J. C. ANDERSON.

SPARK PLUG.

APPLICATION FILED MAR. 20, 1909.

936,507. Patented Oct. 12, 1909.

Fig. 1.

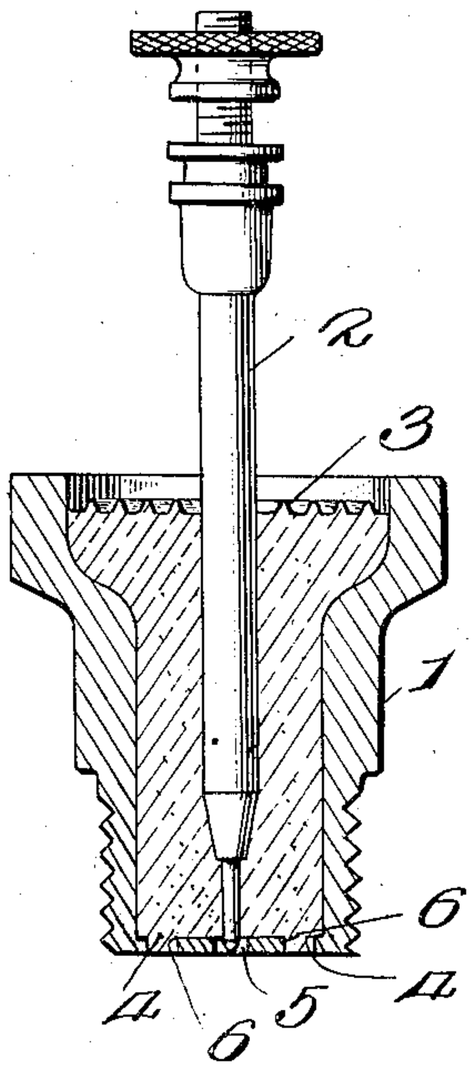


Fig. 3.

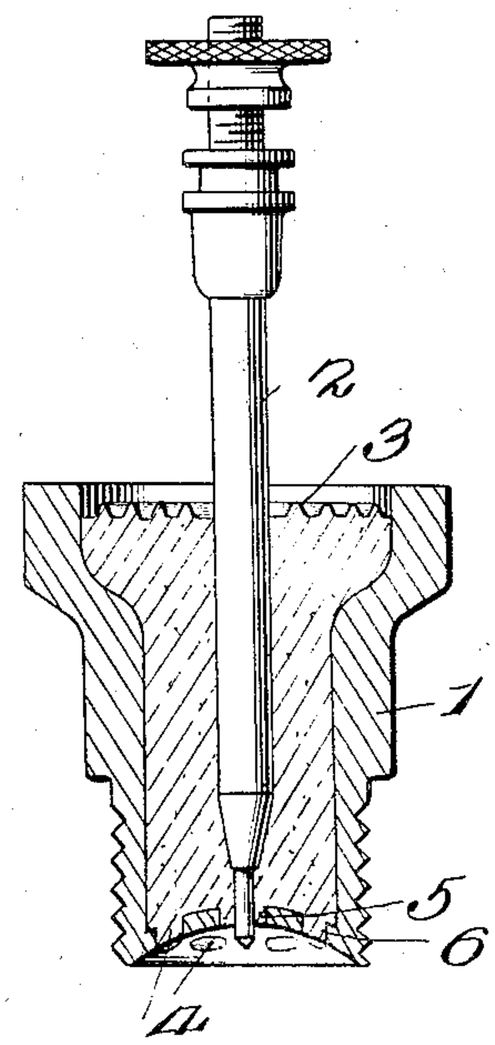


Fig. 2.

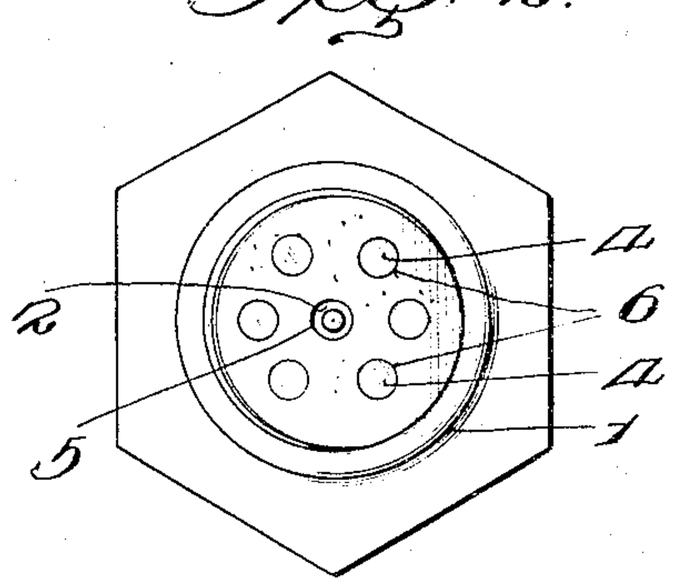


Fig. 4.

