March 23 , 1926. 1,577,900

M. EVANS

SPARK PLUG

Filed Sept. 14, 1923

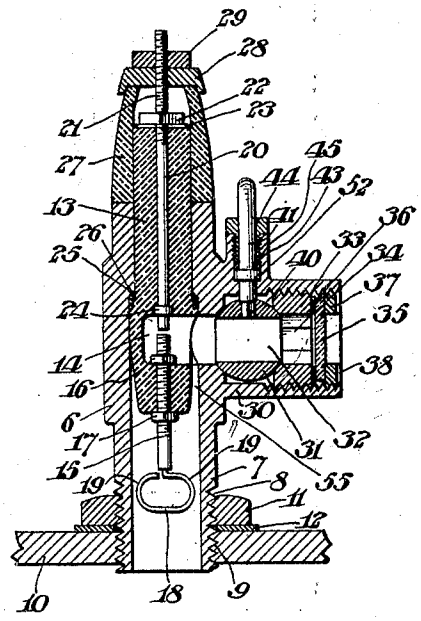


Fig. 1.

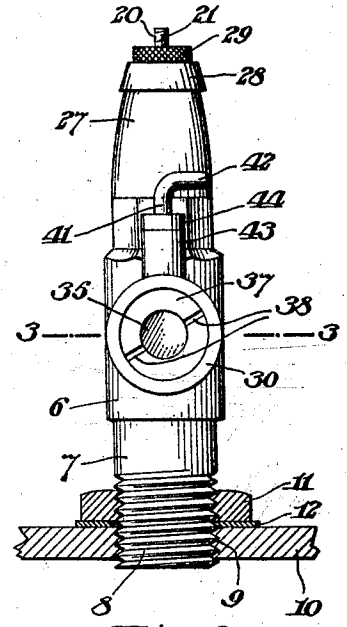


Fig. 2.

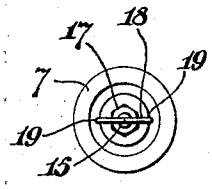


Fig. 5.

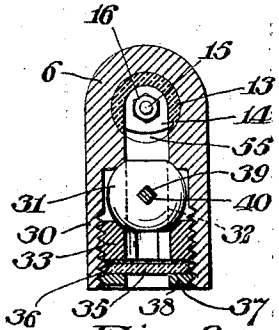


Fig. 3.

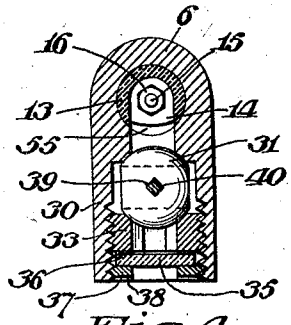


Fig. 4.

Inventor:
Michael Evans,
By Jas. C. Wolverton
Attorney.

Patented Mar. 23, 1926. 1,577,900

UNITED STATES PATENT OFFICE.

MICHAEL EVANS, OF PHILADELPHIA, PENNSYLVANIA.

SPARK PLUG.

Application filed September 14, 1923. Serial No. 662,601.

To all whom it may concern:

Be it known that I, MICHAEL EVANS, a citizen of the United States, residing at Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented certain new and useful Improvements in Spark Plugs, of which the following is a specification.

My invention relates to spark plugs for automotive engines and the like, and relates more particularly to an improved form of spark plug provided with a spark gap device for intensifying the ignition spark, and also provided with means for permitting the observation, when desired, of the operation of the spark plug, as well as the conditions within the cylinder during the operation of the engine.

It is well known to those skilled in the art that the intensity of the ignition spark will be greatly increased by the provision, in the ignition circuit, of an auxiliary spark gap, and it is also well known that faults in the operation of the engine, particularly in multi-cylinder engines, can often be ascertained and determined by the manner in which such auxiliary spark gaps are operating, as well as by the color of the exploding gases within the cylinder at the time of the ignition.

The principal object of my invention is to provide, in a unitary structure, a simple and efficient form of spark plug adapted to be mounted in the cylinder head of a gas engine or the like, having incorporated therein a spark gap device for intensifying the spark at the ignition points, and also having means for observing the operation of the spark gap, as well as the color of the exploding gases, whereby faulty operation of the engine may be readily detected and ascertained.

A further object of my invention is to provide a device of the character aforesaid, of such construction and arrangement that the observation window of the spark plug will be protected from strains and fouling during the time when it is not desired to observe the operations within the interior of the spark plug.

