

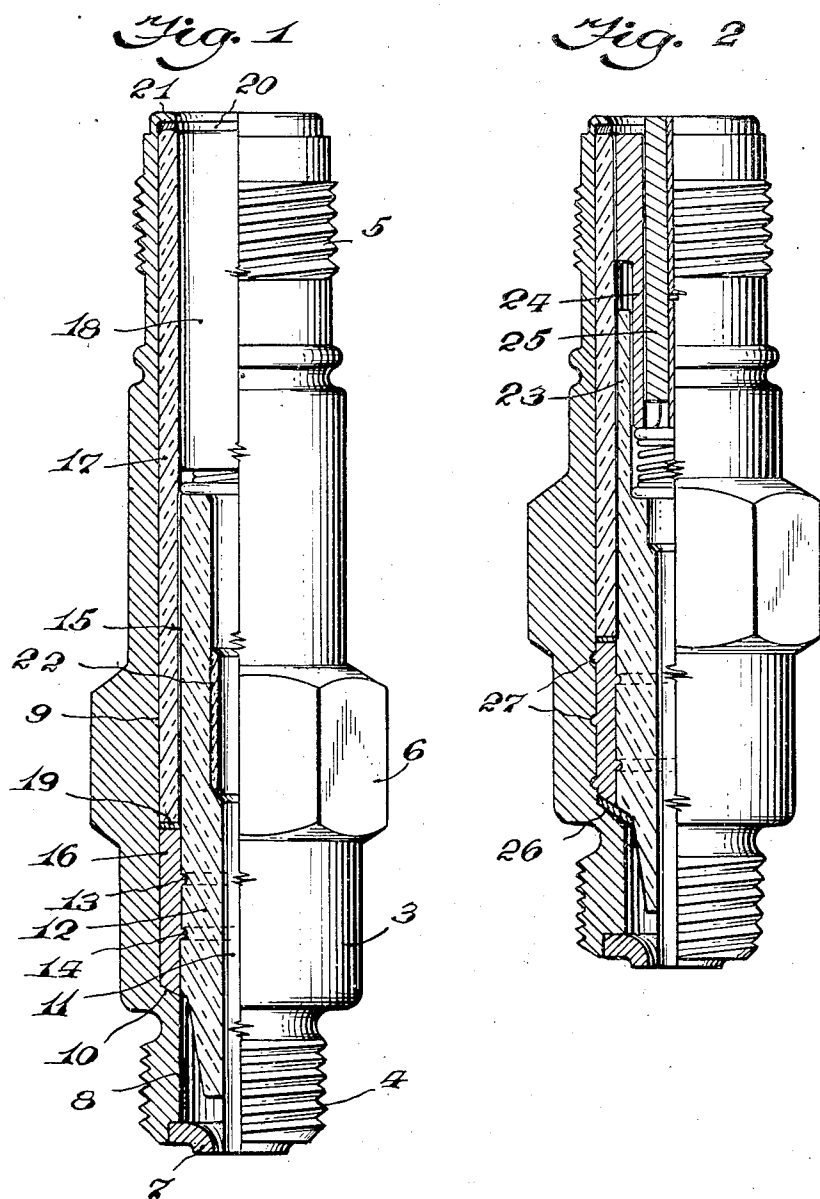
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SPARK PLUG

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SPARK PLUG

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This invention relates to improvements in spark plugs and more particularly to novel shielded spark plugs.

One of the objects of the invention is to construct gasoline engine spark plugs in such manner as to prolong the life thereof and prevent abnormal wear of the sparking points.

Another object is to provide a gas-tight seal between the insulator and shell by means of a cylindrical sleeve which will also serve as a cooling element.

With the foregoing objects outlined and with other objects in view which will appear as the description proceeds, the invention consists in the novel features hereinafter described in detail, illustrated in the accompanying drawings and more particularly pointed out in the appended claims.

In the drawings:

Fig. 1 is a side elevation of a shielded type spark plug partly in longitudinal section.

Fig. 2 is a similar view of a modification.

Referring to the drawings, 3 designates a metallic shell having external threads 4 at one end for use in attaching the plug to an engine cylinder, and having external threads 5 adjacent its opposite end for connection to a lead cable (not shown). Intermediate its ends, the shell has a hex 6 for engagement with the tool used in manipulating the same. An annular electrode 7 is secured to the lower end of the shell. The bore of the shell consists of a restricted portion 8 and a larger portion 9, the latter extending throughout substantially the length of the shell and being of cylindrical shape, and terminating at one end at an annular shoulder 10 of frusto-conical shape.

