July 20, 1948. F. J. WOLFF 2,445,704

SPARK PLUG

Filed July 6, 1944

Fig. 1.

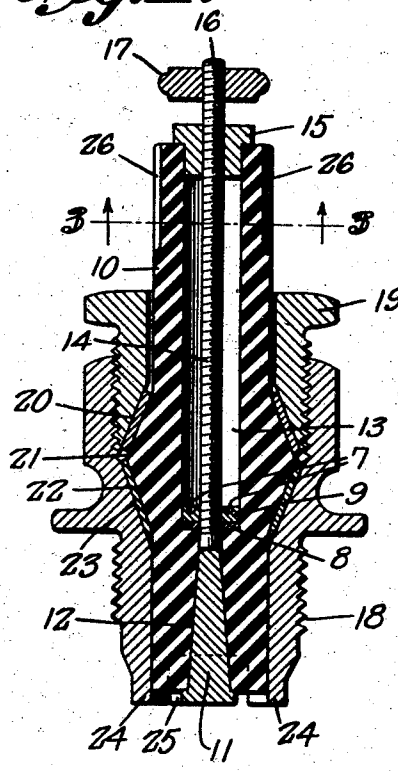


Fig. 2.

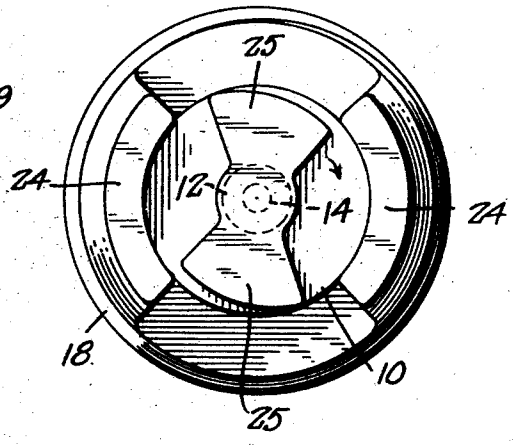


Fig. 3.

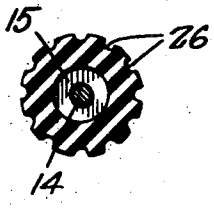
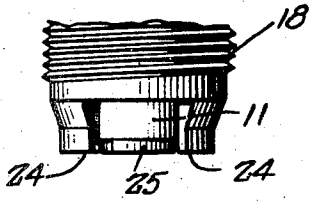


Fig. 4.



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Patented July 20, 1948

2,445,704

UNITED STATES PATENT OFFICE

2,445,704

SPARK PLUG

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Application July 6, 1944, Serial No. 543,631

3 Claims. (Cl. 123—169)

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The object of the invention is to provide a spark plug by means of which adjustment of the gap may be effected or regulated to compensate for deterioration of the terminals due to continued use; to provide a plug of this character in which the sparking terminals lie in a common plane, thus eliminating the shadow that exists where the two electrodes lie in angularly related planes; to provide an adjustable plug in which any carbon bridging the electrodes may be readily dislodged therefrom by going through the process of adjustment, even though adjustment might not otherwise be necessary; and generally to provide an adjustable spark plug which is of comparatively simple form and susceptible of comparatively cheap manufacture in view of the long life properties which it possesses.

With this object in view, the invention consists in a construction and combination of parts of which a preferred embodiment is illustrated in the accompanying drawings, in which:

Figure 1 is an enlarged central vertical sectional view of a spark plug constructed in accordance with the invention.

Figure 2 is a bottom plan view on a still larger scale of the construction of Figure 1.

Figure 3 is a sectional view on the plane indicated by the line 3—3 of Figure 1.

Figure 4 is a side elevational view of the lower end of the shell showing the electrodes.

The core 10 is made preferably of an aluminum oxide under a special process and is intensely hard. At the same time it has high thermal conductivity and practically does not expand or contract under wide variations of temperature.

This core carries the positive electrode or anode 11 which, at its center, is provided with a tapered stem 12 engaged in a correspondingly tapered seat in the core, in the bore 13 of which the threaded extension 14 of the stem is centrally disposed and protrudes beyond the upper end of the core. A nut 9 threaded on the extension 14 bears on a soft metal washer 8 engaged with the shoulder at the bottom of the bore and serves to hold the stem firmly in the core. By reason of the tapered shape gas leakage is effectively prevented. Pin wrench seats 7 in the nut 9 make it possible for a sleeve wrench or other appropriate tool to be used to tighten the nut.

At the open end of the bore 13 the extension 14 receives the shouldered nut 15 which bears on the upper end of the core, maintains the central disposition of the extension and constitutes the protruding portion thereof a binding post 16 with which the conductor attaching nut 17 is engaged.

