

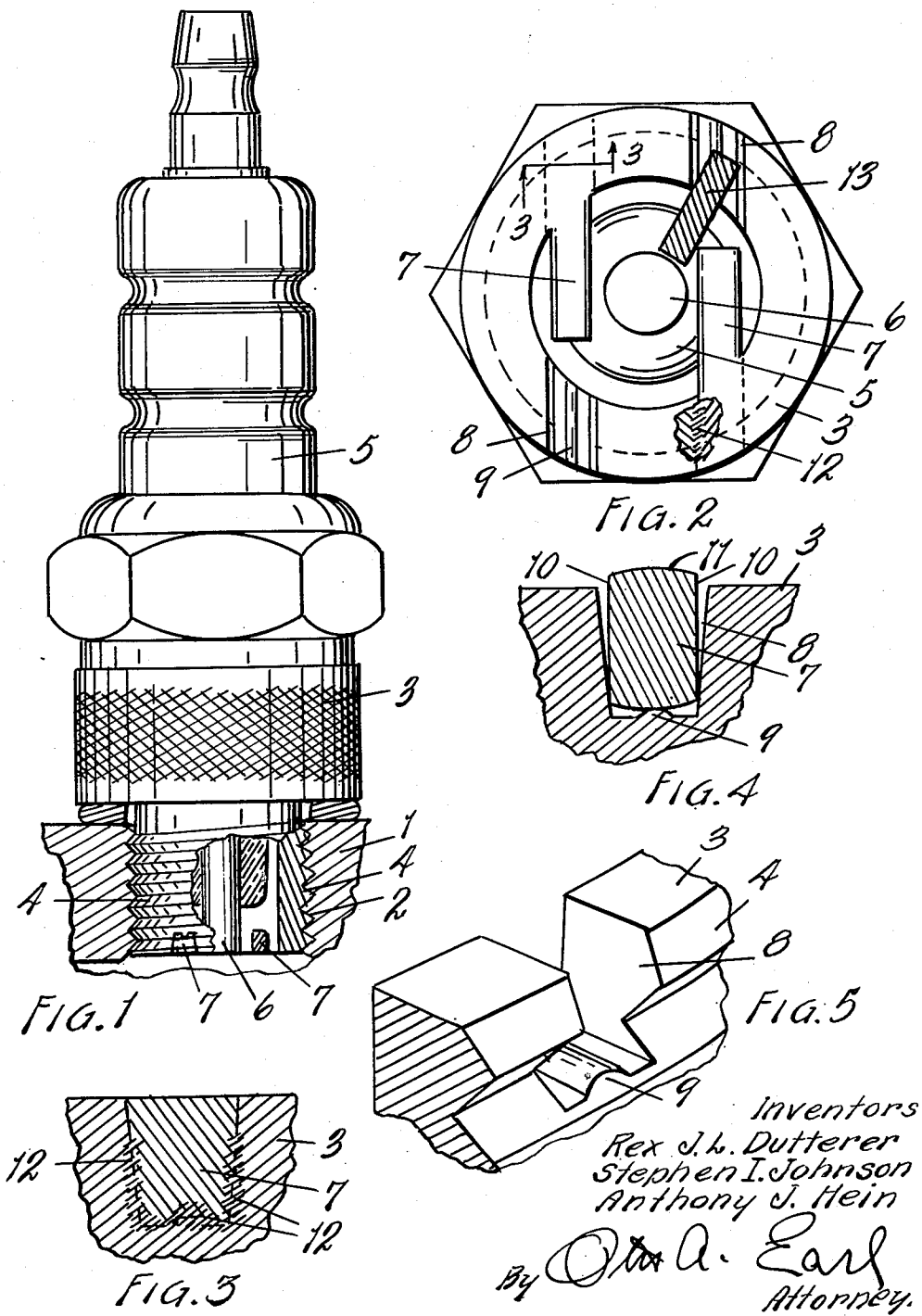
Oct. 21, 1952

R. J. L. DUTTERER ET AL

2,614,548

SPARK PLUG

Filed Aug. 1, 1949



UNITED STATES PATENT OFFICE

2,614,548

SPARK PLUG

Rex J. L. Dutterer, Stephen I. Johnson, and Anthony J. Hein, Hastings, Mich., assignors to Hastings Manufacturing Company, Hastings, Mich., a corporation of Michigan

Application August 1, 1949, Serial No. 107,876

11 Claims. (Cl. 123-169)

1

This invention relates to improvements in spark plugs.