A further object of my invention is to provide, in a device of the character aforesaid, certain improved details of construction.

The nature and characteristic features of my present invention will be more readily understood from the following description, taken in connection with the accompanying drawings forming part hereof, in which—

Figure 1 is a vertical, central, sectional view of a spark plug embodying the main features of my present invention;

Fig. 2 is a front elevation thereof;

Fig. 3 is a horizontal section taken approximately on the line 3—3 of Fig. 2, the parts being shown in the positions assumed when it is desired to observe the operations within the spark plug;

Fig. 4 is a view similar to Fig. 3, but with the internal parts in the positions assumed when it is not desired to observe the operations, that is to say, during the normal functioning of the engine in connection with which the spark plug is used; and

Fig. 5 is an underneath plan view of the lower end of the device, illustrating a preferred arrangement of the sparking terminals.

Referring to the drawings, in the particular embodiment of my invention therein shown, 6 is the housing of the spark plug, the lower tubular portion 7 of which is threaded as at 8, preferably with a non-tapered thread, for a reason which will be hereinafter set forth. The threaded portion 8 engages the complemental threaded portion 9 of the cylinder head 10, and a lock nut 11 is also mounted on the threaded portion 8, a gasket 12 being provided between the lock nut 11 and the top surface of the cylinder head 10.

Mounted in the housing 6 is an insulating member 13, preferably made of porcelain, or other suitable material, the insulating properties of which will not be deteriorated by the heat generated during the operation of the engine. The insulating member 13 is provided, near its lower end, with a chamber 14 open at one side (see Fig. 1). The chamber 14 is in communication with the interior of the tubular portion 7 through a passageway 55, which may be formed by reducing the diameter of the lower portion of the insulating member 13, as illustrated in Fig. 1 of the drawings.

Mounted in the lower end of the insulating member 13 is a spark terminal device, which, in the form shown, comprises a threaded conducting rod 15, the upper end of which terminates within the chamber 14.

Nuts 16 and 17 are mounted on the threaded rod 15 and serve to permit longitudinal adjustment of the upper end of said rod 15 within the chamber 14, for a purpose to be hereinafter set forth. The lower end of the spark terminal device comprises a bow-shaped device 18, the sides 19 of which are arranged in proximity to, but not touching, the walls of the tubular portion 7 of the housing 6, being separated therefrom a sufficient distance to permit the spark to jump to ignite the explosive mixture within the cylinder of the engine.

Mounted in the upper end of the insulating member 13 is a conducting rod 20, the lower end of which extends into the chamber 14 in proximity to the upper end of the rod 15 of the spark terminal device. The rod 20 is provided with an enlarged portion 21, forming a shoulder for the retention of the rod 20 in the insulating member 13 at a fixed position. The upper end of the rod 20 is threaded, as at 21, and a nut 22 is mounted thereon for confining the rod in its proper position in the insulating member 13, as above mentioned. A washer 23 may be disposed between the nut 22 and the upper end of the insulating member 13, for the protection of the insulating member against breakage, serving also as a gasket to prevent leakage of the gases from the interior of the cylinder.

For the purpose of retaining the insulating member 13 within the housing 6, the upper portion thereof may be reduced in diameter forming a shoulder as at 24, a gasket 25 being interposed between said shoulder 24 and the interior shoulder 26 of the housing 6. A sleeve 27, made of insulating material, surrounds the portion of the insulating member 13 which extends above the top of the housing 6, and the lower end of the sleeve 27 bears against the upper end of the housing 6. A threaded cap member 28 is mounted on the threaded portion 21 of the rod 20, the upper end of the sleeve 27 being seated therein, so that when the cap member 28 is advanced sufficiently upon the threaded portion 21 of the rod 20, the insulating member 13 will be securely held in position within the housing 6. A knurled nut 29 may also be mounted on the threaded portion 21 of the rod 20, for attaching the connecting wires of the ignition system of the automotive engine.

The housing 6 is provided with an off-set portion 30, arranged in alinement with the chamber 14 of the insulating member 13. Mounted in this off-set portion 30 is a valve member 31, preferably spherical in shape, and having a central opening 32 extending therethrough. The spherical valve member 31 is confined at the proper location within the off-set portion 30 by means of a cylindrical threaded member 33 which also has a central passageway 34, preferably of hexagonal or other non-circular interior contour, to facilitate the assembly and adjustment of the parts. A disc 35, made of glass or other transparent material, is mounted in the off-set portion 30 in front of the opening 34 of the member 33, a soft metallic washer or gasket 36 being preferably interposed between the inner surface of the transparent disc member 35 and the outer surface of the member 33, this washer 36 serving to minimize breakage of the disc member 35, and also serving to prevent leakage of the gases from the interior of the structure. A threaded ring member 37 is mounted in the off-set portion 30 and serves to confine the transparent disc member 35 in its proper position. The threaded ring member 37 may be provided with a screw driver slot 38, for the purpose of mounting and adjusting the same in the structure.

