

Aug. 8, 1944.

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2,355,443

METHOD OF SEALING SPARK PLUG ELECTRODES IN CERAMIC INSULATORS

Filed Feb. 23, 1942

FIG-1-

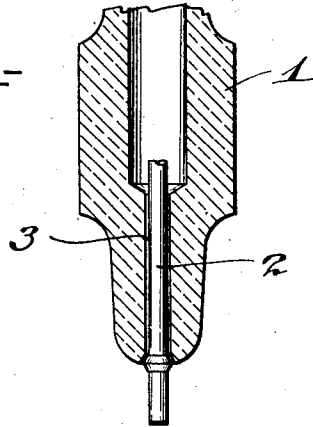
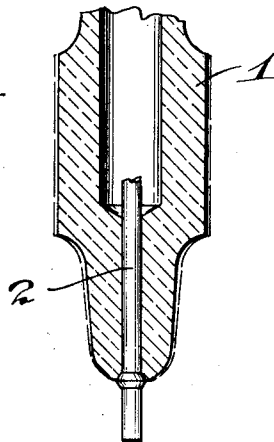


FIG-2-



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2,355,443

METHOD OF SEALING SPARK PLUG ELECTRODES IN CERAMIC INSULATORS

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Application February 23, 1942, Serial No. 432,024

5 Claims. (Cl. 18—59)

This invention relates to spark plugs, and particularly to a method of efficiently sealing electrodes in the ceramic insulators thereof.

Considerable difficulty has been experienced in sealing electrode wires in ceramic insulators either by heat shrinking a green insulator around an electrode, or by inserting the electrode into a matured insulator with or without a sealing medium.

In the case of the green insulator, the shrinkage from firing is considerable both longitudinally and latitudinally of the insulator, and as a result the electrode wire may be too loosely fastened to provide a tight joint, or it may be so tightly fastened as to cause the insulator to split or set up weakening strains therein. In the case of the fired insulator, there is no opportunity to shrink the insulator on the wire and sealing mediums must, therefore, be employed.

The object of the present invention is to obviate these objections by the provision of a method of sealing electrode wires in ceramic insulators, which is simple and economical to perform and effects an efficient sealing thereof by shrinkage without the use of separate sealing mediums and without causing a splitting of the insulator or setting up injurious strains therein.

The invention is fully described in the following specification, and illustrated by the accompanying drawing, in which—

Figure 1 is a central longitudinal section of an initially fired or partially shrunk insulator with an electrode positioned in its bore and showing a slight free space between the insulator and bore wall, and Fig. 2 is a similar view thereof after the final firing or shrinking operation, showing the insulator and electrode in intimate sealed contact.

My method consists in prefiring the ceramic insulator 1 without the electrode wire 2 therein until all but a very small amount of the shrinkage has been removed therefrom. The electrode is then inserted into the insulator bore, with which it has a free sliding fit, as indicated by the space 3, and the insulator is then given a final fire to maturity, which fire is preferably of a rapid nature. The initial firing leaves enough shrinkage in the insulator to bring about an efficient tight sealing of the electrode wire therein during the final firing without setting up harmful strains and stresses in the insulator material.

The purpose of the rapid final firing after the electrode has been inserted is to prevent the recrystallization and consequent rough surface of the electrode, which is produced with a pro-

longed firing and particularly with a firing necessary to fire a green insulator and shrink it onto an electrode. The present method is also found to reduce or avoid the objectionable longitudinal scoring of the electrode, such as is frequently caused where a green insulator is shrunk onto an electrode by a single firing.

It will, of course, be understood that whenever considered necessary or desirable, a wetting agent or melting flux may be applied to the insulator or electrode, or both, to provide a more intimate contact between the members.

