

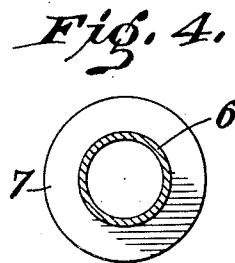
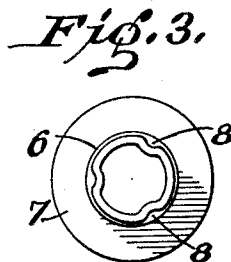
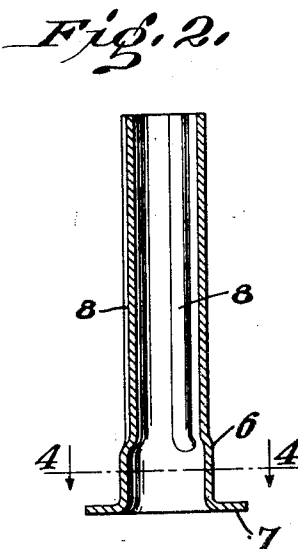
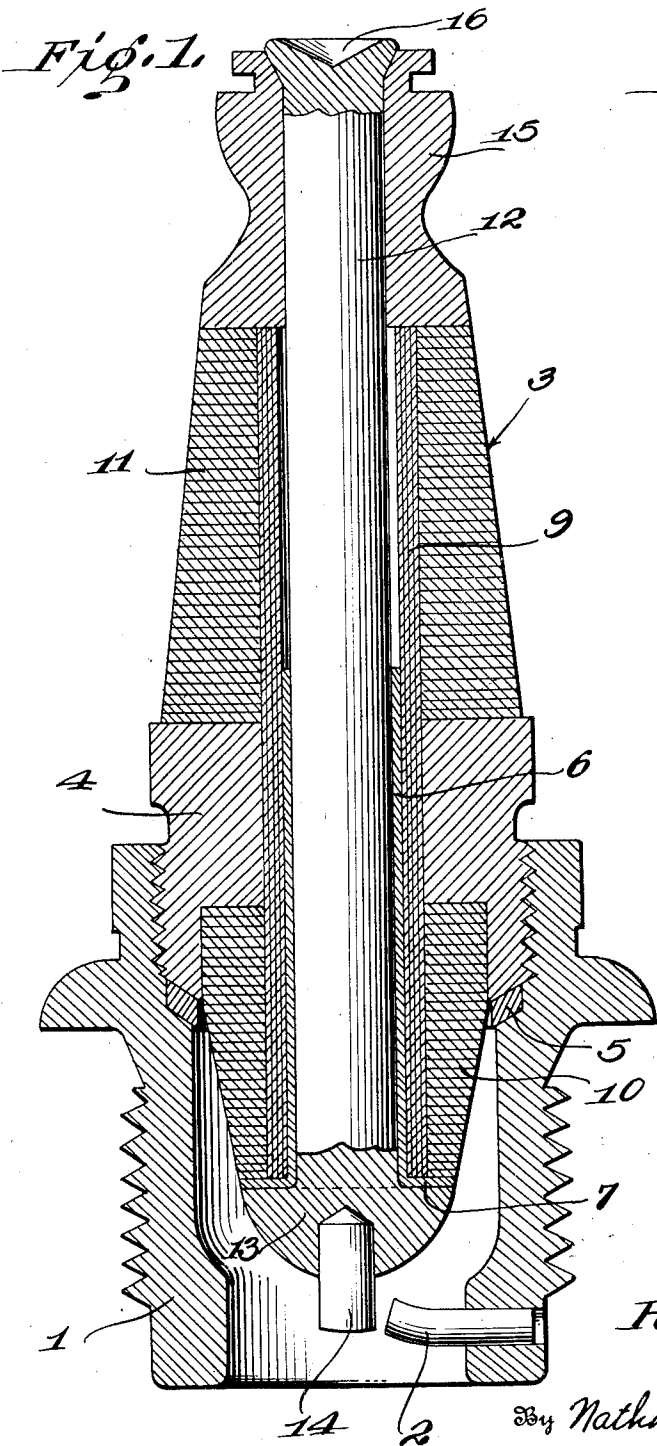
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R. T. HURLEY