The main objects of this invention are:

First, to provide a spark plug which maintains its efficiency over a long period of time and at the same time one which can be very economically produced.

Second, to provide a spark plug which is well adapted for so-called "heavy duty" use and use under severe working conditions and one in which the electrodes are effectively protected against erosion and against accidental injury in handling, and at the same time one in which the electrodes may be easily and effectively "gapped" or adjusted.

Third, to provide a spark plug in which the ground electrodes are so arranged and mounted that the likelihood of becoming excessively or injuriously heated is minimized.

Fourth, to provide a method of producing electrodes having these advantages which results in the very rapid and economical production of the spark plugs with great uniformity.

Objects relating to details and economies of the invention will appear from the description to follow. The invention is defined and pointed out in the claims.

A preferred embodiment of the invention is illustrated in the accompanying drawing, in which:

Fig. 1 is a fragmentary elevational view of a spark plug embodying our invention, portions being broken away and shown in section, the spark plug being illustrated as mounted on a combustion chamber which is conventionally illustrated.

Fig. 2 is an enlarged inner end view partially sectioned and broken away, an adjusting tool for an electrode being shown in section in operative relation thereto.

Fig. 3 is an enlarged fragmentary view in section on a line corresponding to line 3-3 of Fig. 4.

Fig. 4 is an enlarged fragmentary view illustrating certain steps in the making of the spark plug.

Fig. 5 is an enlarged fragmentary perspective view showing another step in the method of manufacture.

It should be understood that all of the views are considerably enlarged, this being done in the interest of clearness and convenience in illustration.

In the accompanying drawing, 1 represents a wall of an internal combustion engine having a

2

threaded bore 2 therein. The embodiment of our spark plug illustrated comprises a metallic shell 3 having external threads 4 at its inner end adapted to threadingly engage the threaded bore 2 in the wall 1. The insulator 5, desirably a ceramic insulator, is mounted in the shell, the details of the mounting and sealing of the shell forming no part of this invention but may be conventional.

The inner end of the insulator projects centrally within the inner end of the shell and terminates in spaced relation to the inner end thereof. The insulated electrode 6 is suitably mounted in the insulator to project centrally of the shell and preferably terminating adjacent or in the plane of the inner end of the shell but not extending beyond the end of the shell. Two ground electrodes 7 are provided in the embodiment illustrated. To mount these electrodes on the shell in such manner that they are fully protected by the shell and in effective heat transfer relation thereto, we form in the shell opposed pairs of slots 8 which are tapered upwardly and have rib-like raised portions 9 in the bottoms thereof. The corresponding slots of the pairs are arranged in alignment as is clearly shown in Fig. 2, the planes of the aligned slots being on opposite sides of the insulated electrode 6. The electrodes 7 are preferably formed of rod stock having parallel sides 10, as shown in Fig. 4, and rounded edges 11. These electrodes are arranged in the slots as shown in Fig. 4 and subjected to pressure and resistance welding current with the result that they are expanded into the slots 8, as shown in Fig. 3, and welded to the walls thereof as indicated at 12.

The welds are not shown in this figure as extending to the edge of the shell but that depends on the length of time the parts are subjected to the welding current. The weld should be such that an electrode is expanded into the slot into heat transfer connection with the walls thereof and desirably welded thereto throughout a substantial portion of the contacting surface as is illustrated.

The forming of the raised portions 9 at the bottom of the slots insures effective welding. The ground electrodes of this method lie entirely within the plane of the end of the shell and are protected from currents of gases which in many cases cause severe erosion of exposed electrodes. Further, the electrodes are so mounted that heat is effectively conducted therefrom to the shell thereby preventing overheating. By forming the corresponding slots of the opposed pairs in alignment they may be readily formed by a milling cutter.