In practice, the electrode used in connection with a ceramic insulator is usually of platinum, or its alloys, inasmuch as most other metals usable for electrodes oxidize and disintegrate, or else melt and flow, at the temperatures encountered in the final shrinking of a ceramic insulator onto an electrode wire. It is thus apparent that the metal or alloy for the electrode should be of a nature, or be treated, to withstand oxidizing and should withstand melting at maturing temperature of the body to which it is joined, and also that its co-efficient of expansion should be similar to that of the insulator.

The following is an illustration of an efficient manner of performing the method where an insulator body of such material as described in my application for patent Serial No. 210,466, filed May 27, 1938, now Patent No. 2,274,067, dated February 24, 1942, is used in connection with a platinum electrode of approximately .051" diameter: The unfired insulator body, provided with an electrode-receiving bore of approximately .059" diameter, and fired for approximately six hours at a temperature of approximately 2900° F., will shrink sufficiently to reduce the bore to approximately .052" diameter. The electrode is then properly positioned in the bore and the insulator is quickly brought up to a temperature of approximately 2950° F. and held there for approximately two hours. This causes the bore diameter to be reduced to approximately .050", thus giving the equivalent of approximately a .001" press fit, which is very satisfactory.

It will be understood that the dimensions, temperatures and times above-referred to are merely illustrative of what has been found to be satisfactory to obtain the most desirable results when using the specified materials and sizes, and that such items may be varied to suit the conditions as to sizes, materials, etc., encountered. It will also be apparent that any reduction by shrinkage of the green insulator, short of an extent which will permit the elec-

trode wire to be inserted in the bore, will produce an advantage over the common method of sealing wires in insulators wherein only a single firing of the insulator to maturity is practiced and the wire is disposed in the insulator during the entire firing.

Having thus described my invention, what I claim as new, and desire to secure by United States Letters Patent, is:

1. The method of sealing an electrode in the bore of a ceramic insulator for a spark plug and wherein the electrode is smaller in diameter than the bore of the green insulator, which consists in initially firing the green insulator to an extent slightly short of maturity to shrink the bore a predetermined extent so that the electrode has a sliding fit therein, then positioning the electrode in the bore, and giving the insulator a final fire to maturity to shrink the bore of the insulator into intimate and sealing contact with the electrode therein.

2. The method of sealing an electrode in the bore of a ceramic insulator for a spark plug and wherein the electrode is smaller in diameter than the bore of the green insulator, which consists in giving the green insulator an initial firing to an extent slightly short of complete firing shrinkage to partially reduce the size of its bore and then a rapid final firing to maturity of shorter duration than the initial firing, and placing the electrode in the bore between the two firings, whereby it is sealed in the insulator by the resultant shrinkage from the final firing.

3. The method of sealing an electrode in the bore of a ceramic insulator for a spark plug and wherein the electrode is smaller in diameter than the bore of the green insulator, which con-

sists in giving the green insulator an initial firing to reduce the size of its bore by shrinkage a predetermined extent and then positioning the electrode in the bore then firing to maturity and sealing the electrode in the insulator by the resultant shrinkage from the final firing, the initial firing reducing the bore diameter to within approximately .003 of an inch of its final shrinkage diameter.

4. The method of sealing an electrode in the bore of a ceramic insulator for a spark plug and wherein the electrode is smaller in diameter than the bore of the green insulator, which consists in giving the green insulator an initial firing to reduce the diameter of its bore from approximately .059" to approximately .052", then inserting an electrode wire in the bore with a clearance of approximately .001 of an inch, and then giving the insulator a rapid firing to maturity to seal the electrode therein.

5. The method of sealing a platinum or platinum alloy electrode in the bore of a ceramic insulator for spark plugs and wherein the electrode is smaller in diameter than the bore of the green insulator, which consists in giving the green insulator an initial firing of approximately six hours to a temperature of approximately 2900° F. to reduce by shrinkage the size of its bore a predetermined extent, and then subjecting the insulator to a final firing to maturity, wherein it is quickly brought up to approximately 2950° F. and held there for approximately two hours, and positioning the electrode in the bore between the two firings, whereby it is sealed in the insulator by the resultant shrinkage from the final firing.

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