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SPARK PLUG

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Inventor
Roy T. Hurley

By *Nathan, Bowman & Helfrich*
Attorneys

UNITED STATES PATENT OFFICE

ROY T. HURLEY, OF DOBBS FERRY, NEW YORK, ASSIGNOR TO HURLEY-TOWNSEND CORPORATION, OF NEW YORK, N. Y., A CORPORATION OF DELAWARE

SPARK PLUG

Application filed October 15, 1930. Serial No. 488,790.

This invention relates to spark plugs, and is in the nature of an improvement upon the invention disclosed in my pending application Serial No. 435,461, filed March 13, 1930, for spark plugs. The present invention has utility independently of the features disclosed in said application, but is illustratively disclosed herein as applied to a spark plug incorporating such feature.

centrally through a spark plug embodying features of the invention;

Figure 2 is a vertical, sectional, detail view through an expandible sleeve employed in the spark plug of Figure 1;

Figure 3 is a plan view of the sleeve of Figure 2; and

Figure 4 is a sectional view taken on the line 4—4 of Figure 2 looking in the direction of the arrows.

10 In said application disclosure is made of a spark plug comprising an expandible sleeve surrounded by a mica tube. If the tube is subjected to radial pressure and circumferential tension by the driving of a central electrode member into the expansible sleeve, a more or less effective seal may result between the central electrode and the insulator retaining nut of the spark plug so that the leakage of gas through the plug may be slight as compared with the leakage occurring in spark 15 plugs of the prior art.

It is an object of the present invention to provide additional or other means for guarding against the leakage of gas through the 25 plug.

To this end it is a feature of the invention that the central electrode has a higher coefficient of expansion than the insulator retaining nut which threads into the shell, and 30 that the shell has a higher coefficient of expansion than the insulator retaining nut. With this kind of an arrangement the pressure between the central electrode and the retaining nut exerted through the expandible sleeve and the mica sleeve is increased as the temperature rises, and the pressure exerted between the retaining nut and the shell is increased as the temperature rises. As a consequence, the possible leakage paths through 35 the plug are sealed with increasing firmness by the heating of the plug, to reduce the leakage. This, in turn, assists in preventing the heating of the plug to an excessive temperature. 40

Other objects and advantages will herein-after appear.

In the drawings forming part of this specification:

Figure 1 is a vertical, sectional view taken

The illustrative spark plug is generally similar to the spark plug of my pending application referred to above, the improvement residing in the adjusting of the coefficients of expansion of the central electrode, the retaining nut and the shell to secure the improved result referred to above.

The spark plug comprises an externally threaded shell 1 adapted to be threaded into a motor. The shell 1 carries a spark electrode 2 which forms one terminal of the spark gap. An insulator and central electrode assembly 3 comprises an externally threaded nut 4 which is screwed tightly into the shell 1 to co-act with the shell in firmly clamping an 75 interposed gasket 5 to form a tight seal. The nut 4 serves as a retaining and supporting member for the central assembly 3.

The central assembly 3 also comprises an expanded sleeve 6 (see Figures 2 and 3), of 80 malleable metal having high heat conductivity, such as copper. This sleeve is provided with a flange 7 at the lower end thereof. It is upon this sleeve that the central assembly is built up. The sleeve 6 may be initially a 85 cylindrical tube provided with the flange 7, but before the steps of incorporating it in a spark plug are begun, longitudinally extending grooves 8 are formed in the outer face of the tube. The grooves 8 terminate a short 90 distance above the lower end of the sleeve. Since the formation of the grooves displaces some of the metal inward, the outside diameter of that length of the sleeve in which the grooves have been formed is reduced by the 95 formation of the grooves and is less than that of the ungrooved lower end portion.

