Feb. 26, 1952 J. J. ROSE 2,586,864

SPARK PLUG ELECTRODE

Filed Aug. 22, 1950

Fig 1

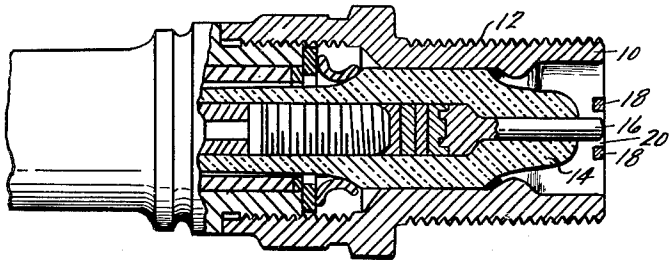


Fig 2

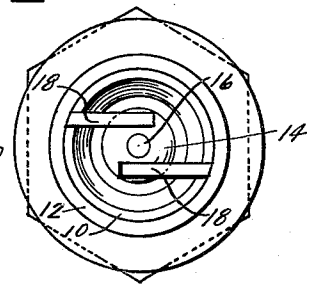


Fig 3

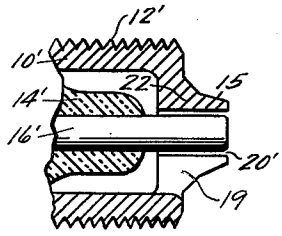


Fig 4

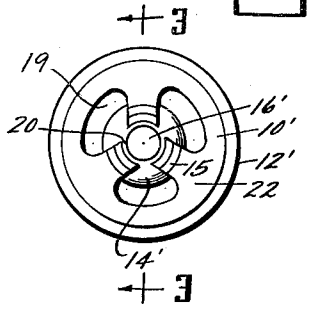


Fig 5

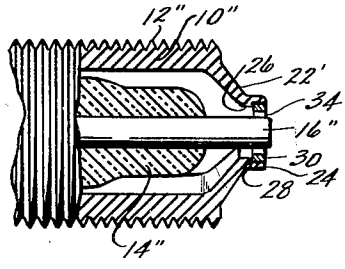
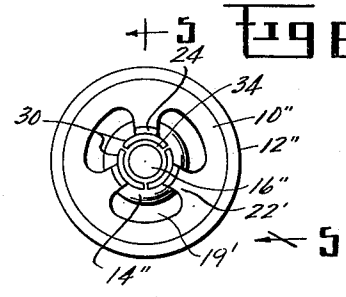


Fig 6



INVENTOR.
JOHN J. ROSE
BY Wade Kooney and
Frederick W. Cottefman
ATTORNEYS

Patented Feb. 26, 1952 2,586,864

UNITED STATES PATENT OFFICE

2,586,864

SPARK PLUG ELECTRODE

John J. Rose, Dayton, Ohio

Application August 22, 1950, Serial No. 180,885

1 Claim. (Cl. 123—169)

(Granted under the act of March 3, 1883, as amended April 30, 1928; 370 O. G. 757)

1

The invention described herein may be manufactured and used by or for the United States government for governmental purposes without payment to me of any royalty thereon.

This invention relates to spark plugs for internal combustion engines and particularly to certain improvements in the electrodes thereof, whereby the spark gap is maintained for a greatly extended period, the performance of the spark in igniting the fuel charge is greatly improved, and high-cost material used in the electrodes is conserved.

As is well known in the art, any feature of design which gives the spark gap an increased life, and any configuration which fully unmasks the spark, i. e., a configuration which exposes substantially all of the spark to the firing chamber of the engine, is an important consideration in aircraft spark plug design.

Spark plugs now in general use on aircraft engines are provided with electrodes of the best material available for long spark gap life. The two materials most commonly used for the electrodes are nickel and platinum alloy. In the somewhat lower cost construction a nickel alloy is used for both the ground and the center electrode. In another high cost spark plug type two parallel platinum wires are used for the electrodes. The material in this type has a low erosion rate but the sparking gap surfaces are very small and thus the life of the gap surfaces are very short. This type of construction, however, is conducive to good ignition because of the open configuration of the gap, whereby there is absence of shielding of the spark. The high cost of these materials makes it important that a minimum of the material be used and that it be formed so as to provide the largest possible area having the largest sparking surface exposed to the firing chamber, and that a minimum of the sparking surface be masked.

The primary object of my invention is to provide an electrode configuration using platinum wire in which the sparking will take place openly, i. e., with the least shielding of the spark and which will give the largest gap area with minimum use of costly material.

Another object is to provide an electrode configuration which will extend the spark gap into the combustion chamber with good means for conducting the electrode heat back to less heated surfaces of the spark plug. My improved design provides large opening into the nose section for reconditioning in the service.

Another object is to provide a spark plug

2

wherein the construction is rugged, the fabrication simple, and the cost low both in manufacturing and in service.

Other objects of the invention will appear from the following detailed description, reference being had to the drawing, wherein:

Fig. 1 is a longitudinal axial section taken at 1—1 of Fig. 2 through a conventional spark plug of a type which is in extensive use but which has faults which the present invention aims to rectify.

Fig. 2 is an end view of the spark plug shown in Fig. 1

Fig. 3 is a fragmentary longitudinal axial section taken at 3—3 of Fig 4 through a second type of spark plug also currently used to a considerable extent.