A central electrode 11 extends axially of the bore and is rigidly secured to and surrounded by an insulator sleeve 12 provided with one or more external cavities or annular grooves 13 and 14, for a purpose hereinafter described. The grooved portion of the insulator is, also, of cylindrical shape as indicated at 15, and is of smaller diameter than the cylindrical portion 9 of the bore. Before the parts are assembled a sleeve 16 of some suitable mineral such as copper or the like, having cylindrical internal and external surfaces, is slipped over the insulator, and then when the insulator carrying the central electrode and sleeve 16 are introduced into the bore, one end of the sleeve will come to rest on the shoulder 10. At such time sufficient pressure is exerted endwise on the sleeve to cause the soft metal or mineral thereof to flow, with the result

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that the material thereof will fill any crevice that may be present at the surfaces 9 and 15. At the same time, the material will enter the grooves 13 and 14 and provide a gas-tight seal. When the soft metal or mineral is compressed, preferably hydraulically, the stresses will be set up in the shell and in the insulator perpendicularly to the axis of both, and as in this direction the shell and also, the insulator have their greatest dimensional change due to expansion, the shell, sealing sleeve, and the insulator, upon becoming heated tend to tighten the seal. Thus, the pressure of assembly is sufficient to cause the material of the sleeve 16 to flow and rigidly unite the three main component parts of the plug as an integral unit with the seal set permanently in a state of compression beyond its elastic limit. After assembly, an insulator sleeve 17 and an end terminal 18 may be introduced into the shell and the insulating sleeve may be spaced from the inner end of the sealing sleeve 16 by a gasket 19. A similar gasket 20 may be arranged at the upper end of the plug and may be secured in place by crimping or spinning an abutment lip 21 integral with the upper extremity of the shell.

To prevent gas leakage along the central electrode 11, a pre-formed ring 22, of copper or the like, may be pressed into place between the electrode and the insulator 12, after the part 22 has been softened sufficiently by heating or otherwise.

In the modification shown in Fig. 2, the central insulator is extended upwardly in the form of a cuff 23 for the reception of a sleeve 24 which surrounds the end terminal 25. The telescoping parts provided by this construction enables me to gain a two inch flash-over length in one and one-half inches. The sealing features in this embodiment may be identical to those shown in Fig. 1. Furthermore, as shown in Fig. 2, the metallic shell of the plug may be provided with spaced grooves 27 arranged perpendicular to the axis of the plug and positioned to receive portions of the sealing sleeve during the assembly of the plug. Here, also, is shown, a gasket 26 placed on the shoulder within the shell and cooperating with an insulator sleeve of larger diameter than the internal diameter of the bore of the shell at the restricted end thereof.

From the foregoing it will be understood that in my method of manufacture, I provide a shell having a definite threaded section with a suitable hex for screwing the part into the engine, and

a substantially cylindrical section extending upwardly therefrom. The shell may be made on a screw machine and is preferably a one-piece structure. In this I place the main insulating sleeve with the sealing sleeve around it. I then join these elements into an integral unit by supplying sufficient pressure to the mineral or metallic sleeve endwise to expand it radially and toward the axis of the plug. The grooves 13 and 14 and grooves 27, if used, provide abutment means for the sleeve 16 to guard against any possible movement while the parts are being assembled, and such sealing sleeve may be annealed to a "dead-soft" condition before the pressure is applied for assembly. Furthermore, such sleeve may be softened by the use of electronic induction, or by heating it to a predetermined temperature before application of pressure.

This insures maximum flow under pressure. As the pressure resultant is in a plane perpendicular to the axis of the insulator, this is advantageous, as in this plane the insulator has its maximum resistance (strength) to pressure applied externally.

It is obvious that the procedure outlined herein is applicable to the conventional unshielded type of spark plug, as well as to the shielded type.

While I have disclosed what I now consider to be preferred embodiments of the invention in such manner as may be readily understood by those skilled in the art, I am aware that changes may be made in the details disclosed without departing from the spirit of the invention as expressed in the claims.

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

1. A spark plug comprising a metallic shell having a bore provided with a substantially cylindrical surface, an annular shoulder in the bore merging with said surface, a central electrode, an insulator surrounding the electrode and positioned within the bore, said insulator having a substantially cylindrical external surface confronting and spaced from the substantially cylindrical surface of the bore, said insulator, also, having a cavity facing the substantially cylindrical surface of the bore, and a pre-formed sleeve of flowable mineral capable of softening due to heat, arranged between and in intimate contact with the substantially cylindrical surfaces of the bore and insulator and filling said cavity.

2. A spark plug comprising a metallic shell having a bore provided with a substantially cylindrical surface, an annular shoulder in the bore merging with said surface, a central electrode, an insulator surrounding the electrode and positioned within the bore, said insulator having a substantially cylindrical external surface confronting and spaced from the substantially cylindrical surface of the bore, said insulator, also, having an annular groove facing the substantially cylindrical surface of the bore, and a pre-formed sleeve of flowable metallic material arranged between and in intimate contact with the substantially cylindrical surfaces of the bore and insulator and extending into said groove.

3. A spark plug comprising a metallic shell having a bore provided with a substantially cylindrical surface, an annular shoulder in the bore merging with said surface, a central electrode, an insulator surrounding the electrode and positioned within the bore, said insulator having a substantially cylindrical external surface confronting and spaced from the substan-

tially cylindrical surface of the bore, said insulator, also, having spaced annular grooves facing the substantially cylindrical surface of the bore, and a pre-formed sleeve of flowable metal arranged between and in intimate contact with the substantially cylindrical surfaces of the bore and insulator and filling said grooves.

