Nov. 17, 1959 B. C. FISHER 2,913,608

SPARKING DEVICE

Filed June 18, 1958

Fig. 1.

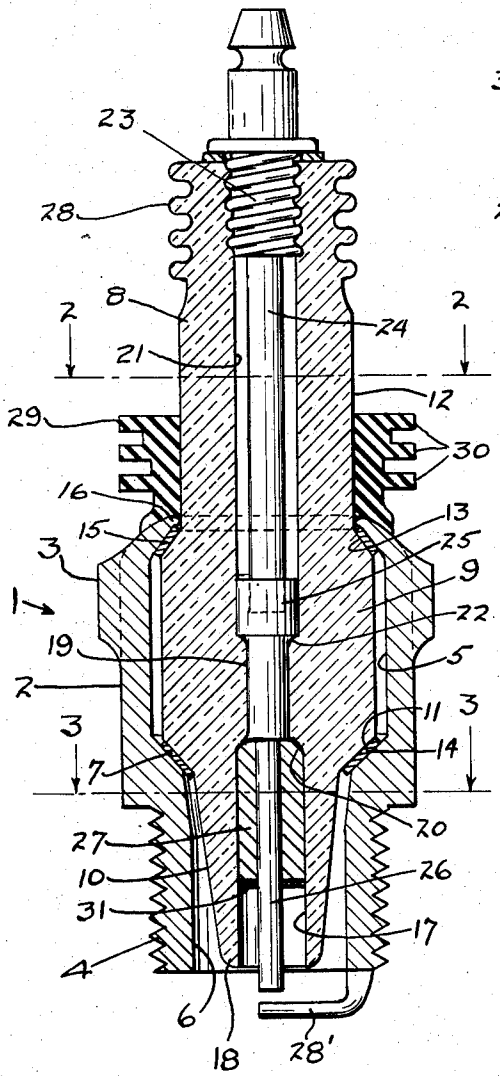


Fig. 2.

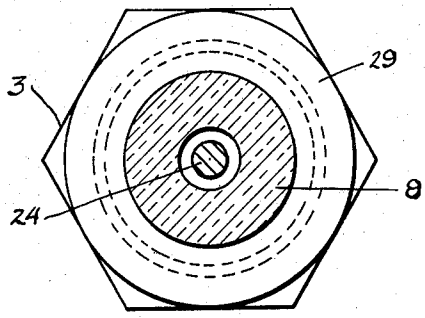


Fig. 3.

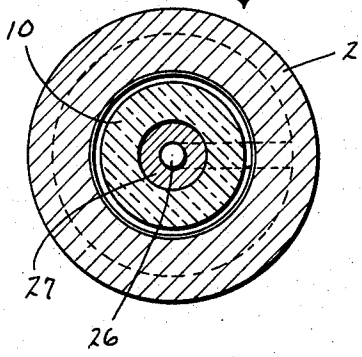
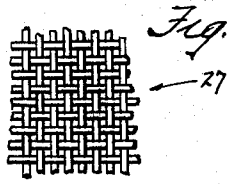


Fig. 4.



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SPARKING DEVICE

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6 Claims. (Cl. 313—11.5)

This invention relates to sparking devices for internal combustion engines and has for its principal object to provide a sparking device which will provide improved efficiency of operation of the engine with which it is used.

Another object of the invention is to provide a sparking device which will operate at a lower temperature than devices heretofore used with better control of the spark and less tendency for the formation of carbon.

Another object of the invention is to provide a sparking device having a skirted insulator in which the temperature of the skirt is maintained below a predetermined maximum and electrical shorting over the rim of the skirt is prevented.

The invention is illustrated in the accompanying drawings, in which:

Figure 1 is a sectional elevational view of the sparking device of the invention;

Figure 2 is a sectional plan view of the device taken on the line 2—2 of Figure 1;

Figure 3 is a sectional plan view of the device taken on the line 3—3 of Figure 1; and

Figure 4 is an enlarged view of a portion of a cartridge which is an important inner part of the device before rolling and compressing.

The sparking device of the invention provides a combustion space inside the device in which the fuel mixture first ignites and produces a "blow torch" effect, firing the mixture in the combustion space of the cylinder substantially instantaneously. The size and shape of this internal combustion space is critical and aids in the control of the timing of the spark. The full explanation of this internal space is given in my United States Patent No. 2,708,428, issued May 17, 1955.