For the purpose of rotating the spherical member 31, the same may be provided in its upper portion with an aperture 39, preferably square in contour, which is engaged by the complementally shaped lower end 40 of a stem 41. The upper end of the stem 41 is provided with a handle 42 for the manual operation of the same. The stem 41 is also provided with an enlarged portion 52, which is confined within an upwardly extending portion 43 of the off-set portion 30 by means of a threaded gland member 44, a suitable gasket or packing 45 being interposed between the lower end of the gland 44 and the shoulder formed by the enlarged portion 52 of the stem 41.

It will be noted, as hereinbefore set forth, that the lower end of the rod 20 is fixed in position within the chamber 14, and that the upper end of the threaded rod 15 of the spark terminal device terminates within said chamber in proximity to, but not touching, the lower end of the rod 20, the nuts 16 and 17 being provided so that the opening between the ends of said respective rods may be adjusted the proper distance to form an auxiliary spark gap for the purpose of intensifying the ignition sparks which jump between the sides of the member 18, at the lower end of the spark terminal device, and the interior wall of the lower tubular portion 7 of the housing 6. It will, of course, be understood that whenever the spark plug is properly functioning, a spark will jump across the gap within the chamber 14 whenever an ignition spark jumps at the terminal.

By reason of the passageway which is afforded through the opening 55, extending between the interior of the engine cylinder and the spark gap chamber 14, when the compression in the engine occurs, a certain amount of the explosive mixture will be forced into the chamber 14, so that, in the event of the ignition spark not properly

jumping from the sides of the terminal member 18, the spark afforded at the auxiliary gap device will also serve to ignite the explosive mixture, and by reason of the explosive gases being contained within the chamber 14, the color of the same may be readily observed at the time of the explosion, for the purpose of indicating faults in the operation of the engine, as more particularly hereinafter set forth.

In the ordinary functioning of the spark plug, the spherical valve member 31 will be turned to the position shown in Fig. 4 of the drawings, so that the window disc 35 will be relieved of the strains of the periodic explosions within the engine cylinder, and will also be protected against fouling through the deposit of carbon on the inner surface of the disc. When, however, it is desired to observe the operations within the interior of the spark plug, the spherical valve member 31 is turned to the position shown in Figs. 1 and 3 of the drawings, so that the action of the spark at the gap, between the ends of the rods 20 and 15, may be observed through the transparent window 35, as also the character of the explosion may be observed for the purpose of indicating lack of compression in particular cylinders, and other faults in the operation of the engine.

It should be noted that, when the spherical valve member 31 is turned to the closed position, the pressure within the interior of the spark plug will tend to seat the same more firmly on the seat provided at the inner end of the member 33, and it should also be noted that, by the arrangement of the lock nut 11 on the threaded portion 8 of the tubular extension 7 of the housing 6, the spark plug may be arranged in the head of the cylinder with the off-set portion 30 projecting in any desired direction for the purpose of affording a more convenient observation of the spark gap through the transparent member 35, which feature would not be obtained by the use of a tapered thread or a straight thread with a permanent shoulder, as in the ordinary spark plugs at present in common use.

It will be seen that there is thus provided a simple and efficient form of spark plug, comprising a unitary structure in which there is provided an auxiliary spark gap device for intensifying the spark at the ignition points, said spark plug also having means for permitting the observation of the auxiliary spark gap as well as the conditions within the cylinders, which means are so constructed and arranged as to protect the observation window from strains and fouling during the normal operation of the engine, and said spark plug also having means for permitting the same to be mounted in the cylinder head with the observation window disposed in any desired direction.

