Aug. 15, 1950 E. W. MITCHEL 2,519,273

SPARK PLUG

Filed April 22, 1946

Fig. 1.

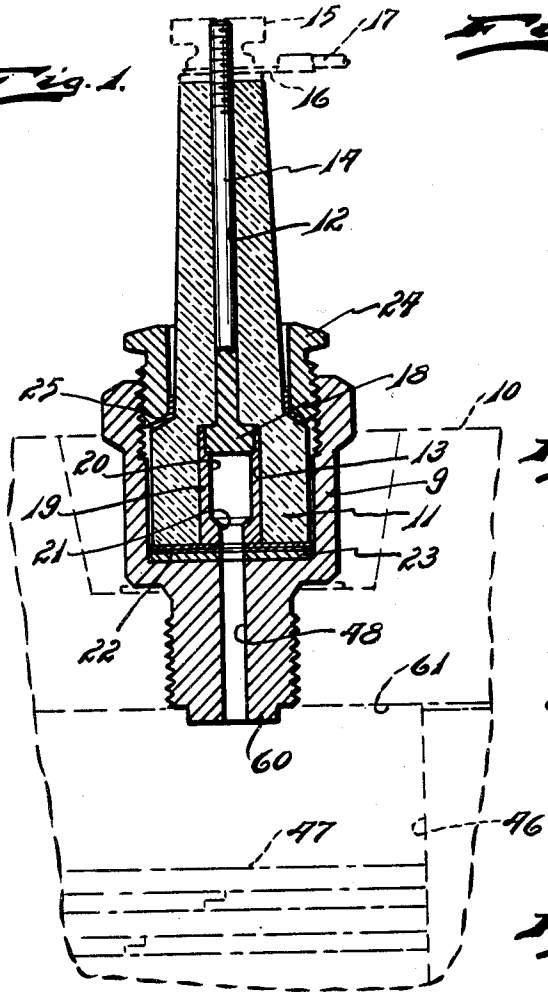


Fig. 2.

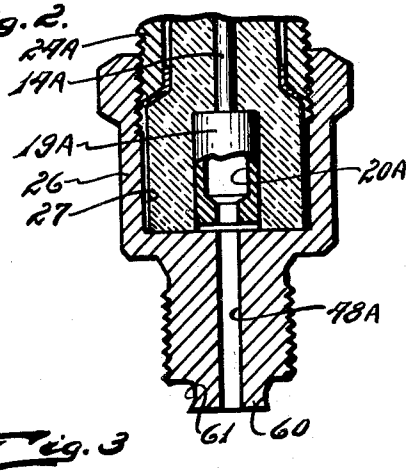


Fig. 3

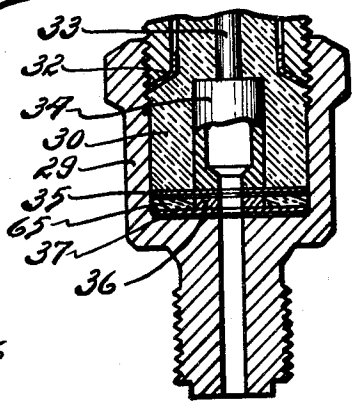


Fig. 4.

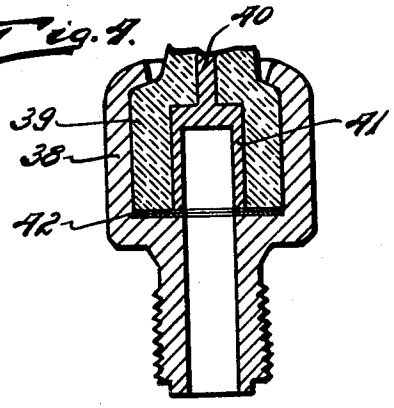
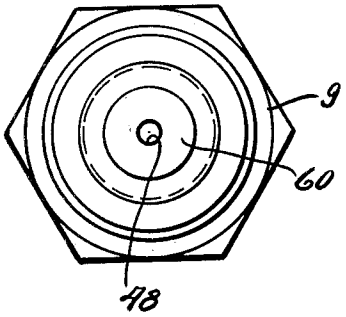


Fig. 5.



INVENTOR
EDWARD W. MITCHEL
BY Thos. A. Donnelly
ATTORNEY

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SPARK PLUG

Edward W. Mitchel, Detroit, Mich., assignor to Hiram W. Broadwell, Detroit, Mich.

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2 Claims. (Cl. 123—169)

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My invention relates to a new and useful improvement in a spark plug and adapted for use in internal combustion engines and has for its object the provision of a spark plug which will be simple in structure, economical to manufacture, durable, and highly efficient in use.

Another object of the invention is the provision of a spark plug so constructed and arranged that the operation of the plug is not controlled by the heat range which is true of conventional spark plugs now in use. The present invention provides a spark plug which, in its operation, depends on the turbulence of the gas effected by the internal construction of the plug.