3

The slots which do not receive the electrodes serve a double purpose, one being that they provide a support for a tool such as is indicated at 13 to facilitate the proper spacing of the ground electrodes from the insulated electrode, and the other is that their edges form reaming edges for clearing the threads of the plug receiving bore of the combustion chamber. It is common experience that when a spark plug is removed the threads are more or less fouled with carbon or other deposit which must be cleaned out before a new spark plug can be properly seated. Spark plugs embodying our invention are highly efficient and very durable. We are aware that the art discloses spark plugs in which the ground electrodes are shrouded but we are not aware of spark plugs having ground electrodes mounted as in our invention or having the advantages of our structure.

We have illustrated and described a practical commercial embodiment of our invention and have not attempted to illustrate or describe other embodiments or adaptations as we believe this disclosure will enable those skilled in the art to embody or adapt our invention as may be desired.

Having thus described our invention, what we claim as new and desire to secure by Letters Patent is:

1. A spark plug including an insulator and an insulated electrode carried thereby and projecting centrally from its inner end, a tubular metallic shell for said insulator, the insulated electrode being supported centrally of and terminating within the shell, said shell having opposed pairs of aligned slots extending axially from and opening at its inner end edge, the planes of the pairs of slots being on opposite sides of the insulated electrode and laterally spaced therefrom, and ground electrodes disposed in diagonally opposite slots and with their inner ends within the shell and spaced from the aligned slots and in side overlapping relation to the insulated electrode and laterally spaced therefrom, said ground electrodes being within the shell and guarded thereby and adjustable toward or from said insulated electrode, the other diagonally opposed slots being open and facilitating the engagement of a tool with the electrode aligned therewith and the fulcruming of the tool on the edges of the slot with which it is engaged for adjustment of the ground electrodes toward or from the insulated electrode.

2. A spark plug including an insulator and an insulated electrode carried thereby and projecting centrally from its inner end, a tubular metallic shell for said insulator, the insulated electrode being supported centrally of and terminating within the shell, said shell having opposed aligned slots extending axially from and opening at its inner end edge, the plane of the pair of slots being laterally spaced from the insulated electrode, and a flat bendable ground electrode disposed longitudinally edgewise of the shell in one of the slots and with its inner end within the shell and spaced from the opposite slot and in side overlapping relation to the insulated electrode and laterally spaced therefrom, said ground electrode having welded joint retaining and grounding connection to the wall of the slot, said ground electrode being within the shell and guarded thereby and bendably adjustable toward or from said insulated electrode, the opposed slot being open and facilitating the engagement of a tool with the electrode aligned therewith and the fulcruming of the tool on the

4

edges of the slot for adjustment of the ground electrode toward or from the insulated electrode.

3. A spark plug including an insulator and an insulated electrode carried thereby and projecting centrally from its inner end, a tubular metallic shell for said insulator, the insulated electrode being supported centrally of and terminating within the shell, said shell having opposed aligned slots extending axially from and opening at its inner end edge, the plane of the pair of slots being laterally spaced from the insulated electrode, and a ground electrode disposed in one of the slots and with its inner end within the shell and spaced from the opposite slot and in side overlapping relation to the insulated electrode and laterally spaced therefrom, said ground electrode being within the shell and guarded thereby and bendably adjustable toward or from said insulated electrode, the opposed slot being open and facilitating the engagement of a tool with the electrode aligned therewith and the fulcruming of the tool on the edges of the slot for adjustment of the ground electrode toward or from the insulated electrode.

4. A spark plug shell and ground electrode assembly comprising a tubular insulator shell having opposite pairs of aligned slots opening to and extending axially from its inner edge, the planes of the pairs of slots being transversely spaced and on opposite sides of and in spaced relation to the axial center of the shell, and bendable ground electrodes disposed and welded in diagonally opposed slots with their inner ends free and terminating in spaced relation to the aligned slots and laterally spaced relative to the center of the shell.

5. A spark plug shell and ground electrode assembly comprising a tubular insulator shell having an aligned pair of slots opening to and extending axially from its inner edge, the plane of the pair of slots being in transversely spaced relation to the axial center of the shell, and a bendable electrode disposed and fixedly secured in one of the slots with its inner end terminating in spaced relation to the other slot which is open to receive a tool and permit its engagement with either side of the electrode and provide fulcruming support therefor facilitating the adjustment of the electrode to and from the center of the shell.