Having thus described the nature and characterisitc features of my invention, what I claim as new and desire to secure by Letters Patent is:

1. A spark plug comprising a housing adapted to be mounted in the cylinder of an automotive engine, conducting members, and means for insulating said conducting members from said housing, the structure having an internal spark gap chamber, in communication with the interior of the engine cylinder, said conducting members having ends terminating in said chamber in proximity to each other to form an auxiliary spark gap therebetween, a transparent window member mounted in a portion of said housing, opposite said internal spark gap chamber, a valve member enclosedly mounted in said housing and interposed between the window member and the spark gap chamber, adapted to be mounted in the cylinder of an automotive engine and externally extending manually operable means for rotating said valve member between the open and closed positions.

2. A spark plug comprising a housing adapted to be mounted in the cylinder of an automotive engine, conducting members, and means for insulating said conducting members from said housing, the structure having an internal spark gap chamber in communication with the interior of the engine cylinder, said conducting members having ends terminating in said chamber in proximity to each other to form an auxiliary spark gap therebetween, said housing having an off-set portion in alinement with the spark gap chamber, a transparent window member mounted in said off-set portion, a valve member enclosedly mounted in said off-set portion and interposed between the window member and the spark gap chamber, and adapted to close the communication between said chamber and the inner surface of the window member and externally extending manually operable means for rotating said valve member between the open and closed positions.

3. A spark plug comprising a housing adapted to be mounted in the cylinder of an automatic engine, conducting members, and means for insulating said conducting members from said housing, the structure having an internal spark gap chamber in communication with the interior of the engine cylinder, said conducting members having ends terminating in said chamber in proximity to each other to form an auxiliary spark gap therebetween, one of said conducting members being adjustable with respect to the other, said housing having an off-set portion in alinement with the spark gap cham-

ber, a transparent window member mounted in said off-set portion, a valve member enclosedly mounted in said off-set portion and interposed between the window member and the spark gap chamber, and adapted to close the communication between said chamber and the inner surface of the window member and externally extending manually operable means for rotating said valve member between the open and closed positions.

4. A spark plug comprising a housing adapted to be mounted in the cylinder of an automotive engine, a unitary insulating member mounted therein, said insulating member having an internal spark gap chamber formed therein, said insulating member being so shaped as to afford a communication between the spark gap chamber and the interior of the cylinder, conducting members mounted in said insulating member having their ends terminating in said chamber in proximity to each other to form an auxiliary spark gap therebetween, a transparent window member mounted in a portion of said housing opposite said internal spark gap chamber, a valve member mounted in said housing interposed between the window member and the spark gap chamber, and adapted to close the communication between said chamber and the inner surface of the window member and externally extending manually operable means for rotating said valve member between the open and closed positions.

5. A spark plug comprising a housing, adapted to be mounted in the cylinder of an automotive engine, a unitary insulating member mounted therein, said insulating member having an internal spark gap chamber formed therein, said insulating member being so shaped as to afford a communication between the spark gap chamber and the interior of the cylinder, conducting members mounted in said insulating member having their ends terminating in said chamber in proximity to each other to form an auxiliary spark gap therebetween, said housing having an off-set portion in alinement with the chamber in the insulating member, a transparent window member mounted in said off-set portion, a valve member mounted in said off-set portion and interposed between the window member and the spark gap chamber and adapted to close the communication between said chamber and the inner surface of the window member, and externally extending manually operable means for rotating said valve member between the open and closed positions.

6. A spark plug comprising a housing adapted to be mounted in the cylinder of an automotive engine, conducting members, and means for insulating said conducting members from said housing, the structure having an internal spark gap chamber in communication with the interior of the engine cylinder, said conducting members having ends terminating in said internal chamber in proximity to each other to form an auxiliary spark gap therebetween, said housing having an off-set portion in alinement with the spark gap chamber, a transparent window member mounted in said off-set portion, a spherical valve member enclosedly mounted in said off-set portion and interposed between the window member and the spark gap chamber, and externally extending manually operable means for rotating said valve member between the open and closed positions.

7. A spark plug comprising a housing adapted to be mounted in the cylinder of an automotive engine, conducting members, and means for insulating said conducting members from said housing, the structure having an internal spark gap chamber in communication with the interior of the engine cylinder, said conducting members having ends terminating in said internal chamber in proximity to each other to form an auxiliary spark gap therebetween, said housing having an off-set portion in alinement with the spark gap chamber, a spherical valve member enclosedly mounted in said off-set portion, a valve seating member threaded in said off-set portion having an opening extending therethrough, a transparent window member mounted in said off-set portion adjacent to said valve seating member, a ring member threaded in said off-set portion for retaining said window member, and manually operable means for rotating said valve member.

In testimony whereof, I have hereunto signed my name.

MICHAEL EVANS.