Figure 1 shows the sparking device of the invention as comprising a metallic shell 1, preferably of steel, having an outer surface of two different diameters. The main portion 2 has the larger diameter and is provided with a hexagonal outer rim 3 to receive a socket wrench for screwing the device into the cylinder block of an internal combustion engine. The portion 4 of smaller diameter is threaded to fit into the tapped hole in the cylinder block provided for it.

The thickness of the shell at both portions 2 and 4 may be about the same, forming a cylindrical inner surface 5 for the main portion 2 and a cylindrical inner surface 6 for the portion 4 with a bevelled portion 7 connecting the two surfaces.

An insulator 8 has a main cylindrical portion 9, slightly smaller in diameter than the inside of the portion 2 of the shell, and a length slightly less than the inner length of said portion. The insulator fits in the shell 1 with the main portion 9 of the insulator within the portion 2 of the shell. The insulator has a tapered portion 10 extending within the portion 4 of the shell to a point near the end of the portion 4 thereof. Between the tapered portion 10 and the main portion 9 is a bevelled surface 11 having the same slope as the bevelled surface

7 of the shell. The insulator has an extended portion 12 somewhat smaller in diameter than the main portion 9, there being a bevelled surface 13 between the extended portion and the main portion which lies just inside the end of the shell portion 2 when the insulator is inserted in the shell. Soft metal gaskets 14 and 15, preferably of copper are placed respectively against the bevelled surfaces 11 and 13 when the insulator is inserted in the shell and the end of the portion 2 of the shell is rolled over, as at 16, to hold the insulator securely within the shell with a gas-tight connection.

The insulator 8 has a bore extending through it having different diameters. That portion 17 of the bore within the tapered portion 10 has straight sides extending a short distance into the main portion 9 of the insulator. This portion of the bore cooperates with the outer tapered wall of the portion 10 to form a skirt having a narrow rounded end 18 a short distance from the end of the portion 4 of the shell.

In the main portion 9 of the insulator there is a short portion 19 of the bore which is approximately half the length of the main portion 9 and has a diameter smaller than the other bore portions. This portion 19 of the bore joins the portion 17 with a rounded shoulder 20. The portion 21 of the bore extending through the extended portion 12 of the insulator has a diameter approximately the same as the portion 17 and joins the portion 19 with a rounded shoulder 22. The outer end of the bore portion 21 is enlarged and threaded to receive a threaded portion 23 of a stud 24 which is smaller in diameter than the bore portion 21 and, when screwed into position, extends to a point just short of the inner end of the bore portion 21.

A conductive glass sealing member 25 is positioned within the bore portion 19 and extends from the shoulder 20 to a point just beyond the end of the stud 24. This member is made of glass into which is embedded particles of a metal, such as silver, and is fused into position so that it completely seals the bore against the passage of gases therethrough.

A conducting rod 26 extends from the sealing member 25 to a point just beyond the end of the shell portion 4 and forms one of the sparking electrodes. This rod is secured in position by a porous conducting member 27 which forms an important part of the invention. The member 27 is formed of a rectangular sheet of fine metal wires woven into cloth and then rolled into a cylinder or cartridge with a hole axially through the center to accommodate the rod 26 and then die pressed. The wires are preferably made of copper in ribbon form and the completed cylinder is of just the right size so that it can be inserted under pressure into the bore portion 17 where it lies in close contact with the rod 26, the inner wall of the bore portion 17, and the conductive glass sealing member 25. Thus, a good electrical contact is formed between the conducting rod 26 and the conductive glass sealing member 25. When pressed into place, the member 27 with the rod 26 inserted therein fills the space within the bore portion 17 and secures the rod in position.

The member 27, which I call a copper "Basterite cartridge," has an important effect on the operation of the sparking device. Although it appears to occupy a large portion of the space within the bore portion 17, it is actually porous because of the interstices between the individual wires and therefore forms part of the firing space referred to above. Since the wires are a good heat conductor, heat will flow into it from the rod 26 and from the insulator skirt of the insulator portion 4. Because of the porous nature of the member 27, there is a relatively large surface from which the heat may pass into the surrounding gases and materials so as to dis-

sipate the heat during intake and compression strokes. Thus, the skirt and rod **26** are prevented from overheating, with the result that the device operates much cooler than spark plugs now in use and with much less carbon formation. In addition, the porous nature of the member **27** causes it to have a certain amount of resiliency, so that it never can exert enough pressure under the expansion of heat against the walls of the insulator to cause them to crack in operation.