6. A tubular metallic spark plug shell having an externally threaded portion at its inner end and opposed pairs of aligned ground electrode receiving slots in the wall thereof opening to and extending axially from its inner end edge, the planes of the pairs of slots being transversely spaced and on opposite sides of and in spaced relation to the axial center of the shell whereby ground electrodes may be disposed in diagonally opposed slots and supported with their inner ends in spaced relation to the slot aligned therewith and in laterally spaced relation to an insulated electrode disposed centrally within the shell.

7. A spark plug including an insulator and an insulated electrode carried thereby and projecting from its inner end, a tubular metallic shell for said insulator, the insulated electrode being supported centrally of and terminating within the shell, said shell having angularly spaced electrode receiving slots in the wall thereof extending axially from and opening to its inner end edge, and bendable ground electrodes disposed in the said slots with their inner ends free within the shell and in side overlapping relation to the insulated electrode and laterally spaced there-

5

from, said ground electrodes being within the shell and guarded thereby and bendably adjustable towards and from said insulated electrode, said shell having tool supporting members angularly spaced relative to the slots in which the ground electrodes are disposed facilitating the adjustment of the ground electrodes to or from the insulated electrode.

8. A spark plug including an insulator and an insulated electrode carried thereby and projecting from its inner end, a tubular metallic shell for said insulator, the insulated electrode terminating within the shell, said shell having angularly spaced slots in the wall thereof, and a bendable ground electrode disposed in one of the slots with its inner end free and within the shell and in laterally spaced side overlapping relation to the insulated electrode and bendably adjustable relative thereto, the other slot being open facilitating the engagement of a tool with either side of the free end of the ground electrode and the fulcruming engagement of the tool with an edge of the slot for adjustment of the ground electrode to or from the insulated electrode.

9. A spark plug shell and ground electrode assembly comprising a tubular insulator shell having a slot open to and extending axially from its inner edge, and a bendable electrode disposed and fixedly secured in said slot with its inner end free and spaced from and guarded by the wall of the shell and disposed in laterally spaced relation to the axial center of the shell, said electrode being mounted within and protected by the shell, said shell having another open slot extending from its inner edge and angularly spaced from the point of attachment of the ground electrode to the shell for engagement by a tool engaged with either side of the free end of the ground electrode for adjusting it to or from an insulated electrode disposed within and surrounded by the shell.

10. A spark plug shell and ground electrode assembly comprising a tubular insulator shell having a plurality of angularly spaced slots open to

6

and extending from its inner edge, and bendable ground electrodes disposed and welded in said slots with their inner ends free and spaced from and guarded by the wall of the shell and disposed in laterally spaced relation to the axial center of the shell, said shell having other open slots angularly spaced relative to the point of attachment of the ground electrodes to the shell and adapted to fulcrumingly receive a tool engaged with either side of the free end of a ground electrode for adjustment thereof toward or from the axial center of the shell.

11. A spark plug shell and ground electrode assembly comprising a tubular insulator shell having an externally threaded portion at its inner end, a bendable ground electrode disposed within the shell and guarded thereby, and having its outer end fixedly secured thereto with its inner end free and bendable and spaced from and guarded by the wall of the shell, said shell having an open slot extending axially thereof and into the threads of the shell and angularly spaced relative to the point of attachment of the electrode to the shell to facilitate the adjustment of the electrode laterally in either direction by engagement of either side thereof with a tool fulcrumingly engaged with a side wall of the slot.

REX J. L. DUTTERER.
STEPHEN I. JOHNSON.
ANTHONY J. HEIN.

REFERENCES CITED

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

UNITED STATES PATENTS

Number	Name	Date
1,940,324	Rabazzana	Dec. 19, 1933
1,943,028	Rabazzana	Jan. 9, 1934
2,120,492	Graf	June 14, 1938
2,150,724	Nowosielski	Mar. 14, 1939
2,150,725	Nowosielski	Mar. 14, 1939
2,292,974	Smithells	Aug. 11, 1942
2,360,279	Rollert	Oct. 10, 1944