

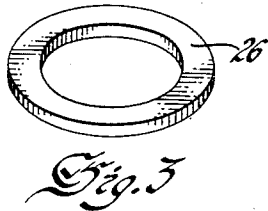
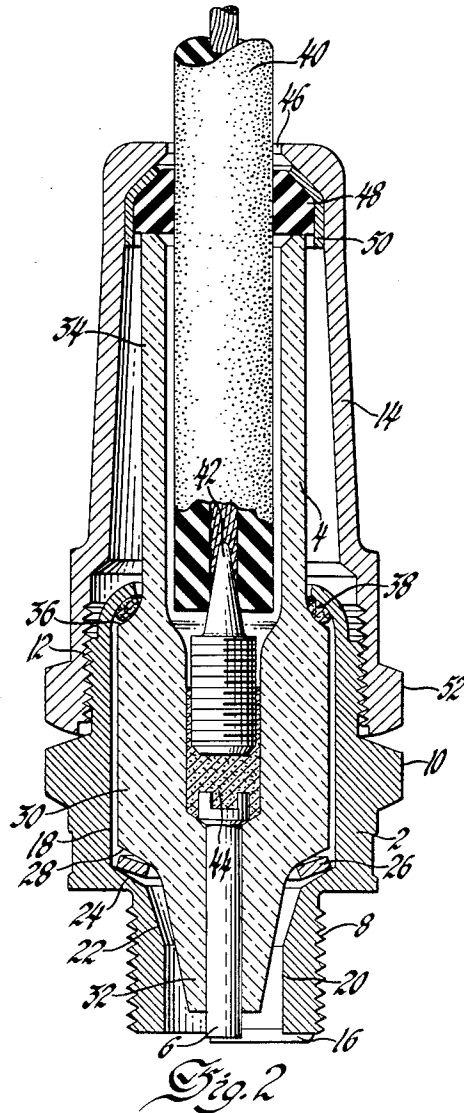
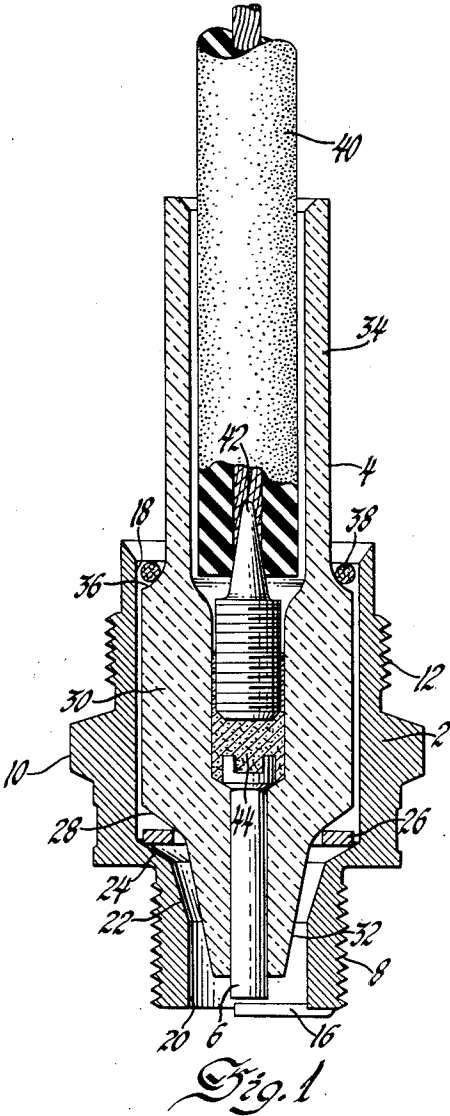
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SPARK PLUG

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SPARK PLUG

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9 Claims. (Cl. 123—169)

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The present invention relates to igniting devices and more particularly to an improved spark plug construction.

To be effective in maintaining maximum efficiency of combustion in internal combustion engines it is well known that spark plugs must be free from fouling materials which interfere with the spark discharge and leakage paths which permit loss of the compressed combustion gas from the cylinders.

Fouling being brought about by combustion of the gases and adherence of dirt and grease to the insulator body may be partially prevented by shielding or may be removed by cleaning. Leakage paths once developed in the spark plug structure usually cannot be repaired and the replacement of the defective spark plug is necessary to obtain the maximum combustion efficiency in an engine.

It is an object of the present invention to provide a new and improved low cost shielded spark plug construction which is extremely resistant to the development of leakage paths in the spark plug structure.

It is a further object to provide an improved gasket seal for spark plugs.

Heretofore the sealing of the spark plug insulator in the shell has been obtained by interposing soft deformable gaskets between the cooperating shoulders formed on the insulator and in the shell respectively. As such gaskets are usually made of such materials as copper, once they are deformed by the assembly of the spark plug parts they lack sufficient resiliency to maintain a strong spring-biased contact between the gasket and the respective component parts of the spark plug.

The above and other objects are attained in accordance with the present invention by providing a sealing gasket in spark plugs made of a highly resilient material which even though deformed in the assembly of the spark plug has sufficient resiliency to maintain a spring-biased contact between the gasket and the assembled shell and insulator thereby providing effective sealing of the spark plug structure.

