June 21, 1960 E. McLAREN 2,942,135

SPARK PLUG

Filed Jan. 31, 1958

Fig. 1.

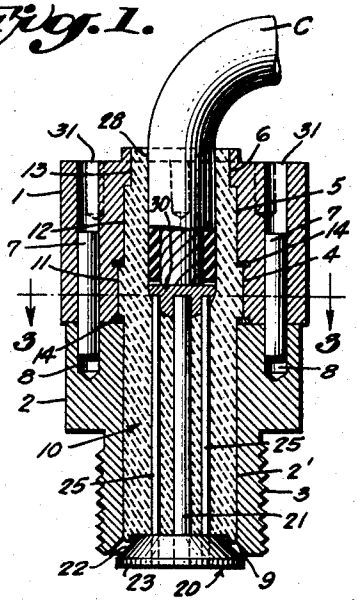


Fig. 4.

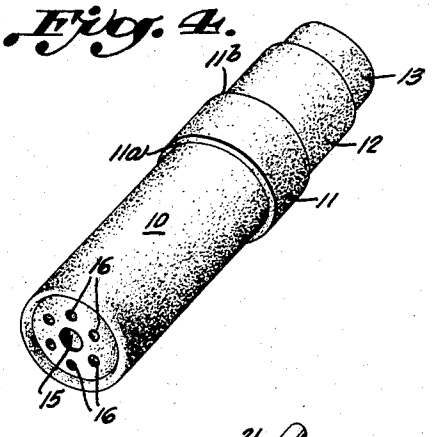


Fig. 5.

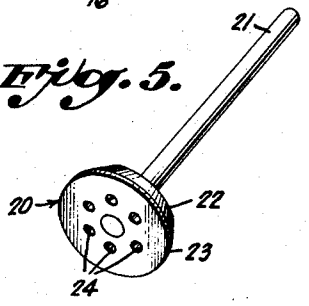


Fig. 2.

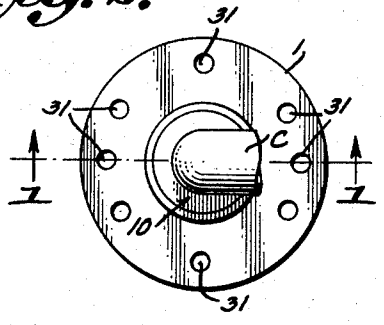


Fig. 6.

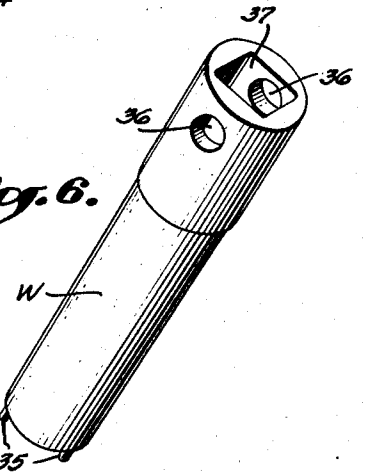
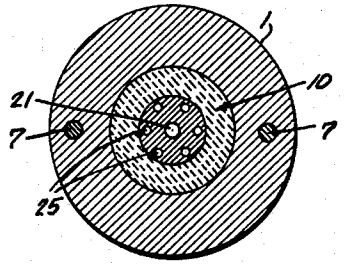


Fig. 3.



INVENTOR

EDWARD McLAREN

BY Samuel Edwards

ATTORNEY

United States Patent Office 2,942,135 Patented June 21, 1960

2,942,135

SPARK PLUG

Edward McLaren, Newburgh, N.Y., assignor to Eli Ladenheim, Ellenville, N.Y.

Filed Jan. 31, 1958, Ser. No. 712,517

4 Claims. (Cl. 313—136)

This invention relates to a spark plug and more particularly to a spark plug having an annular sparking electrode for producing an annular spark discharge.

It is the object of the present invention to provide a spark plug composed of comparatively few parts of rugged design which, following the assembly thereof, is capable of producing an effective spark discharge for a limitless long period of time, without fouling or destruction of the parts producing the spark discharge.

It is another object of the invention to provide a reliably operating spark plug which may be used in all locales where a spark discharge may be desired, such as internal combustion engines, oil burners, jet burners, etc.

It is another object of the invention to provide a spark plug having the essential parts thereof so encased and sheathed that maximum protection is afforded to the parts while in use, and breakage or damage of the component parts in the course of dismantling of the engine is well-nigh impossible.

It is a further object of the invention to provide a spark plug which is self-cleaning, by preventing the accumulation of the fouling components within the field of the spark gap.

The invention proceeds upon the principle of providing a spark plug having a ceramic core and a protective metal housing therefor encasing the ceramic core in its entirety, to afford protection against breakage or other damage. The metallic housing, which is preferably of heat-resisting steel, is of comparatively short length relative to its diameter, to produce a stubby spark plug having great structural strength. The sparking efficiency of the plug is enhanced by the provision of a disc electrode positioned adjacent to the bottom of the ceramic core with a conical face spaced from a correspondingly tapered face on the end of the steel housing, which is grounded in the conventional manner, to provide a spark discharge which ignites effectively the combustible mixtures sought to be exploded with the spark discharge. The annular spark discharge effectively burns up all of the combustible components and prevents the formation of deposits of carbon and other deleterious components which in time diminish or destroy the effectiveness of the spark plug.

