

Aug. 21, 1956

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2,760,099

LOW TENSION SPARK PLUGS

Filed May 4, 1953

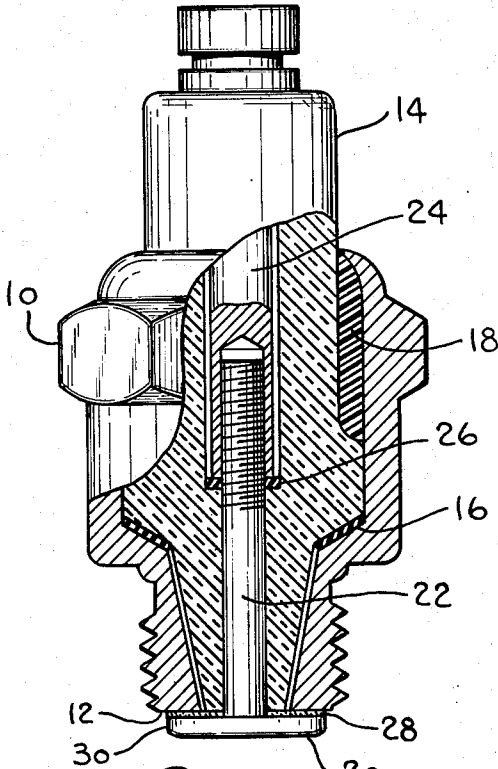


FIG. 1

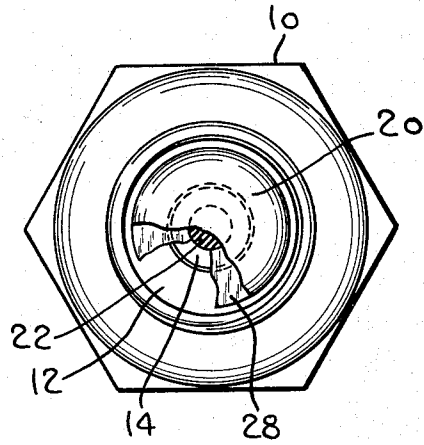


FIG. 2

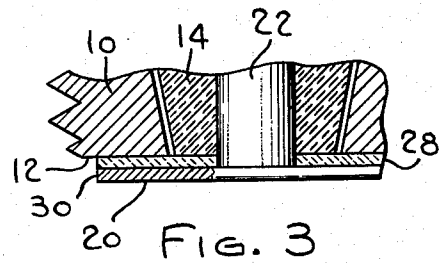


FIG. 3

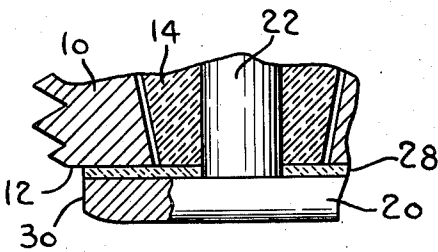


FIG. 5

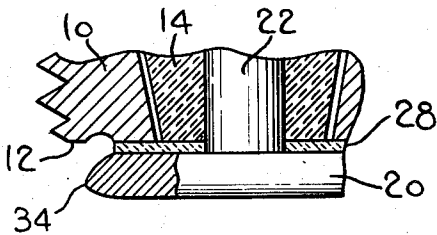


FIG. 6

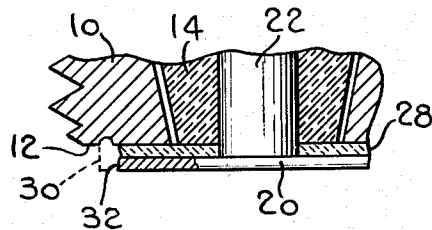


FIG. 4

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LOW TENSION SPARK PLUGS

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Application May 4, 1953, Serial No. 352,767

1 Claim. (Cl. 313—131)

This invention relates to improvements in low tension spark plugs.

Such plugs operate at relatively low voltages, in the neighborhood of 1000, require small gaps, say from approximately .002" to .015", and discharge a relatively large amount of current, say about 400 amperes, in the short time of about 1/2 to 1 1/2 microseconds. Under such conditions the sparking faces of the electrodes rapidly erode which either changes the spacing of the spark gap or causes the spark to recede and thus quickly cause the plug to lose its specified operating characteristics.

It is an object of this invention, therefore, to provide a spark plug of this type which will retain substantially the same spark gap and maintain the spark at its operating level even though erosion takes place during use.

Another object of this invention is to provide a spark plug having the foregoing characteristics which is relatively inexpensive to manufacture and may be made within close tolerances and standards of performance.

These objects are obtained by providing electrodes with sparking face abridged by the spark guiding face of a gap forming insulator and arranging all such faces so that as erosion takes place on one sparking face a new sparking surface will be exposed in the plane of the face thereof and the other sparking face, together with the spark guiding face, will recede along a line parallel with the plane of such first face. The electrode providing the receding face has a thickness within a range which will permit the entire edge which constitutes the sparking face to recede and leave no overhanging lip behind which the spark may occur without fuel ignition. The sparking face along which erosion takes place at newly exposed places in the plane of the face is used to determine the optimum level of the spark with physical relation to the combustion chamber. This level and the spark gap will not be changed during use by the action of erosion.