Other objects will appear in the description which follows:

It is recognized that various modifications and changes may be made in the detail of structure illustrated without departing from the invention itself and it is intended that such shall be embraced within the scope of the claims which form a part hereof.

Forming a part of this specification are drawings in which:

Fig. 1 is a longitudinal, vertical, central, sectional view of the invention,

Fig. 2 is a fragmentary, central, sectional view of a slight modification,

Fig. 3 is a central, sectional view of a further slight modification,

Fig. 4 is a fragmentary central, sectional view showing further modification,

Fig. 5 is an end view of the plug.

In the drawings I have illustrated the spark plug as comprising a metallic shell 9 which is inserted into the cylinder block 10 which is provided with the cylinder 46 in which is slidably mounted the piston 47. Engaging in one end of the shell 9 is the insulating member 11 having the bore 12 formed therethrough opening into a pocket or chamber 13. Extending through the bore 12 is the rod or electrode 14 on which is threaded the nut 15 to secure the terminal lug 16 of the cable 17 in contact with the rod or electrode 14. The rod 14 is provided with a head 18 to which is attached the shell 19 having a chamber 20 formed therein opening to a constricted passage-way 21. The rod and shell may be, if desired, formed of a single piece of material with the end turned in to form the restricted passage 21 after the bore 20 has been formed in the shell 19. The core of the spark plug embodying the insulating member 11 rests upon the insulating washer 22 which, in turn, rests upon the metal ring 23 positioned in the bottom of the shell 9.

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In use the sparking would be between the edges of the portion 19 at the end of the passage 21 and the edges of the disc 23 at the edges of the passage 48.

A jam nut 24 is threaded into the shell 9 and presses the gasket 25 against the shoulder of the core or insulating member 11. This forces the insulating member 11 into close contact with the washers 22 and thus there is provided a structure which is leak-proof against the compressed gases.

In operation the piston 47 will compress the gases forcing the same to flow through the passage 48 into the chamber 20. When the gas is ignited by the spark the combustible mixture, which is in the passage 48, the passage 21 and the chamber 20, will ignite. It is preferred that the chamber 20 be circular in cross section. When this takes place there is a discharge of flame into the cylinder 46. The passage 48 is considerably smaller in diameter than the chamber 20 but of greater length than the diameter of the chamber 20 so that there is a constricted outlet passage through which the ignited gases in the chamber 20 may pass. This produces a sort of jet action which effects a spreading of the flame through the compressed gases in the upper end of the cylinder resulting in quicker ignition of these gases, higher degree of efficiency particularly in increasing speeds of a vehicle and in economy in consumption of fuel.

With spark plugs as now constructed, the spark plug is adapted for a certain heat range and the spark plugs are classified as cold, medium or hot, depending on the heat range with which they are intended to be used. To provide these plugs of different heat range the plugs are constructed with various thicknesses of insulation about the central electrode. The purpose is to provide a spark plug so insulated that it will become hot enough to prevent carbon formation thereon. Consequently, the slark plug to be used will depend upon the motor with which it is to be used, the use to which the motor is to be put and in general the heat developed by the engine. In plugs as now constructed there is a gap or space between the metal shell and the insulation to which carbon can and does adhere. The present invention eliminates this space so that no space is provided in which carbon can form or adhere to the insulation. With a spark plug constructed according to the present invention attention need not be given to any heat range as the present plug is adapted for all heat ranges and is not effected in its efficiency and operation by a variation of heat of the engine. This is so primarily

because of the turbulence created by the passage of the gas into and out of the chamber 20 and this turbulence remains substantially uniform regardless as to the heat developed.

Another problem in spark plug construction is to provide a spark plug that will not leak gas. Where the stem 14 is passed through the porcelain insulating core 11 it is difficult to maintain a construction which is leak-proof against the gas because of the variation of expansion and contraction of the metal and porcelain parts. The amount of heat used in the operation of the engine, which is sufficient to keep the conventional type of spark plug clean along the insulation or porcelain, loosens the porcelain and causes a leak, thus shortening the life of the spark plug and reducing the efficiency of the engine. There is also a loosening of the connection between the porcelain and metal shell sufficient to cause leakage which results from variance in expansion and contraction. The present invention does not get as hot as the conventional heat range type of spark plug and, therefore, a larger part of contact for sealing may be used and not be affected by the expansion or contraction. Another advantage so far as leak-proofing is concerned is that in the present invention a very small portion of the insulator is exposed to the pressure of the cylinder and this is not true of the conventional type of spark plugs. That is, in the present invention the insulation is not directly exposed to the explosion or combustion pressure as in conventional plugs now in use, but only indirectly from any expansion of shell 19 and the head 18 by the pressure in chamber 20.

Another objectional feature to be overcome in the fabrication of spark plugs and in their operation relates to the spark gap. It is important that this spark gap remain at a permanent predetermined set distance and that this gap be maintained during the operation of the spark plug. In the present invention this is accomplished as the gap is established when the spark plug is assembled and this gap is so constructed as to be shielded from the impulse of the exploding gas more than the open type of points. It has also been noted that the wearing of the sparking points is not effected alone by the action of the spark but that there is a wear resulting from a "gas wash." This "gas wash" is the passing of the gases across the sparking points. In the present invention this is avoided because the sparking parts are not open to the gases which are moving about in the cylinder 46.

