May 27, 1958 W. B. SMITS 2,836,756

SURFACE DISCHARGE SPARK PLUG

Filed Dec. 30, 1953

FIG.1

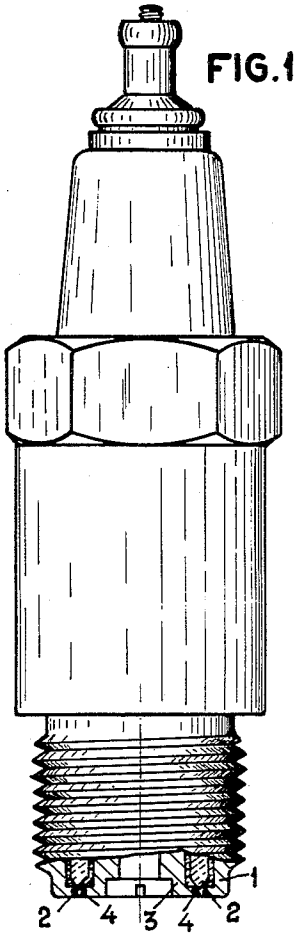


FIG.3

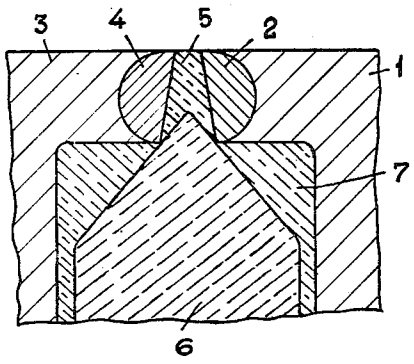
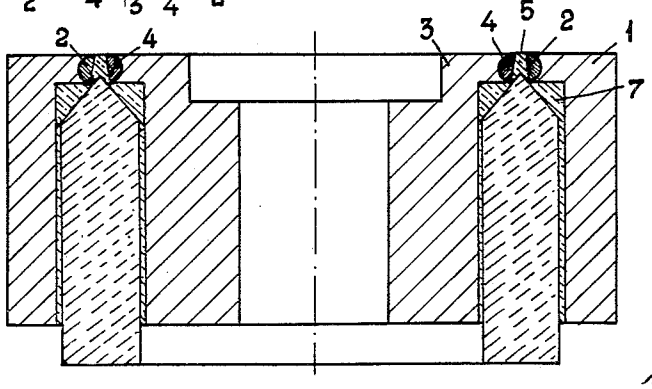


FIG.2



INVENTOR
WYTZE BEYE SMITS,

BY Robert B Pearson
ATTORNEY

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SURFACE DISCHARGE SPARK PLUG

Wytze Beye Smits, Voorburg, Netherlands

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3 Claims. (Cl. 313—131)

The invention relates to a surface discharge spark plug for low voltages, for example, below about 4,000 volts, in which the separator body located between the electrodes consists of a glass or enamel mass.

Spark plugs of this kind are already known, in which the space between the electrodes is filled up completely with a mass of molten glass or glassy material. The object of such spark plugs is to prevent the appearance of cracks in the glass separator body. It has been found that upon the glass mass between the electrodes gradually wearing away during operation the sparking path of the spark becomes so great that in the course of time the voltage of the electric energy to be supplied to the spark plug becomes too high.

The invention has for its object to furnish an improvement, and this object is attained in that below the glass mass a body of insulating material which is resistant to great heat, for example, ceramic material, has been provided, which penetrates into the glass mass between the electrodes. Preferably this part is shaped like a cone, and the apex of the cone penetrates a short distance into the glassy material between the electrodes.

This has the result that the spark can never burn in deeply and always emerges above the electrodes, and that the path along which the surface discharge spark travels will always remain shorter than is the case in a spark plug in which the entire space between the electrodes is filled up with a glass mass which gradually burns away completely, so that the spark can burn in deeply into this mass and is not arrested until the spark impinges on the ceramic body, while according to the invention the apex of the cone of the ceramic body provides for the spark being constantly directed outwards, so that a strong spark is always produced in the combustion chamber of the engine.

The electrodes of the spark plug according to the invention are preferably made of a material which is greatly resistant to high temperatures, such as molybdenum or tungsten, the coefficient of expansion of which is equal or practically equal to that of the holders in which the electrodes are mounted, while the coefficients of expansion of the intermediate glass mass or the like and the ceramic body have the same value.

The invention is elucidated further with reference to the drawing illustrating an embodiment.

Fig. 1 illustrates the spark plug according to the invention.

Fig. 2 is a vertical cross-section through the sparking element.

Fig. 3 is a cross-section through part of the sparking element, shown on a greatly enlarged scale.

For a clear distinction between the known spark plugs and that according to the invention reference is made to Fig. 3.

In this figure, 1 is the holder of the outer electrode 2, and 3 the holder of the inner electrode 4, which electrodes consist, for example, of tungsten, preferably made from a drawn tungsten wire of circular cross-section, which has been polished. Between the electrodes 2 and 4 there is disposed a mass of molten glass 5, while into this glass penetrates a conically shaped ceramic body 6; the remaining space 7 is also filled up with molten glass. The electrode surfaces have to converge towards the sparking surface, so as to prevent the glass falling out.

If the space between the electrodes 2 and 4 were to be filled up completely with glass, as is the case in some known spark plugs, and small cracks should arise in the glass owing to the varying temperatures to which it is subjected, at the bottom of the electrodes an electric disruptive discharge would take place, so that the spark plug would become worthless.

If further between the electrodes were to be disposed glass alone and a ceramic body extending almost to the bottom of the electrodes, with the wearing away of the electrode material the requisite voltage will increase disproportionately, because the creeping path extends to below the electrodes and the spark is not arrested until it impinges on the ceramic body.

According to the invention these disadvantages are eliminated, the ceramic body 6 on the contrary being conical, and the apex of the cone penetrating into the glass mass 5 to about one-third of the height of the electrodes. It is found that when the spark impinges on the ceramic body, with the gradual wearing away of the glass mass 5, the voltage need be raised only slightly, because the length of the creeping path increases only slowly. When even the electrodes have worn away to the bottom, the length of the creeping path of the ceramic body is such that it is bridged by the voltage value of the coil.

Since the electrodes 2 and 4 are made from a tungsten or molybdenum wire, the holders have to consist of a steel with the same coefficient of expansion; the coefficients of expansion of the molten material and the ceramic body likewise have to be of the same order of magnitude. Since this molybdenum or tungsten adheres only to glass or enamels which are melted between the electrodes, they are covered with a thin galvanized coating of copper, nickel or the like, which guarantees good adhesion to the molten material.

I claim:

1. A low tension surface discharge spark plug comprising, two electrodes, a mass of glassy material separating said electrodes and forming at the surface thereof a path over which a spark travels, and a heat resistant insulating material penetrating said glassy mass from the location remote from said surface and having at least a portion thereof lying between said electrodes.

2. A spark plug according to claim 1 in which said insulating material tapers to a point toward said surface, said point lying a distance from said surface which is at least two-thirds the depth of said electrodes.

3. A spark plug according to claim 1 in which said heat resistant insulative material is ceramic.

References Cited in the file of this patent

UNITED STATES PATENTS

2,122,571	Hastings	July 5, 1938
2,235,325	Mohrle	Mar. 18, 1941
2,527,489	Smits	Oct. 24, 1950