The electrical energy from the ignition system is fed to the sparking electrode in a reliable manner by the provision of a plurality of auxiliary conductors surrounding a central shank which mounts the annular sparking electrode, and the several current paths for the electrical energy serve to minimize local heating of the ceramic core so that no failure of the spark plug can arise on this account. Not only do the auxiliary conductors aid in dissipating the intense heat generated at the sparking electrode to prevent a buckling of the central shank, but the bundle of conductors serves to impart an added degree of mechanical strength to the assembly.

The component parts of the ceramic core and the surrounding steel housing are so designed that a plurality of break-joints or seals are formed along the junction surfaces between the core and the housing in order to

preclude any seepage of gaseous, liquid or solid matter from the cylinder into which the plug is mounted to the exterior thereof.

Furthermore, the spark plug incorporates additional features which promote dissipation of heat from the plug and facilitate the removal of the plug from the engine block and its insertion thereinto.

Other objects and purposes will appear from the detailed description of the invention following hereinafter, taken in conjunction with the accompanying drawing wherein:

Fig. 1 is a vertical sectional view with certain parts in elevation of the spark plug in accordance with the invention, along line 1—1 of Fig. 2;

Fig. 2 is a plan view of the spark plug shown in Fig. 1;

Fig. 3 is a horizontal sectional view along line 3—3 of Fig. 1;

Fig. 4 is a perspective view of the ceramic or porcelain core of the spark plug assembly;

Fig. 5 is a perspective view of the sparking electrode with the supporting shank therefor; and

Fig. 6 is a perspective view of a plug wrench adapted to manipulate the spark plug for rapid assembly or disassembly from an engine block without damage to any of the parts.

As shown in the drawings, the spark plug in accordance with the invention consists of a metallic housing which is preferably formed of heat-resisting steel and comprises an upper cylindrical part 1 adjoined to a lower cylindrical part 2 having a threaded end 3 which is designed to be threaded into an engine block or analogous structure, as is well known in the art.

While the internal bore 21 of the lower housing part 2 is of uniform diameter, the bore of the upper part 1 is stepped in three parts, 4, 5 and 6 of successively decreasing diameters. A pair of diametrally opposed pins are seated in the bottom end face of part 1 which cooperate with corresponding recesses 8 in the upper face of lower housing part 2, and following the assembly of the spark plug as described in detail hereinafter, the two housing parts are joined together by pressure between the parts and resistance welding at the interengaging pins and sockets 7 and 8.

The lower end of the housing 3 below the bore 2' is provided with a bevelled face 9 and constitutes the ground electrode for the spark discharge. The bevel of face 9 is preferably 45°.

The core 10 for mounting the active electrode of the spark discharge is formed of any suitable heat resistant ceramic or porcelain of any composition known in the art and is provided with a smooth lateral surface at the lower end thereof for engagement with the internal bore 2' of housing portion 2, and with portions 11, 12 and 13 at the upper end thereof of successively diminishing diameters for close interfitting engagement with the stepped parts 4, 5 and 6, respectively, of the internal bore of housing portion 1. The intermediate portion 11 of maximum diameter of the ceramic core presents a pair of shoulders 11*a* and 11*b* at the opposite ends thereof against each of which is adapted to be seated a thin metallic washer 14 of brass or similar soft metal to overlie the joint between the ceramic shell and surrounding housing 1. These washers are shown of appreciable thickness in Fig. 1 for the purpose of illustration, but actually they may have a thickness of one or two thousandths inch and serve solely as sealing rings for breaking the joint between the core and the steel housing to prevent capillary passage of gas or oils along the junction surfaces between the core and the housing.

The sparking electrode 20 shown in Fig. 5 is formed of any corrosion and heat-resistant alloy of the types

known in the art and may consist of heat-resistant steel. The electrode **20** is formed as a disc having a lateral edge **23** and a bevelled edge **22** of a slope conforming to the slope of the sparking edge **9** of the ground electrode, which slope is preferably of an angle of 45°. The shank or post **21** integral with the disc **20** extends upwardly from the center thereof. In addition, a plurality of apertures **24** are provided in the disc equidistantly around the shank for anchoring auxiliary conductors or electrodes **25** which are adapted to pass through corresponding recesses **16** in the bndy of the ceramic core surrounding the central bore **15** therein for the accommodation of the central shank **21**. The electrodes **25** and central shank **21** extending from the annular sparking electrode **20** project into and terminate at the base of recess **28** in the opposite end of the ceramic core and these several conductor members are interconnected by means of a drop of solder or babbit **30** at the base of the recess. The insulated cable C, having a central conductor therein leading from the distributor cap, fits closely into the recess **28** and the exposed end of the cable contacts the unifying metal mass **30** and the central shank **21** and auxiliary conductors **25** to effectively transmit the electrical energy to the sparking electrode **20**. The subdivision of the energy into multiple paths, preferably six paths in addition to the path of the central electrode for optimum operation, serves to minimize the heating effects in the central core to prevent a deterioration thereof on this account.