Various size gaps may be easily obtained with a spark plug constructed in this manner. In Fig. 2 I have shown a slight modification in which the shell 26 is provided with the space 27 in which the insulating core 28 is positioned and held in position by the jam nut 24a. This insulating core is provided with the electrode 14a having the head 19a constructed as for 19. The washer 22 and the ring 23 shown in Fig. 1, have been removed from the assembly shown in Fig. 2.

In Fig. 3, I have shown a slight modification in which I have inserted, between the insulating core 30 and the bottom of the shell 29, a metallic ring 36 and insulating washers 35 and 37. The metallic ring 36 is further insulated from shell 29 by insulating ring 65. The electrode 33 is provided with a head 34 and the jam nut bears up against the sealing member 32. In this construction the sparking would be through the central passage formed in the washers 35 and 37 and the ring 36. Should a short circuit take place between the member 34 and the ring 36 the spark then would jump from the ring 36 to shell 29 and if a short develops between the ring 36 and the shell 29 then the sparking would, of course, be from member 34 to ring 36.

In Fig. 4, I have illustrated a construction in which the shell 38 receives the porcelain insulator 39 and through which is extended the electrode 40 having a head 41. This head 41 is spaced from the bottom of the shell 38 by an insulating washer 42. It is believed obvious that by removing the insulating washers as shown in Fig. 2, or increasing their number, the gap for sparking may be varied. It will also be noted in Fig. 2, that the head 19a is positioned inwardly slightly from the face of the insulating core 28. By varying this distance the gap may also be varied. However, in all types of construction the chamber 20 is provided with the passage 48 communicating therethrough so that the jet action of the flame into the cylinder 46 is obtained while the turbulence which sets up in the chamber 20 is also present.

In the operation of the engine a certain amount of oil is wiped up along the walls of the cylinder 46 by the piston 47 and as the mixture is compressed this oil is wiped along the under side of the dome of the compression chamber. To prevent this oil from entering through the passage 48 a downwardly projecting portion 60 is provided on the shell member 9. This projection 60 extends below the top of the dome 61 so that any oil previously thereon would be deflected downwardly and only combustible gases would pass through the passage 48. In Fig. 2, projection 60a is shown with a concave side wall 61 which tends to further eliminate any oil from entering into the spark plug.

Experience has shown that a spark plug constructed in this manner is highly efficient particularly in fuel economy and speed in pick-up of an engine.

It will be noted that there are five characteristic features of the present invention which have been mentioned. First, an explosive chamber having two or more sizes of passages leading thereto and therefrom is used which creates a turbulence within the plug itself and which serves to clean the sparking area. Secondly, a chamber within the spark plug having a passage leading thereinto and therefrom of a uniform size may be used and in such instance the turbulence of the gases which is set up in the cylinder serves to keep the points clean. Third, the sparking gap is so located within the chamber that a comparatively small percentage of the combustible gases contact or pass the sparking points thus eliminating corrosion caused by "gas wash." Fourth, the chamber into which the mixture of combustible fuel is forced is so located that it fires or explodes within the plug thus causing a jet of ignited gas to issue out of the opening of the plug so as to speed up complete combustion. Fifth, the present invention is so constructed on the lower end with an extension beyond the threaded portion so as to extend beyond the cylinder head or free from the cylinder head and so shaped as to protect the opening leading into the chamber within the plug from surplus lubricating oils which are traveling radially or otherwise around the end of the plug thus allowing only combustible gases to enter the plug. These features have proven

to render such a plug so constructed highly efficient.

What I claim as new is:

1. A spark plug of the class described, comprising: a metallic shell adapted for mounting in an engine block and having a cup-shaped portion; a neck projecting outwardly from the face of said cup-shaped portion and provided with a passage therethrough communicating with the interior of said cup-shaped portion; an insulating body mounted in said cup-shaped portion; a metallic electrode extended through said insulating portion; and a hollow head on the inner end of said electrode communicating with the passage through said neck, and in spaced relation to said shell a sufficient distance for effecting sparking thereto; said hollow head being of greater inside diameter than the diameter of said passage and said passage being of greater length than the inside diameter of said head.

2. A spark plug of the class described, comprising: a metallic shell formed cup-shaped at one end; a neck projecting outwardly from the closed end of said shell and having a passage formed therethrough into the interior of said cup-shaped portion; an insulating body mounted in the cup-

shaped portion of said shell; a metallic electrode projecting through said insulating body; a head formed on the inner end of said electrode and provided with a chamber formed therein communicating with the passage through said neck, said head terminating in spaced relation to said shell for sparking toward the same; said chamber being of greater diameter than the passage through said neck and of a diameter less than the length of the passage through said neck.

EDWARD W. MITCHEL.

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