4. A spark plug comprising a metallic shell having a bore provided with a substantially cylindrical surface, an annular shoulder in the bore merging with said surface, a central electrode, an insulator surrounding the electrode and positioned within the bore, said insulator having a substantially cylindrical external surface confronting and spaced from the substantially cylindrical surface of the bore, said insulator, also, having a cavity facing the substantially cylindrical surface of the bore, and a pre-formed copper sleeve arranged between and in intimate contact with the substantially cylindrical surfaces of the bore and insulator and filling said cavity.

5. A spark plug comprising a metallic shell having a bore provided with a substantially cylindrical surface, an annular shoulder of the bore merging with said surface, the shell having external threads provided adjacent to opposite ends thereof and an external hex intermediate the ends thereof, a central electrode in the shell, an insulator surrounding the electrode and positioned between the bore, said insulator having a substantially cylindrical external surface confronting and spaced from the substantially cylindrical surface of the bore, said insulator, also, having a cavity facing the substantially cylindrical surface of the bore, a pre-formed sleeve of flowable metal abutting said shoulder, arranged between and in intimate contact with the substantially cylindrical surfaces of the bore and insulator and filling said cavity, said sleeve being of materially less length than the shell, and a tubular insulator arranged in said bore at one end of the sleeve and surrounding a portion of the said first-mentioned insulator, said tubular insulator extending from the sleeve to a point in close proximity to one end of the shell.

6. A spark plug comprising a metallic shell provided at one end with an electrode and having a bore provided with a substantially cylindrical surface, an annular shoulder in the bore merging with said surface and positioned adjacent to said electrode, a central electrode in the shell terminating at one end adjacent to the first-mentioned electrode, an insulator surrounding the central electrode and positioned within the bore, said insulator having a substantially cylindrical external surface confronting and spaced from the substantially cylindrical surface of the bore, said insulator, also, having a substantially annular cavity facing the substantially cylindrical surface of the bore, a sleeve of flowable mineral substance abutting said shoulder, arranged between and in intimate contact with the substantially cylindrical surfaces of the bore and insulator, and filling said cavity, said insulator having a tubular extension projecting away from the first-mentioned electrode, an end terminal extending into the tubular extension of the insulator, a cuff surrounding the end terminal and projecting into the tubular extension of the electrode, and a tubular insulator arranged in the bore at one end of said sleeve and surrounding said cuff and the tubular extension of the first-mentioned insulator.

7. A spark plug comprising a metallic shell having a bore provided with a substantially cylin-

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drical surface, an annular shoulder in the bore merging with said surface, a central electrode, an insulator surrounding the electrode and positioned within the bore, said insulator having a substantially cylindrical external surface confronting and spaced from the cylindrical surface of the bore, said shell having a cavity facing the substantially cylindrical surface of the insulator, and a pre-formed sleeve of flowable mineral resting on said shoulder and arranged between and in intimate contact with the cylindrical surfaces of the bore and insulator and filling said cavity.

8. A spark plug as claimed in claim 1, in which the metallic shell is provided with a cavity facing the substantially cylindrical surface of the insulator and the sleeve of flowable mineral fills said cavity.

9. A spark plug as claimed in claim 1, in which a second sleeve of flowable mineral is arranged between and in intimate contact with the central electrode and the insulator.

10. A spark plug comprising a metallic shell having a bore provided with a substantially cylindrical surface, an annular shoulder in the bore merging with said cylindrical surface, a central electrode, an insulator surrounding the electrode and positioned within the bore, said insulator having a substantially cylindrical external surface confronting and spaced from the substantially cylindrical surface of the bore, said insulator, also, having a cavity facing the substantially cylindrical surface of the bore, a pre-formed sleeve of flowable mineral arranged between and in intimate contact with the substantially cylindrical surfaces of the bore and insulator and filling said cavity, an insulator sleeve extending into the shell and surrounding the first-mentioned insulator and arranged in end-to-end relation with the sleeve of flowable mineral, an abutment at one end of the shell, and a gasket spacing said abutment from an end of the insulator sleeve.

11. A spark plug comprising a one-piece metal-

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lic shell having a bore provided with a substantially cylindrical surface, an annular frusto-conical shoulder in the bore merging with said surface, a central electrode, an insulator surrounding the electrode and positioned within the bore, said insulator having a substantially cylindrical external surface confronting and spaced from the substantially cylindrical surface of the bore, said insulator also having a groove extending around the insulator and facing the substantially cylindrical surface of the bore, a pre-formed sleeve of flowable mineral, capable of softening due to heat, arranged between and in intimate contact with the substantially cylindrical surface of the bore and insulator and having a frusto-conical surface contacting said shoulder, a gasket resting on the upper end of the sleeve, an insulator sleeve lining the shell above the pre-formed sleeve and resting on said gasket, a second gasket resting on the upper edge of the insulator sleeve, and means integral with the shell overlying the second gasket and holding the parts in assembled relation.

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