In operation, the cartridge **27** seems to act like an inductance, increasing the intensity of the spark over that produced by the same device in the same electrical circuit but without the cartridge.

If desired, the end of the insulator extension may be provided with fins **28**. These fins increase the electrical path between the central conductor and the shell to prevent flashover.

I also provide a collar **29** of Bakelite or other material less rigid than the ceramic of the insulator. This collar fits snugly over the insulator against the shell and may be provided with circular ribs **30**, as shown. The purpose of the collar is to protect the insulator when a socket wrench is placed over the insulator to screw the sparking device into position in the cylinder block. If the wrench is tilted while in this position, the inside surface will strike the ribs of the collar before touching the insulator.

In assembling the cartridge **27**, I place a neoprene-asbestos gasket **31** on the end thereof which is held thereon by friction with the wall of the insulator. This has the effect of protecting the cartridge until the wires thereof have become oxidized. When the device is used, the neoprene immediately burns off and the asbestos remains as a porous layer.

The dimensions and shape of the interior of the firing space of the device are critical, as explained in the patent referred to above, although of course they may vary somewhat for engines of different size and compression rates. For an ordinary, high compression, automobile engine, the following dimensions for the internal firing space were found to give good results:

	Inches
Internal diameter of shell portion **4**	.387
Length of shell portion **4** from gasket **15** to end	.4375
Diameter tapered portion **10** adjacent gasket **15**	0.380
Diameter tapered portion **10** at end	0.320
Length tapered portion **10** from gasket **15** to end	0.532
Diameter of bore **17**	0.205
Length of bore **17**	0.750
Length of cartridge **27**	0.50
Width of cartridge wire	from 0.020 to 0.030
Thickness of cartridge wire	from 0.003 to 0.005
Diameter of rod **26**	0.068
Extension of rod **26** beyond end of shell	0.03125
Diameter of bore **19**	0.101

The operating temperature of the end of the skirt may be controlled by the length of the cartridge **27**. If the cartridge is made longer, the end of the skirt and the center electrode will operate at a lower temperature.

While one embodiment of the invention has been shown and described, modifications may be made without departing from the spirit of the invention. I do not therefore wish to limit my invention except by the limitations contained in the appended claims.

What I desire to claim and secure by Letters Patent is:

1. A sparking device for an internal combustion engine comprising a tubular metallic shell, an insulator within said shell and having a skirt thereon extending towards one open end of said shell, a conducting rod positioned within said skirt terminating adjacent the end of said shell, means providing an electrical conducting path through said insulator to said conducting rod, a porous conducting member within said skirt surrounding said conducting rod and in contact therewith and with the inner walls of said skirt, and a ground conductor attached to one end of said shell and cooperating with said rod to form a spark gap.

2. A sparking device, as defined in claim 1, in which the porous conducting member fills a portion only of the space within the skirt.

3. A sparking device, as defined in claim 2, in which the porous conducting member is formed of metal wire, woven into cloth, rolled into a cylinder, and compressed.

4. A sparking device, as defined in claim 1, in which the conducting rod is independent of the electrical conducting means through the insulator but is held in contact with the inner end thereof by the porous conducting member.

5. A sparking device, as defined in claim 1, in which the porous conducting member comprises a flat sheet of woven copper ribbon, rolled into a cylinder with a hole through the center for the conducting rod, and compressed into the space within the skirt so that it is in contact with the inner wall of said skirt and said conducting rod.

6. A sparking device for an internal combustion engine comprising a shell, an insulator within said shell, a conductor extending through said insulator and terminating adjacent the end of said shell, a ground conductor attached to said shell and cooperating with the end of said conductor to form a spark gap, said insulator having a skirt spaced from the walls of said shell and from said conductor and terminating adjacent the spark gap end of said shell, and porous conducting means within said skirt and in contact with said conductor for controlling the temperature of the end of said skirt and the tendency to short circuit electrically around the edge of said skirt the space between said conductor and said skirt being greater than the space between said skirt and said shell, and said porous conducting means filling the innermost portion of said space and terminating at a distance from the end of said skirt.

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