2 021 908 A (IRCA SPA) 5 December 1979<br>-----                                                                  |                                  |                                              |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                     |                                  | TECHNICAL FIELDS SEARCHED (Int.Cl.6)         |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                     |                                  | H05B<br>H01C                                 |
| The present search report has been drawn up for all claims                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                     |                                  |                                              |
| Place of search                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                     | Date of completion of the search | Examiner                                     |
| THE HAGUE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                     | 5 June 1998                      | Wirner, C                                    |
| <p>CATEGORY OF CITED DOCUMENTS</p> <p>X : particularly relevant if taken alone<br/>Y : particularly relevant if combined with another document of the same category<br/>A : technological background<br/>O : non-written disclosure<br/>P : intermediate document</p> <p>T : theory or principle underlying the invention<br/>E : earlier patent document, but published on, or after the filing date<br/>D : document cited in the application<br/>L : document cited for other reasons<br/>&amp; : member of the same patent family, corresponding document</p> |                                                                                                                     |                                  |                                              |

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