For a better understanding of the invention, reference may be had to the drawing in which Figure 1 is a cross-sectional view of a spark plug embodying the present invention prior to the final assembly operation; Figure 2 is a view similar to Figure 1 illustrating the assembled spark plug with a shield attached to the assembly, and Figure 3 is a perspective view of the lower sealing gasket of the spark plug.

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Referring now to the drawing the spark plug is illustrated as comprising a shell 2 and an insulator 4 containing an electrode 6 centrally disposed in the shell. The shell 2 is formed with a threaded reduced end 8 for turning the spark plug into a cooperating aperture in the cylinder head of an internal combustion engine and a hexagonal section 10 adapted to cooperate with a suitable tool to apply a turning moment to the spark plug. The shell is threaded at 12 to provide means for attaching an internally threaded shield 14 for preventing accumulations of dirt and moisture on the insulator and terminal. An electrode 16 is attached to the shell at the end of the reduced section 8 for cooperation with the electrode 6 in the insulator 4. Internally the shell 2 is formed with cylindrical bores 18 and 20 separated by adjacent conical portions 22 and 24; the upper conical portion 24 being provided as a seat for a spring steel gasket 26 and the lower shoulder 28 of the enlarged section 30 of the insulator 4.

The insulator 4 is made of aluminium oxide, a material commonly used in the manufacture of spark plug insulators because of its high resistance to heat shock and fractures. It is formed with an enlarged section 30 and a conical lower end 32 adapted to conform to the generally internal contour of shell 2. The upper portion 34 of the insulator is cylindrical and of less diameter than the enlarged portion 30 thereby providing a shoulder at 36 for the upper sealing gasket 38. The upper portion 34 of the insulator being cylindrical is adapted to receive the terminal end of an ignition cable 40. An electrical circuit is established between the ignition cable 40 and the electrode 6 through a pronged terminal 42 which is sealed into the insulator by a copper-glass seal 44 commonly used for such purposes in spark plug manufacture. The copper-glass seal 44 forms a suitable bonding material for connecting the electrode 6 to the terminal 42 and in addition adheres to the walls of the insulator 4 to prevent gas leakage past the electrode and terminal.

In assembling the main body of the spark plug the washer gasket 26 is positioned in the shell to rest on the shoulder 24. The insulator assembly is then disposed in the shell so that the shoulder 28 of the insulator is in contact with the inner peripheral edge of the washer gasket 26. A soft metal gasket 38 is then positioned on shoulder 36 of the insulator 4 and the upper end of the shell 2 is turned inwardly as shown in Figure 2. In turning the upper end of the shell inwardly the metal gasket 38 is compressed be-

tween the inturned portion of the shell and the shoulder 36 of the insulator while simultaneously the insulator is urged downwardly causing the inner peripheral edge of the washer gasket 25 to be displaced downwardly. The washer gasket 26 being made of a high carbon steel as, for example, SAE 1080 steel retains a high degree of resiliency forming an effective sealing contact between the edges of the washer and the respective shoulders 24 and 28 of the insulator and shell. Because of the resilient character of the washer 26 the sealing contacts between the washers 26 and 38 and the shell and insulator are maintained regardless of any differential expansion between the shell and insulator due to varying temperature conditions surrounding the spark plug. In addition, with the use of a sealing washer such as 26 the commonly practiced assembling step of heating a thinly machined section in the shell to high temperatures for reduction of the overall length of the shell by compression while simultaneously sealing the insulator within the shell may be eliminated with the attendant discoloration of the shell and the heat shocks induced in the insulator.

To protect the exposed portion of the insulator from accumulation of dirt, oil and moisture the shield 14 is provided. The shield has an aperture 46 in its upper end through which the cable 40 may be passed for engagement with the terminal 42. Adjacent the apertured end the inner wall is conically shaped for the positioning of a rubber grommet 43. The grommet 43 is provided with a metal collar 50 of a shape corresponding to the internal configuration of the shield adjacent the aperture. The grommet and collar assembly are passed on to the cable 40 after it has been passed through the shield aperture 46 and forms a gasket between the shield and the upper end of the insulator 4. When the shield is turned on to the shell 2 the rubber grommet 43 is compressed between the collar and insulator causing its inner wall to tightly grip the cable 40. A hexagonal section 52 similar to the hexagonal section 19 of the shell 2 is provided on the shield for cooperation with a suitable tool to turn the shield on to the shell.

A shielded spark plug made in accordance with the present invention will find particular useful application in marine and other engines where moisture and spray deposits on the insulator interfere with the normal functioning of the spark plug.

While the embodiment of the present invention as herein disclosed constitutes the preferred form it is to be understood that other forms might be adopted all coming within the scope of the claims which follow:

What I claim as new and desire to secure by Letters Patent of the United States is:

1. In a spark plug, a casing provided with an internally tapered shoulder and in inturned end portion, an insulator disposed in said casing said insulator having an enlarged mid section with upper and lower tapered shoulders at the ends thereof, a soft metal gasket interposed between said inturned end portion and said upper tapered shoulder and a spring steel washer interposed between said internally tapered shoulder and said lower shoulder, said washer having its inner edge resiliently displaced axially to provide substantially line sealing contact engagement between radially spaced diagonally disposed edges of said washer and said internally tapered and lower shoulders and yieldingly urge

said inturned end portion and said upper shoulder into sealing engagement with said soft metal gasket.