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The core is retained in the shell 18 in the usual manner by means of the locking sleeve 19 which is threaded into the shell with its lower end bearing on a gasket 20 seated upon the shouldered portion 21 of the core, this shouldered portion also engaging a similar gasket 22 which intervenes between it and the seat 23 with which the shell is formed. As appears from the drawings, the shouldered portion is so formed that the upper and lower shoulders have their faces, at any point, arranged on converging lines.

The negative electrode or cathode is formed at the lower end of the shell and is provided with diametrically opposite sparking terminals 24 having the general shape of circular segments of which the inner or free edges are arcuate and lie in a common circle of which the axis of the stem 12 is the center.

The lower end of the core 10 below the shouldered portion 21, has an exterior diameter corresponding to the interior diameter of the shell, so as to completely fill the latter, thus avoiding any pockets in which carbon deposits may lodge or lead oxide settle to short-circuit the terminals.

In manufacture the positive electrode or anode is preferably welded to its stem. Its sparking terminals 25, while the same in number as the terminals 24, are differently shaped on their free ends which, while they are arcuate, have the arc made on a slightly less radius than the arc of the terminals 24 but generated from centers, eccentric to the axis of the stem 12.

The cathode terminals 24 and the anode terminals 25 are so proportioned in dimensions that when they are in the relative positions shown in Figure 2 of the drawings, the desired length of air gap exists and the spark from one anode terminal to the associated cathode terminal will continue to jump at this point until disintegration of the terminals has reached a point where the gap has become too wide. Then the sparking will take place on the other pair of terminals until that pair have out-lived their usefulness in their relative positions. After this latter pair have disintegrated to the point where the proper air gap no longer exists, adjustment becomes necessary, this being carried out by backing off the locking sleeve 19 slightly and rotating the core 10 a slight angular distance by means of a wrench or other tool applied to the tool seat 26 which is a ribbed portion of the core 10. Slight rotation of the core will bring the anode and cathode terminals nearer together and position them relatively so that two new air gaps of the proper size will be

established. And there will then exist new sparking points on both electrodes, that is, with each adjustment to establish new air gaps, new points of activity for the spark will be found on both electrodes.

The positive and negative electrodes are so proportionately dimensioned that if the center lines of the terminals lie in common radial lines, the heel ends of the terminals **25** will engage the nose ends of the terminals **24**. Similarly, when the parts are in the position indicated in Figure 2 the nose ends of the anode and cathode terminals are spaced the proper distance to afford the appropriate gap.

In cases where carbon bridges one or both gaps and must be broken to re-establish them, the same operation as adjustment is carried out except that the positive electrode is moved angularly back and forth so that the edges of its terminals **25** pass the edges of the terminals **24**, thus breaking up and dislodging any carbon. Of course such an operation must be followed with the proper adjustment of the electrodes. However, there is little likelihood of bridging carbon deposits due to the close relation of the anode and cathode terminals and the lower end of the insulating core **10**. By reason of the lead repellent property of the latter accumulations of lead oxide that would otherwise short-circuit the terminals are eliminated.

By the provision of the adjustable multiple terminal anode, as shown, the life of the plug is not only many times the life of the conventional plug by reason of the plural terminals but the adjusting feature increases the useful life many times more.

Not only is the tapered fit between the electrode stem and the core an insurance against leakage around the electrode, but it also makes for a minimum of strain on the core due to inequality of expansion in it and the electrode stem. Further the tapered connection being in the zone of the largest part of the core where the latter is surrounded by the shell, the lateral pressure tending to rupture the core is successfully resisted.

The invention having been described, what is claimed as new and useful is:

1. A spark plug having shell and core carried electrodes of which the latter is rotatably adjustable with each having a plurality of terminals, the edges of the terminals of one electrode lying in a common circle while the edges of the terminals of the other electrode are generated on substantially the same radius as the former but with their centers eccentric to, but equally spaced from, the axis of the core.

2. A spark plug having shell and core carried electrodes of which each has a plurality of terminals, the edges of the terminals of the shell carried electrode lying in a common circle while the edges of the terminals of the core carried electrode are generated on substantially the same radius as the former but with their centers eccentric to, but equally spaced from, the axis of the core, the core carried electrode being angularly adjustable to progressively move its terminals toward the terminals of the shell carried electrode.

3. A spark plug having shell and core carried electrodes of which the former is in the form of angularly spaced terminals of the general shape of segments of a circle and the latter generally in the form of sectors, the core carried electrode being angularly adjustable on a center lying in the axis of the core, the free edges of the shell carried electrode terminals lying in a common circle and the free edges of the core carried electrode terminals being arcuate with the arcs of all generated with the same radius but on centers eccentric to, and equally spaced from, the axis of the core.

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