Sept. 5, 1950 T. OPERHALL 2,521,647

SPARK PLUG

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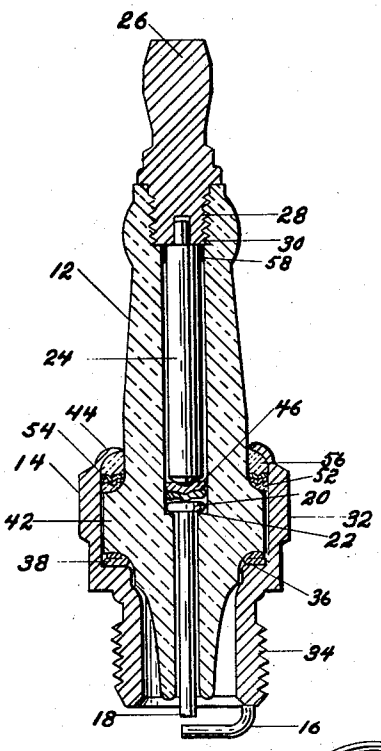


Fig. 1



Fig. 2

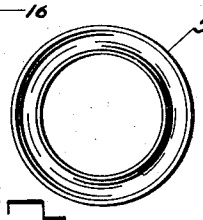


Fig. 3

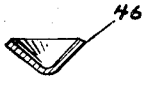


Fig. 4

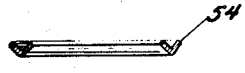


Fig. 6



Fig. 5



Fig. 7

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SPARK PLUG

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2 Claims. (Cl. 123—169)

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This invention relates to spark plugs, and particularly to the internal construction thereof.

An object of the invention is to provide a spark plug having improved heat control qualities.

Another object is to provide a spark plug having a high degree of imperviousness to the escape of combustion gases. In this connection the invention embraces novel methods of sealing both the central and perpiheral spaces of the plug, to prevent gas leakage along either of these paths.

A further object is to simplify and improve the construction of spark plugs, and the processes involved in the assembly thereof.

These and other objects of the invention will become apparent upon examination of the following description and reference to the accompanying drawings illustrating one embodiment of the invention. The invention is not limited to this embodiment, of course, but includes all embodiments within the scope of the appended claims.

In the drawings, Fig. 1 is a longitudinal sectional view of a spark plug embodying the invention;

Fig. 2 is a plan view of one of the central sealing elements, on an enlarged scale;

Fig. 3 is a plan view of one of the peripheral sealing elements;

Figs. 4 and 5 are sectional views of the central sealing element, before and after application of sealing pressure; and

Figs. 6 and 7 are sectional views of the peripheral sealing element, before and after application of sealing pressure.

Referring first to Fig. 1, there is shown a ceramic type of spark plug having a main insulating body 12, an outer shell 14, an outer electrode 16 secured to shell 14, a central electrode 18 with a head 20 supported on annular shelf 22 of body 12, a central stem 24 aligned with electrode 18, and a terminal post 26 having a threaded shank 28 for engagement with threads 30 of the body 12. Shell 14 has a wrench receiving portion 32, a cylinder engaging threaded portion 34, an annular shelf 36 to receive a soft metallic gasket 38 for cushioned support of the wider part 42 of the body 12, and an upper rim 44 which is initially upstanding but is thereafter rolled inwardly, radially, for a purpose to be described.

Electrode 18, of highly durable heat resistant metal, such as a nickel alloy, fits loosely in the lower bore of body 12, when initially inserted, but is held against axial movement by the elements inserted thereafter, as will be described. Central stem 24, of any ordinary metal such as

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a common grade of readily machinable steel, has a diameter considerably greater than that of electrode 18, the purpose being to accelerate heat transfer to the terminal post 26, where it is most readily dissipated. This concept, which I believe to be novel, of enlarging the diameter of the metallic heat flow path at approximately the point where the spark plug emerges into the air stream, that is, adjacent the base of the exposed portion of the dielectric body 12, produces a highly desirable heat dissipating characteristic for the plug as a whole, in that the resultant increased heat absorbing capacity of the central stem 24 reduces materially the tendency, in known types of ceramic plugs, for too great absorption of heat by the dielectric material. The increased diameter of the upper portion of the metallic path affords a quicker means of heat escape than in former designs, hence assuring cooler operating temperatures for the body 12 and also resulting in extended electrode life; while the smaller lower diameter assures against too rapid heat flow (hence possible chilling) at the spark gap.

The novel means for sealing the plug, both centrally and peripherally, will now be described. After insertion of the central electrode 18, I drop into place a plurality of (as shown, two) conical diaphragms 46 fashioned from the metal alloy commercially known as "invar" or similar conducting material having a zero, or near zero, thermal coefficient of expansion, the diaphragm having a thickness of .015 of an inch or thereabouts. These are inserted with their apices downwardly disposed, as in Fig. 4 and a pressure of 2300 pounds, more or less, is then applied. This pressure is necessary to spread the diaphragms 46 into tight sealing engagement with the circular wall of the body 12, the diaphragms flattening into the shape shown in Fig. 5. No other seal is necessary to assure tightness against gas leakage centrally of the plug.

Peripheral tightness is produced by the following method: After inserting the body 12 into the shell 14, I drop into place a ring 52 of asbestos impregnated with silicone resin, or some equivalent element having a certain degree of resilience and compressibility. I then insert two or more rings 54 having V-shaped cross-sections, as indicated in Fig. 6, fashioned out of cold rolled steel of .026'' thickness, or thereabouts. These are inserted with their narrow edges downwardly disposed and are then spread radially—after addition of another compressible ring 56 similar in composition to ring 52—by applying 4700 pounds pressure axially and inwardly to rim 44 of shell

14, thus turning said rim into the final shape shown in Fig. 1. The pressure thus applied causes rings 54 to bite into the body 12 on the one hand, and the shell 14 on the other, thus assuring tightness against gas leakage peripherally of the plug. As members 54 and 14 are of the same material, their thermal expansion and contraction will be approximately harmonized, hence the possibility of deterioration of the sealing properties of the plug is minimized. The sealing properties of diaphragms 46 likewise remain undiminished in use, as the use of a non-expanding material such as invar removes the possibility of creation of excessive strains centrally or radially of the plug.

Stem 24 may be firmly secured to body 12 by applying silicone resin or equivalent cementing material, as indicated at 58.

Having thus described the various features of the invention, what I claim as new and desire to secure by Letters Patent is:

1. A spark plug having a dielectric body, an outer metal shell, and sealing means therebetween including asbestos gaskets impregnated with silicone resin, a plurality of metal rings interposed between the gaskets and deformed to substantially flat cross sections, and means on the shell for retaining the sealing means under pressure.

2. A spark plug having a dielectric body, an outer metallic shell, and spaced seals therebetween, one of said seals comprising a metallic ring pressed upon itself, and the other seal including asbestos gaskets impregnated with silicone resin and a plurality of metallic rings interposed between the gaskets and pressed to substantially flat cross sections and means on the shell for retaining the seals under pressure.

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