2. In a spark plug, a casing having an internal tapered shoulder, an insulator disposed in said casing, said insulator having an enlarged mid-portion with an upper and lower tapered shoulder at the ends thereof and a resiliently dished spring washer interposed between said internally tapered and lower shoulders, said washer having inner and outer oppositely disposed edges in line contact engagement with said lower and internally tapered shoulders to permit differential expansion between said casing and insulator while maintaining substantially uniform contact engagement between said washer, insulator and casing.

3. In a spark plug, a casing having an internal tapered shoulder, an insulator disposed in said casing, said insulator having an enlarged mid-portion with an upper and lower tapered shoulder at the ends thereof and a spring steel washer interposed between said internally tapered and lower shoulders, said washer being resiliently and downwardly dished to provide for diagonally disposed edges of said washer to be in line contact engagement with said lower and internally tapered shoulders thereby permitting differential expansion between said casing and insulator while simultaneously maintaining substantially uniform contact engagement between said washer, insulator and casing.

4. In a spark plug, a hollow metallic shell having an internally and downwardly tapered shoulder, an insulator disposed in said shell to be supported by said shoulder, said insulator having an enlarged mid-portion with an upper and lower shoulder at the ends thereof, and a spring steel washer interposed between said tapered and lower shoulders, said washer being resiliently dished downwardly into substantially truncated conical form to provide for diagonally disposed edges of said washer to be in line contact engagement with said lower and tapered shoulders thereby permitting differential expansion between said shell and insulator while simultaneously maintaining substantially uniform contact engagement between said washer, insulator and shell.

5. In a spark plug, a hollow metallic shell having an internally and downwardly tapered shoulder, an insulator disposed in said shell to be supported by said shoulder, said insulator having an enlarged mid-portion with an upper and lower shoulder at the ends thereof, and a spring steel washer interposed between said tapered and lower shoulders, said washer being resiliently dished downwardly into substantially truncated conical form to provide substantially line contact engagement respectively between inner and outer radially spaced oppositely disposed edges of said washer and said lower and tapered shoulders thereby permitting differential expansion between said shell and insulator while simultaneously maintaining substantially uniform contact engagement between said washer, insulator and shell.

6. In a spark plug, a casing having an internal tapered shoulder, an insulator disposed in said casing, said insulator having an enlarged mid-portion with an upper and lower tapered shoulder and a resiliently dished spring washer of high carbon steel interposed between said internally tapered and lower shoulders, said washer having inner and outer oppositely disposed

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edges in line contact engagement with said lower and internally tapered shoulders to permit differential expansion between said casing and insulator while maintaining substantially uniform contact sealing engagement between said washer, insulator and casing.

7. In a spark plug, a casing having an internal tapered shoulder, an insulator disposed in said casing to be supported on said shoulder, said insulator being provided with a recessed upper end for receiving an ignition cable and an enlarged mid-portion with an upper and lower tapered shoulder, and a resiliently dished spring steel washer interposed between said internally tapered and lower shoulders, said washer having inner and outer oppositely disposed edges in line contact engagement with said lower and internally tapered shoulders to permit differential expansion between said casing and insulator while maintaining substantially uniform contact engagement between said washer, insulator and casing.

8. In a spark plug, a hollow metallic casing having an internally tapered shoulder and an inturned end, said casing being externally threaded adjacent said inturned end, an insulator disposed in said casing to be supported on said shoulder, said insulator having an enlarged mid-portion with an upper and lower tapered shoulder, a soft metal gasket interposed between said inturned end and upper shoulder, a spring steel washer interposed between said internally tapered and lower shoulders, said washer being resiliently dished to provide line contact engagement between radially spaced diagonal edges of said washer and said lower and internally tapered shoulders thereby permitting differential expansion between said casing and insulator while simultaneously maintaining substantially uniform contact sealing engagement between said soft metal and spring steel gaskets and said insulator and casing, and an internally threaded shield in threaded engagement with said casing adjacent said inturned end.

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9. In a spark plug, a hollow metallic casing having an internally tapered shoulder and an inturned end, said casing being externally threaded adjacent said inturned end, an insulator disposed in said casing, said insulator being provided with a recessed upper end for receiving an ignition cable and an enlarged mid-portion with an upper and lower tapered shoulder, a soft metal gasket interposed between said inturned end and upper shoulder, a spring steel washer interposed between said internally tapered and lower shoulders, said washer being resiliently dished to provide line contact engagement between radially spaced diagonal edges of said washer and said lower and internally tapered shoulders thereby permitting differential expansion between said casing and insulator while simultaneously maintaining substantially uniform contact sealing engagement between said soft metal gasket, spring steel gasket, insulator and casing, and an internally threaded shield in threaded engagement with said casing adjacent said inturned end, said casing having an aperture therein to receive and dispose an ignition cable in said recessed upper end.

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