A sheet of compressible, heat-resisting, insulating material, such as mica, is next snugly wrapped around the sleeve 6 in the form of 100

a multiple-ply tube 9. Upon this tube 9 the lower end 10 of the insulator is built up of washers of suitable insulating material, such as mica. The nut 4 is then impaled upon the tube and the upper end 11 of the insulator is built up by placing upon the tube further washers of mica or other suitable material. As thus assembled, the nut 4 does not bind upon the tube 9 but fits it rather snugly.

The central electrode is next inserted in the sleeve 6 from the lower end thereof. The central electrode comprises a shank 12 and a nose 13, the nose being larger than the shank, but of such small mass that the heat absorbed by it may be rapidly and efficiently conducted away, principally by the shank 12 and the sleeve 6. The nose 13 carries a sparking tip 14 of suitable material.

Prior to the insertion of the central electrode, the sleeve, insulator and nut assembly is longitudinally compressed, and this pressure is maintained throughout the insertion of the electrode.

The shank 12 of the central electrode is of a diameter to snugly fit within the ungrooved lower end of the sleeve 6. It may be started in the sleeve readily therefore, but when it reaches the internal ribs formed by grooving of the exterior of the sleeve, it must be driven. This driving of the electrode through the sleeve eliminates the grooves and expands the grooved portion of the sleeve to the diameter of the ungrooved portion. Such expansion of the sleeve 6 simultaneously applies circumferential tension and radial pressure to the tube wall 9 so that the tube wall is pressed with considerable force between the sleeve and the nut 4. The shank 12 and the sleeve 6 have at least as high coefficients of heat expansion as the nut 4, so that this pressure is not relieved when the spark plug becomes heated in use.

After the insertion of the central electrode, the conductive terminal 15 is placed upon the upper end of the shank 12 and the upper end of the shank is upset, as shown at 16, to hold the parts in assembled relation and under pressure.

The central electrode 12 is desirably made of a chrome nickel steel such as that known commercially as "Cyclops No. 17", which has a coefficient of expansion of .000016 per degree centigrade. This material will resist oxidation where exposed to the hot gases in the cylinder. The coupling nut 4 is desirably made of an ordinary machine steel having a coefficient of expansion of approximately .000012 per degree centigrade, while the shell 1 is desirably made of a high nickel steel alloy having a coefficient of expansion between .000009 and .000002 per degree centigrade. The above coefficients of expansion are to be understood, of course, as given only for purposes of illustration. The important feature of the invention is that the retaining nut

has a higher coefficient of expansion than the shell, and that the central electrode in turn has a higher coefficient of expansion than the retaining nut.

As a result of this relationship, the sleeve 6 and the tube 9 are pressed radially more and more tightly between the central electrode and the retaining nut as the temperature rises, so that rising temperature results not in an opening of leakage paths, but in a more effective sealing of the possible leakage paths. The retaining nut in turn bears outward with greater force against the shell as the temperature rises and it also bears downward with greater force against the sealing gasket 5. As a result, the possible leakage path between the shell and the retaining nut is sealed with greater security as the temperature rises.

While I have illustrated and described in detail certain preferred forms of my invention, it is to be understood that changes may be made therein and the invention embodied in other structures. I do not, therefore, desire to limit myself to the specific constructions illustrated, but intend to cover my invention broadly in whatever form its principle may be utilized.

I claim:

1. In a spark plug, the combination with a shell, of a nut threaded in the shell, a central electrode, and a body of flexible insulating material interposed between the central electrode and the nut, said nut having a lower thermal coefficient of expansion than the central electrode.

2. In a spark plug, the combination with a shell, of a nut threaded in the shell, a central electrode, and a tube of flexible insulating material interposed between the central electrode and the nut, said nut having a lower thermal coefficient of expansion than the central electrode, and said shell having a lower thermal coefficient of expansion than the nut.

3. In a spark plug, the combination with a shell, of a nut threaded in the shell, a central electrode, a tube of flexible insulating material interposed between the central electrode and the nut, and a radially expanded member snugly fitting the electrode and radially compressing the insulating tube against the nut, said nut having a lower thermal coefficient of expansion than the central electrode.

In testimony whereof I have affixed my signature to this specification.

ROY T. HURLEY.