June 13, 1944. J. A. JEFFERY 2,351,128

METHOD OF EFFECTING SEAL BETWEEN CENTER ELECTRODE AND INSULATOR OF SPARK PLUGS

Filed Feb. 23, 1942

FIG-1-

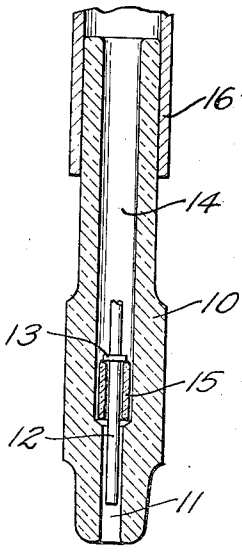


FIG-2-

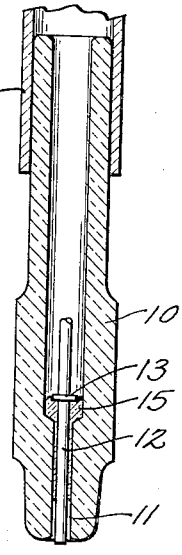


FIG-3-

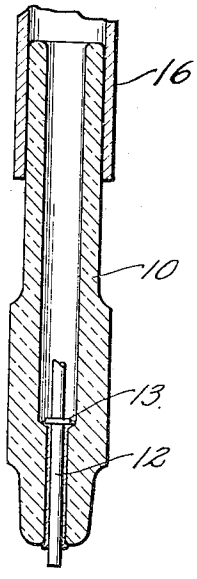


FIG-4-

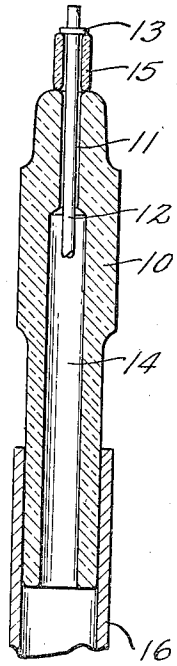


FIG-5-

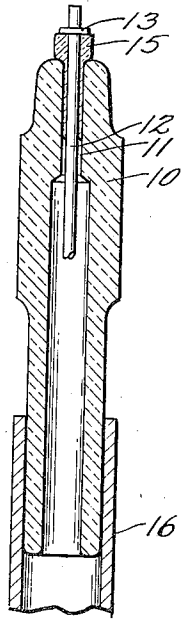


FIG-6-

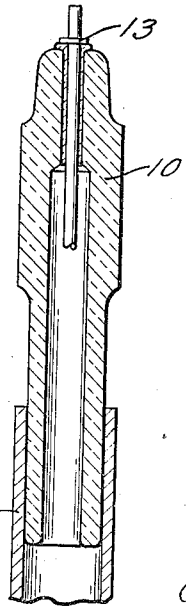
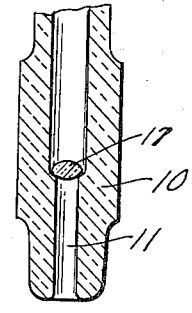


FIG-7-



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2,351,128

METHOD OF EFFECTING SEAL BETWEEN CENTER ELECTRODE AND INSULATOR OF SPARK PLUGS

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5 Claims. (Cl. 49—81)

This invention relates to spark plugs, and has for its object the provision of a novel, efficient and economical method of sealing center electrodes in the receiving bores of spark plug insulators.

The invention is illustrated in the accompanying drawing, in which—

Figure 1 is a central longitudinal section of a spark plug insulator showing the first step in one method of practicing the invention, with an electrode partially in position in the insulator receiving bore and a short tubular length of sealing glass in initial heating position thereon and in longitudinal section; Fig. 2 is a similar view with the glass tube melted and partially flown into the bore around the electrode and the electrode moved nearly to seating position in the insulator; Fig. 3 is a similar view showing the electrode sealing operation completed; Figs. 4, 5 and 6 are views similar to Figs. 1, 2 and 3, respectively, showing the electrode introduced from the outer end of the insulator and the sealing effected by external pressure, such as might be induced by the creation of a vacuum within the insulator, and Fig. 7 shows a small quantity of glass or glaze deposited in the insulator on the counterseat before the electrode is placed therein.

In the drawing, 10 designates the customary insulator of a spark plug, which insulator is preferably of ceramic material and has at its firing end a small central longitudinal bore 11 for receiving a center electrode 12. The bore 11 of the fired insulator should be slightly larger in diameter than the electrode wire to provide a slight space therebetween entirely around the electrode for receiving a sealing medium. In practice, a difference in diameter of .002 to .003 of an inch is found sufficient. This, however, may be increased or diminished within the scope of the invention.

The electrode 12 is provided with an upset 13 at a suitable location thereon to coact with the insulator 10 at one end of its bore 11 to properly position the assembly. In Figs. 1, 2 and 3 the upset 13 is located to have seating or stop coaction with the insulator on the counterseat at the inner end of the bore 11, while in Figs. 4, 5 and 6 it is shown as located to have stop coaction with the insulator at the outer end of said bore. The insulator is shown as having the customary larger center bore 14 extending to the rear end of the insulator from the inner end of the small bore 11.

