Feb. 29, 1944. D. H. CORBIN ET AL 2,342,842

METHOD OF SEALING ELECTRICAL CONDUCTORS IN INSULATORS

Filed Oct. 8, 1940

Fig. 1.

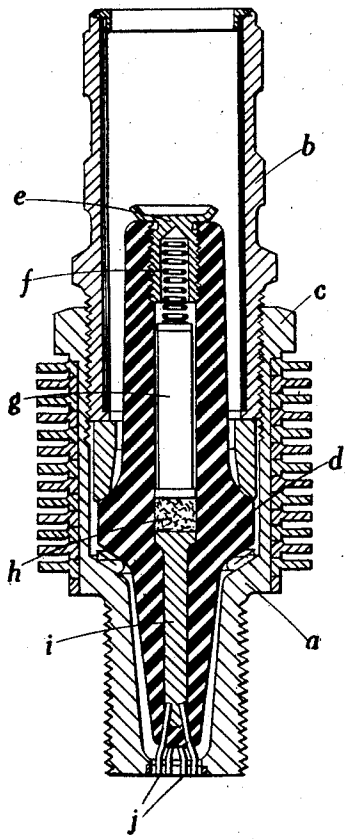


Fig. 2.

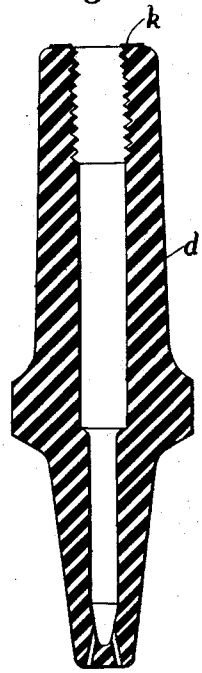


Fig. 3.

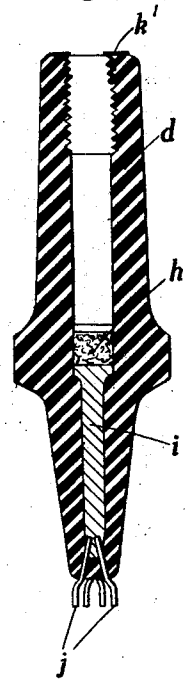


Fig. 4.

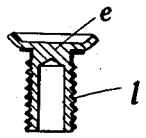
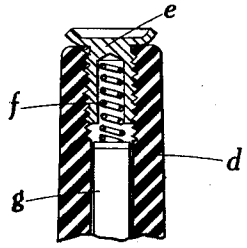


Fig. 5.



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METHOD OF SEALING ELECTRICAL CONDUCTORS IN INSULATORS

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Application October 8, 1940, Serial No. 360,316
In Great Britain October 16, 1939

1 Claim. (Cl. 123—169)

This invention relates to methods of sealing conductors in insulators, and is particularly concerned with the attachment of the conductor to and the sealing of the conductor in a non-porous, highly refractory insulator.

Difficulty is experienced in attaching any metal or sealing means to such insulators, on account of their non-porosity and also on account of the inability of known sealing materials to withstand the high temperature at which such insulators are fired.

According to this invention the conductor is attached to and sealed in the insulator by means of a metallic coating applied in a fine state to the insulator in its unfired condition, so that after firing the insulator is coated at the part where the joint or seal is to be effected, by a layer of the metal or alloy. By this means the conductor can be soldered or brazed to the insulator and sealed therein.

Platinum or a platinum-group alloy, such as alloys of platinum with rhodium, ruthenium and palladium, form suitable coatings.

The invention is particularly applicable to the sealing of a central electrode in the insulator of a spark plug. Such insulators as now used are made of highly refractory oxides such as those of aluminium, zirconium and the like. They are non-porous after firing and consequently there is difficulty in sealing the electrode in the insulator.

A spark plug having an insulator formed mainly of alumina is shown in Figure 1 of the accompanying drawing the other figures of which show the various steps of the process.

The spark plug shown in Figure 1 is intended to be connected at its top end to a shielded harness (not shown) and it consists of an outer, finned shell *a* having a shield connector piece *b* held thereon by a nut *c*. Inside the shell is the insulator *d* through whose centre is a composite electrode consisting of a threaded retainer *e*, adapted to contact with the central connector of the harness (not shown), a spring *f*, a resistor element *g*, a conductive seal *h*, a conductive core *i*, and spark terminals *j*.

The invention can be applied to various forms of conductors in insulators and as applied to spark plugs, the simplest application would be to one having a simple, single-piece electrode. For illustrative purposes the attachment of the threaded retainer *e* to the insulator *d* will be described with reference to Figures 2 to 5.

First, a quantity of platinum-rhodium alloy, consisting of 90% platinum and 10% rhodium, is reduced to the chloride salts by the action of aqua regia. The chloride salts are then reduced to metallic powder which is ground to a fine state and mixed with an oil or other liquid carrier. This mixture is then applied to the top part of the insulator as shown by the thickened line *k* in Figure 2, before it is fired. The insulator is then fired at a temperature of 1700° C. or so, and after firing, the alloy is found to adhere to the insulator and provide it with a metallic surface as indicated by the thickened line k^1 in Figure 3 which shows the shrunken insulator *d* with core *i* and terminals *j* in place, ready for the further assembly of the other parts.

The threaded retainer *e* is then tinned, as shown diagrammatically by the thick line *l* in Figure 4, by means for example, of a suitable flux such as zinc chloride. The resistor element *g* and spring *f* are then inserted, as shown in Figure 5 and the retainer is then screwed into position and the whole assembly heated so as to produce a gas-tight joint.

The invention is not limited to the above specific procedure, for the obtaining of the mixture of the metal in the oil or other liquid can be produced in various ways other than by the initial reduction of the alloy to the chloride salts. Furthermore the invention is not limited to the particular platinum-rhodium alloy nor to an alloy of these particular metals themselves.

What we claim and desire to secure by Letters Patent is:

A method of making a spark plug having an insulator with a threaded central bore, which comprises coating the threaded part of said bore with finely divided metal before the insulator is fired, then firing the insulator to a dense non-porous condition at a temperature to form said metal into a layer, and subsequently attaching a threaded retainer piece to said layer.

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