To assemble the plug, the central ceramic core is first seated in the housing portion **1** so that the sealing washers **14** may assume their position as shown in the drawing. Thereafter, the housing portion **2** is mounted on the opposite end of the core followed by the junction of the housing portions **1** and **2** by pressure and resistance welding. The sparking electrode is then inserted into the bottom of the ceramic core until the shank **21** and auxiliary conductors **25** protrude into the recess **28** at the opposite end of the core. These several conductors and shank are unified at that point by solder or other mass of metal for electrical contact with the cable C when the same is inserted into the opening **28** at the top of the spark plug. The energy fed to the sparking electrode by the seven multiple conductors effects an annular discharge across the spark gap resembling a glowing cigar lighter.

The plug is formed of cylindrical parts which facilitates machining and other fabricating operations. With an external diameter of housing **1** of one inch and length of ceramic core of 1 1/16", a plug of short or stubby length is attained, namely one having a ratio of diameter to length of approximately two to three. This results in a plug of great strength. In addition, the plug evidences good heat dissipating characteristics and this may be enhanced by the provision of a plurality of bores **31** in the top face of the housing **1** which in nowise influences the strength of the housing. Since the entire length of the ceramic core **10** is surrounded by the metallic housing, maximum protection against breakage and damage is afforded by this feature.

A pair of the diametral holes **31** in the top of the housing may be used as sockets for the reception of the lugs **35** projecting from one end of a plug wrench W as shown in Fig. 6, which may be engaged by a suitable rod extending through holes **36** in the opposite ends of the plug, or by an additional tool fitting within rectangular socket **37** at said end, for the purpose of turning the wrench to disengage or insert the plug within its cylinder.

While I have described my invention as embodied in a specific form and as operating in a specific manner for purposes of illustration, it should be understood that I do not limit my invention thereto, since various modifications will suggest themselves to those skilled in the art without departing from the spirit of my invention, the scope of which is set forth in the annexed claims.

I claim:

1. A cylindrical spark plug comprising a cylindrical ceramic core encased in its entirety by a steel housing with external threading on one end thereof, an annular sparking electrode adjacent to said end of said metallic housing with both the wall of the electrode and the internal wall of the housing adjacent thereto beveled correspondingly at an angle of substantially 45° to form an annular sparking gap therebetween, an integral shank extending from said electrode through the center of said ceramic core, a plurality of auxiliary conductors equidistantly spaced around said shank extending from said sparking electrode in parallel to said shank through bores in said core, said shank and auxiliary conductors terminating within a recess in the end of said core opposite to said sparking electrode, and a mass of soldering metal interconnecting the ends of said shank and conductors within said recess for electrical contact with an electrical cable extending from the ignition system.

2. A device as set forth in claim 1 wherein said ceramic core is of enlarged diameter at a portion thereof to present displaced shoulders on the lateral wall of said core and thin metallic washers seated on said shoulders to seal the joints between the core and the encasing steel housing at said shoulders.

3. A device as set forth in claim 2 wherein said steel housing is composed of two component cylindrical units integrally connected together adjacent to the enlarged portion of said ceramic core.

4. A cylindrical spark plug comprising a cylindrical ceramic core encased in its entirety by a steel housing with external threading on one end thereof, an annular sparking electrode adjacent to said end of said metallic housing with both the wall of the electrode and the internal wall of the housing adjacent thereto beveled correspondingly at an angle of substantially 45° to form an annular sparking gap therebetween, an integral shank extending from said electrode through the center of said ceramic core, a plurality of auxiliary conductors equidistantly spaced around said shank extending from said sparking electrode in parallel to said shank through bores in said core, said shank and auxiliary conductors terminating within a recess in the end of said core opposite to said sparking electrode, a mass of soldering metal interconnecting the ends of said shank and conductors within said recess for electrical contact with an electrical cable extending from the ignition system, and a plurality of cooling recesses bored in the end wall of said metallic housing remote from the threaded end, at least one pair of said recesses serving as sockets for receiving the lugs of a plug wrench on a circular end face corresponding to the exposed end of the cylindrical spark plug.

References Cited in the file of this patent

UNITED STATES PATENTS

1,501,368	Powell	July 15, 1924
1,518,248	Broluska	Dec. 9, 1924
1,529,853	Thoma	Mar. 17, 1925
1,538,517	Gebhardt	May 19, 1925
2,031,293	Wamelink	Feb. 18, 1936
2,121,178	Sousa	June 21, 1938
2,214,958	Gotterba	Sept. 17, 1940
2,318,440	Wall	May 4, 1943
2,790,104	Smits	Apr. 23, 1957
2,831,993	Lentz	Apr. 22, 1958