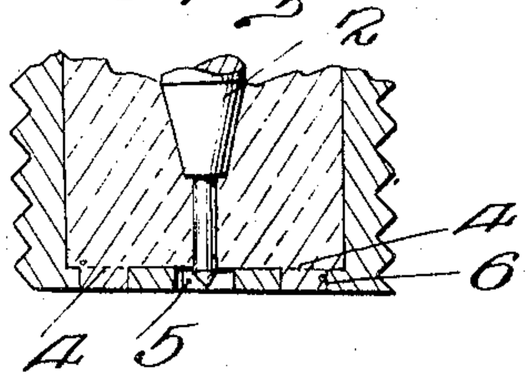
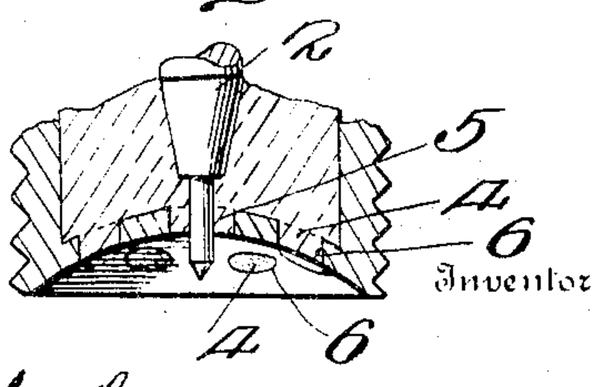


Fig. 5.



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SPARK-PLUG.

936,507. Specification of Letters Patent. Patented Oct. 12, 1909.

Application filed March 20, 1909. Serial No. 484,725.

To all whom it may concern:

Be it known that I, JAMES C. ANDERSON, a citizen of the United States, residing at Washington, in the District of Columbia, have invented certain new and useful Improvements in Spark-Plugs; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to certain new and useful improvements in spark-plugs, particularly of that type shown and described in Letters Patent granted to me July 7, 1903, No. 732,812, in which the central electrode and casing are insulated by glass, welded to the electrode and casing.

My present invention has for its object to produce a spark-plug which shall be simple and economical of construction, and which shall be devoid of the possibility of short-circuiting by reason of the presence of carbon, oil or moisture deposited on, or between the electrodes.

With these ends in view, my invention consists in the details of construction and arrangement hereinafter more fully set forth.

In order that those skilled in the art to which my invention appertains may know how to make my improved spark-plug and fully appreciate its advantages, I will proceed to describe the same, referring by numerals to the accompanying drawing in which:

Figure 1 is a central longitudinal section of a spark-plug embodying the features of my invention; Fig. 2 is an inner end view of the same; Fig. 3 is a view similar to Fig. 1, and illustrating a modification of the same. Fig. 4 is a detail section of the construction shown at Fig. 1, and on enlarged scale to more fully illustrate the relation of the electrodes and the insulation; and Fig. 5 is a similar enlarged sectional view of the modified construction shown at Fig. 3.

Similar reference numerals indicate like parts in the several figures of the drawing.

1, represents the casing, and 2, the positive electrode insulated from one another by a body of glass, 3, welded to the casing and the electrode as fully set forth in the Letters Patent hereinbefore referred to.

The shell, 1, as clearly shown in Figs. 4 and 5, terminates at its inner end in a thin integral head which constitutes the negative electrode 4. This head or negative electrode is formed with an opening 5, the edge of which surrounds, and is at sparking distance from the positive electrode 2, and also with a series of openings 6, between the central opening 5 and the periphery of the shell. The insulating glass 3, enters these openings 6, and terminates flush with the outer surface of the electrode, while it terminates at the locality of the opening 5, coincident with the inner surface of said electrode, as shown at Fig. 4, or with the outer surface, as shown at Fig. 5, as may be preferred. The perforations or openings 6 in the negative electrode are provided in order that the flash of the explosion within the explosive chamber of an engine may be readily observed from without.

In Fig. 3, I have shown a modification in which the head, or negative electrode 4, is of concaved form, which may be desirable when the spark plug enters the explosive chamber in a vertical direction. In this modified construction, it will be seen that the positive electrode where it passes through the central opening 5 projects slightly beyond the outer exposed surface of the negative electrode, and hence should any lubricating oil or moisture accumulate upon the exposed end of the positive electrode, or between it and the negative electrode, it will be led to gravitate toward the extremity of the electrode, and sparking will then take place above such obstruction and until the heat generated will evaporate or dispel the same.