The novel features, which are considered characteristic of the invention, are set forth with particularity in the appended claim. The invention itself, however, both as to its organization and its method of operation, together with additional objects and advantages thereof, will best be understood from the following description of a specific embodiment when read in connection with the accompanying drawing, in which:

Fig. 1 is a view partly in side elevation and partly in section of a low tension spark plug embodying the present invention;

Fig. 2 is a bottom plan view of the plug of Fig. 1 with parts broken away and shown in section;

Figs. 3 and 4 are fragmentary sectional views of the lower end of the plug illustrating diagrammatically the manner in which the sparking surfaces erode; and

Figs. 5 and 6 are views similar to the Figs. 3 and 4 illustrating by contrast the effects of erosion if the center electrode is thicker than necessary.

Referring to the drawings, the spark plug exemplifying this invention has a metal shell 10 of conventional design functioning as the outer electrode. The bottom of

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the shell constitutes a sparking face 12 on such outer electrode. Such face lying in a plane normal to the axis of the plug determines the level at which the arc will take place with respect to the plug and any combustion chamber in which the plug is seated in normal fashion. A ceramic core 14, also of conventional design with an internal bore, is held within the shell 10 against a gasket 16 by sealing material 18 and has its bottom substantially flush with the sparking face 12.

A center electrode consists of a thin disc-like head or member 20 which has a stem 22 extending upwardly into the bore of the core 14 and threadedly connected to a stud 24 extending in such bore from the top of the core 14. A gasket 26 at the lower end of stud 24 provides a seal for the stem 22. The upper side of the member 20 is spaced from the sparking face 12 by a layer of insulating material 28 which is coextensive with such upper side. This layer thus determines the amount of the spark gap. The edge of the member 20 extending between the sides of such member constitutes a sparking face 30 on the center electrode. The spark or arc jumps from the sparking face 30 to the sparking face 12, being guided by the edge of the insulating material 28.

Contrary to some theories now being advanced concerning the necessity and advantage of building up carbon deposits on the spark guiding face of the insulating material, it has been discovered that for best operation of a low tension spark plug, the gap should be as small as is commercially feasible so that the required spark over voltage will be less than the applied low tension charge, and the spark guiding surface of the insulating member should be as free as possible of carbon particles, combustion residues, and other conductive materials. Therefore, in the plug herein described the thickness of the insulating material is not greater than .010 inch.

Various types of insulating material may be used. One type consists of a very thin layer of glass (can be under .010 inch thick). Such layer may be fused to one or both of the electrode 20 and shell 12. It is not affected by the subsequent sealing of such electrode. The spark between the sparking faces 12 and 30 creates enough heat to melt and erode the edge of the glass layer as fast as the sparking face 30 erodes toward the center of the plug. Another type of insulating material consists of thin disc-like sheets of mica placed over the stem 22 and inserted between the head 20 and the bottom of the shell 10 and core 14. Care must be taken to get mica which is low in impurities to resist interior breakthrough and form conductive paths inwardly of the spark guiding edge of the mica.

The thickness of the electrode 20 will vary depending upon the metallurgical composition thereof. The essential characteristic is to make it thin enough so that substantially the whole surface of its edge will erode inwardly evenly. In Figs. 3 and 4 the electrode 30 is thin enough so that it erodes evenly. A new receded sparking surface formed by such erosion is indicated at 32. With conventional nickel alloy the thickness should be approximately .015 inch. If the thickness of the electrode 20 is too great as diagrammatically shown in Figs. 5 and 6, the erosion will not extend over the area of the edge and thus will tend to leave an overlying lip as indicated at 34. This blankets the spark which recedes between the sparking faces and destroys its efficiency.

Hence as erosion takes place the spark or arc will move inwardly along the sparking face 12. As pits or valleys form in the surface of the face 12 by erosion the gap is automatically increased and the resistance increased. However, the spark will always tend to jump the shortest gap and since face 30 is eroding inwardly of the axis of the plug the next shortest gap will be toward the center of the plug. However, the face 12

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always determines the level of the arc with respect to the plug (and consequently the combustion chamber) and hence such level does not vary during the useful life of the plug. This, together with the fact that the gap (and consequently the spark) remains substantially constant, makes the plug of constant efficiency throughout its span of usefulness. The use of a flat backing surface (upper side of electrode 20) for the insulating material permits such layer to be extremely thin and still retain sufficient mechanical strength and dielectric properties. In some instances gaps as small as .002 inch may therefore be obtained.

Although only one embodiment of the invention is shown and described herein, it will be understood that this application is intended to cover such changes or modifications as come within the spirit of the invention or scope of the following claim:

I claim:

A low tension spark plug having a metal shell electrode the bottom face of which constitutes a first sparking face determining the level of the arc; an internally bored insulating core having a lower end substantially even with said sparking surface; a second electrode comprising a thin flat sided member having its sides parallel to and in overlapping relationship with said first sparking

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surface and an edge constituting a second sparking face, the thickness of said second electrode being small enough so that erosion on the sparking face edge thereof recedes the edge over its full distance between the sides to prevent occurrence of overhanging lips which lessen the effectiveness of the arc, a layer of insulating material not greater than .010 inch thick between the upper side of said second electrode and said first sparking surface and said lower end; said layer determining the spark gap, said insulating material being of a character which will burn away at a rate equal to the rate of erosion of said second sparking face, the edge of said layer being parallel to and forming a straight extension of said first mentioned edge and constituting a spark guiding smooth bridge between said sparking faces, and a stud secured to said second electrode and extending through and sealed in the bore of said core.

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