Fig. 4 is an end view of the spark plug shown in Fig. 3.

Fig. 5 is a fragmentary longitudinal axial section taken at 5—5 of Fig. 6 through my improved spark plug.

Fig. 6 is an end view of the spark plug shown in Fig. 5.

Like reference characters refer to like parts throughout the several views.

Referring now to the conventional plug shown in Figs. 1 and 2 the plug body 10, made of nickel steel or other suitable metal, is screw threaded at the forward end as at 12 for connection to an engine cylinder. A core 14, of porcelain, or other suitable dielectric is concentrically positioned in and closely fitted into the plug body.

The main electrode 16, usually of round platinum wire, passes centrally through the core 14 and is held concentrically positioned thereby. The grounded electrodes 18 consist of two axially transverse parallel platinum wires preferably of square cross section extending across the nose of the plug and having one end of each wire welded to the nose of the plug, the spacing between the parallel wires being such as to leave a spark gap 20 between the main electrode 16 and the grounded electrodes 18.

From a consideration of Figs. 1 and 2 it is obvious that from the nature of the gap, the spark is concentrated over a very small area of the electrodes, and while there is no shielding of the spark, the life of the electrodes is very short thus wasting all but a small part of the precious metal used.

Figs. 3 and 4 show a fragmentary axial section and an end view respectively of another conventional type of spark plug known in the art as "massive electrode" type or "cloverleaf" type. The plug body 10' usually of a nickel steel alloy

or like low cost conductive material is threaded at 12' for connection into the cylinder. The nose of the plug body is somewhat frusto-conical, being smaller at the extreme end. The core 14' has an outer diameter to fit the plug interior and an inner diameter to receive the main electrode 16' which may, like the plug body be made of a suitable grade of nickel steel alloy where an inexpensive plug is called for, but may preferably be made of platinum or platinum alloy if the diameter is kept small. The core 14' may be made of porcelain, mica, or other suitable nonconductive material.

The nose 15 of the plug body is bored enough larger than the main electrode 16' to provide the gap 20', then three openings 19 in a clover-leaf pattern are cut longitudinally through the nose 15 leaving three grounded electrodes 22 which are an integral part of the body 10'.

While the design shown in Figs. 3 and 4 is conducive to economical manufacture, there is a quite serious fault in that the spark may localize at the front or at the rear of the gap 20' or in between, whereby a considerable portion of the spark is hidden or masked; which results in unsatisfactory ignition.

Turning now to the present invention which is shown in Figs. 5 and 6, the plug body or shell 10'', the threaded portion 12'', the core 14'' and the main electrode 16'' are all conventional in configuration being substantially like those parts shown and described with reference to Figs. 3 and 4.

In the present invention, however, the nose 24 is first provided with a considerably enlarged bore as at 26, then counterbored to a shoulder as at 28. The three clover-leaf openings 19' are formed to extend lengthwise through the shell, leaving three equally spaced electrode supports 22', which are then fitted with a platinum ring 30 which is pressed into the bore up to the shoulder and welded to the three inner ends of the supports. The platinum ring 30 is preferably afterward divided into three segmental electrodes the dividing being done either before or after the welding operation or, the ring may be left whole where no adjustment of the spark gap in service is contemplated. The main electrode 16'' may if desired be made of nickel alloy, but may profitably be made of platinum if the diameter of the wire used is not too large, a diameter being determined upon which will leave a proper gap 34 between the outside of the main electrode 16'' and the bore of the ring 30.

The ring 30 is preferably made relatively narrow, measured in an axial direction and the bore 26 of relatively large diameter, which insures that

the spark will be concentrated in the gap 34 at the forward end of the plug between the platinum segments of the ring 30 and the main electrode 16''. It may be seen that with this construction, all electrodes are of platinum yet no great amount of the precious metal is required, and no considerable amount of the platinum is wasted when the plug has reached the end of its usable life. This arrangement, therefore, not only conserves platinum but localizes the spark at the forward end of the plug so that a minimum of masking is caused. Thus a "massive electrode" type of plug is provided having all the advantages of the conventional "massive electrode" plug without the disadvantage of masking pointed out with reference to the plug shown in Figs. 3 and 4.

Having described one embodiment of my invention, I claim:

An improved spark plug which comprises a hollow cylindrical body of steel or similar low cost metal, externally threaded at one end for connection to an ignition chamber, a central electrode, a series of circumferentially spaced grounded electrode supporting arms, each an integral part of said hollow cylindrical body extending from the threaded end radially inward and axially away from the threaded end, thus providing a nose on the plug which is both outside and inside somewhat in the form of a frustum of a cone, the said frustum being provided at the extreme outer end with a bore larger than the central electrode thereby leaving a spark gap and a counterbore larger than the bore, thereby providing a shoulder on the inside of each electrode supporting arm, a narrow ring of platinum or the like externally fitted to said counterbore and welded to said shoulders, the inside diameter of said ring being larger than said central electrode to provide a spark gap, and said ring being composed of as many spaced apart segments as there are electrode supporting arms, whereby the spark gap is adjustable.

JOHN J. ROSE.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,128,580	Brown	Feb. 16, 1915
1,325,439	Dinger	Dec. 16, 1919
2,109,029	Nowosielski	Feb. 22, 1938
2,208,030	Holmes	July 16, 1940
2,356,102	Tognola	Aug. 15, 1944
2,391,456	Hensel	Dec. 25, 1945