In carrying out my invention it is found preferable in practice to deposit a small quantity of sealing medium 15, such for instance as glass or glaze, on the electrode near its upset or stop shoulder 13, in the form of a short tube section as shown in Figs. 1 and 4, or in any other suitable manner. This having been done, the electrode with the glass thereon is partially assembled with the insulator by inserting the free end portion of the electrode, which is without the sealing medium, into the proper end of the insulator bore. In this operation the insulator is preferably upright so that the electrode with its glass section or deposit falls by gravity to the position in the insulator shown in Fig. 1 or 4. Heat is then applied to the sealing medium to soften it to a flowing consistency and at the same time fluid pressure of a gaseous nature is applied to the sealing medium to induce its flow into the bore around the electrode. During this flowing of the sealing medium, the electrode moves therewith preferably but not necessarily by gravity until stopped by the coaction of its upset 13 with the respective marginal end wall of the bore.

If desired, a small quantity of the sealing medium 17 may be supplied to or over an end of the bore 11 separate from the electrode, as shown in Fig. 7, and when this has been softened the electrode may be introduced or permitted to pass therethrough into the bore. The sealing medium, at the same time, is forced by differential fluid pressure into the bore in sealing relation around the insulator.

If the electrode is provided with an upset 13 which seats on the insulator at the respective end of the bore and thereby closes such bore, it is necessary to flow the sealing medium into the bore around the electrode before such sealing occurs. If, however, the limit of movement of the electrode in the insulator bore is effected in some other manner than by an upset 13, so that the bore is not sealed against the sealing medium flowing therein, the flowing of the medium may be effected wholly or partially after the electrode has been placed in predetermined final assembled relation in the electrode.

It is further apparent that if the sealing medium is initially supplied to the end of the bore in a soft flowing state, it may, by suitable heating of the insulator, be maintained in or subsequently returned to such state preparatory to introducing the electrode therethrough into the bore or effecting a proper final assembling thereof.

The sealing medium may be forced into the in-

sulator bore 11 by suitable gaseous fluid pressure applied at the inner end of the bore in Figs. 1, 2 and 3, and at the outer end thereof in Figs. 4, 5 and 6. In each figure, 16 designates a nozzle or fitting engaged to the rear end of the insulator and in Figs. 1, 2 and 3 is intended to have connection with a fluid pressure supply source (not shown), and in Figs. 4, 5 and 6 with a vacuum source (not shown). This fluid force should be maintained until the excess of molten glass or glaze, which is used in sealing, starts to exude from the opposite end of the bore, and the sealing medium supply should be in sufficient quantity to fill the space in the bore between the insulator wire and bore wall to any desired depth.

The softening and maintaining of the sealing medium in a sufficiently fluent state to be forced into the insulator bore may be accomplished by heating the adjacent parts of the insulator sufficiently to effect such purpose.

If considered necessary or desirable, a lower melting wetting agent than the sealing medium may be first applied to the insulator or to the electrode, or both, so as to make a more intimate contact between the sealing medium and members. It will, of course, be understood that in order to obtain the most satisfactory results a proper co-efficient of expansion in the parts or materials should be maintained.

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

1. The method of providing a seal between the insulator and center electrode of a spark plug wherein the electrode is received by an insulator bore of greater diameter than the electrode to form a space therebetween, which consists in supplying a quantity of sealing medium of glass or glaze to one end of the bore, softening the medium by application of heat, introducing the electrode through the sealing medium to proper assembled relation to the insulator and when the sealing medium is soft forcing the sealing medium into the bore around the electrode by fluid pressure.

2. The method of providing a seal between the insulator and center electrode of a spark plug wherein the electrode receiving bore of the insulator is slightly larger in diameter than the electrode, which consists in supplying a quantity of sealing medium of glass or glaze to an end of the bore, heating the adjacent parts of the insulator to soften the sealing medium, introducing the electrode through the soft sealing medium and a predetermined extent into the bore and at the same time forcing the medium into and substantially filling the space in the bore around the electrode by application of fluid pressure to the sealing medium.

3. The method of providing a seal between an insulator and center electrode of a spark plug wherein the electrode is received by an insulator bore of greater diameter than the electrode to form a space therebetween, which consists in supplying a quantity of sealing medium of glass or glaze to an end of the bore, heating the adjacent parts of the insulator to soften the sealing medium a predetermined extent, introducing the electrode through the soft sealing medium and a predetermined extent into the bore and at the same time forcing the sealing medium into and substantially filling the space in the bore around the electrode by application of fluid pressure to the sealing medium at the inner end of the bore.

4. The method of providing a seal between an insulator and center electrode of a spark plug, wherein the electrode is received by an insulator bore of greater diameter than the electrode to form a space therebetween, which consists in supplying a quantity of sealing medium of glass or glaze to an end of the bore, heating the adjacent parts of the insulator to soften the sealing medium a predetermined extent, introducing the electrode through the soft sealing medium and a predetermined extent into the bore and at the same time forcing the sealing medium into and substantially filling the space in the bore around the electrode by application of fluid pressure to the sealing medium at the outer end of the bore.

5. The method of securing a center electrode in spark plug insulator bores, which bores are open at both ends and wherein the electrode has a stop shoulder for coaction with the insulator to limit the insertion of the electrode in the bore, which consists in depositing a sealing medium of glass or glaze to an end of the bore, rendering or maintaining the sealing medium soft by application of heat thereto through the insulator body, inserting the electrode to its limit in the insulator bore through the end thereof receiving said deposit and at the same time applying fluid pressure to the sealing medium to force it into the space between the electrode and wall of the bore to seal the electrode in the bore.

JOSEPH A. JEFFERY.