In either of the constructions shown, it will be seen that the negative electrode surrounds the positive electrode and is at all points at the minimum sparking distance from the positive electrode, and that the insulating body at the particular locality at which the sparking takes place is coextensive only with the sparking gap or arc between the electrodes. At this point I wish to state that it has heretofore been desirable and customary to make the superficial area of the exposed surface of the insulating material as great as possible within the limits of the proportions of the spark plug, for instance by extending the insulation straight across from the central electrode to the inner wall of the shell, again by extending the central electrode and the surrounding insulation beyond the inner extremity of the shell, or by forming a cavity in the insula-

tion and between it and the central electrode, thus as stated securing the greatest possible distance from one extremity to the other of the exposed surface of the insulation. My invention on the contrary involves the generic feature of reducing the distance over the exposed surface of the insulation to the minimum and at the locality at which the sparking occurs in order that any short circuiting body which may be deposited upon the surface of the insulating material will be dispelled or evaporated by the heat generated by the spark.

As shown in the drawing, the insulating material 3 which is welded with the shell 1, and positive electrode 2, presents a surface at the particular locality at which the sparking must take place, coextensive with the sparking gap between the electrodes, and this sparking gap is preferably of minimum extent in order that the spark may be of the greatest intensity, in order that it may overcome and dispel the comparatively feeble conductivity of any short circuiting substance which may be deposited in the gap or arc between the electrodes, and hence operate to expel or remove the same, and thus preserve continuous and uninterrupted sparking.

When the insulating body 3 extends only to, and in the same plane with the inner surface of the negative electrode 4, the sparking takes place within the circumferential space between it and the positive electrode 2, and hence the surface of the insulating material coincident with the inner surface of the negative electrode is subjected to the cleansing or wiping action of such spark, and expels or dissipates any short circuiting medium. Likewise if the insulating material extends to, and coincident with the outer surface of the negative electrode, the spark will jump from the positive to the negative electrode and over the insulating material, and in a similar manner dissipate any short circuiting material which might be deposited upon the surface of the insulation.

I wish it to be understood that the generic and underlying feature of my invention resides in the fact that the insulating material at the particular locality at which the sparking takes place is coextensive only with the sparking gap or arc between the two electrodes, or in other words, the two electrodes are so arranged that one completely surrounds the other at uniform and minimum sparking distance, and that the entire circumferential area of the insulation between the electrodes is such, that the flash from the central electrode to the surrounding electrode simultaneously and uniformly traverses the entire surface of the insulating material 3, and consequently the entire surface of this insulating material is kept free from the presence of any short-circuiting body, and this is what is meant by the statement that the area of the insulating material between the electrodes is coextensive with the sparking gap or arc between the two electrodes. This condition is secured as illustrated in the drawing by reducing or attenuating the inner extremity of the electrode 2, in order that when the surrounding electrode 4, is brought into minimum sparking distance with the former, the entire circumferential area of the insulating material between the two electrodes is such that the flash will be uniform and simultaneous in every radial direction, and hence sparking cannot take place at any one radial point while short-circuiting material may be deposited at some one or more other radial localities. In other words, the extreme diameter of the insulating material surrounding the central electrode is coextensive with the sparking gap or arc between the electrodes. While the relation between the two electrodes and the insulating material at the locality where the spark occurs is designedly such that the spark occurring will be a ring spark and trend in all radial directions simultaneously, it will also be understood, that this described relation of the electrodes and the insulating surface is such, that if for any unforeseen reason the spark should cease to be a ring-spark, and should travel in a single radial line from the central electrode to the surrounding electrode, and moisture or other short-circuiting body be deposited upon the insulating material either side of the sparking path, the entire superficial area of the insulation is so limited as not to provide surface sufficient for the deposited moisture &c. to overcome the natural sparking between the electrodes. I have taken pains to reiterate this feature of construction in order that there may be no doubt as to this generic feature of my invention, as I consider it of the utmost importance. While I prefer to arrange the positive electrode centrally within the insulating material between it and the shell or casing, I desire it to be understood that I do not wish to be confined to this particular construction, as the positive electrode may pass through a surrounding spark gap or opening in the inner end of the shell at any other locality, so long as the relation between the electrodes and the body of insulating material is such as described that at the particular locality at which the sparking takes place, the spark must traverse the entire surface of the insulating material and operate to keep such surface free from the presence of any short-circuiting medium.

Having described the construction, operation and advantages of my improved spark plug, what I claim as new and desire to secure by Letters Patent is:

1. A spark plug embodying in its organization, a shell having its inner end returned at an angle to its axis to constitute one of its electrodes; a second electrode longitudinally disposed within the shell and terminating in reduced and attenuated form within sparking distance from the surrounding returned end of the shell; and a body of insulating material confined between the shell and the longitudinally disposed electrode and in contact with the returned end of the shell and bridging the space between it and the longitudinally disposed electrode.

2. In a spark plug such as described, a shell returned at its inner end at an angle to its axis, and formed with a perforation or orifice therein; an electrode longitudinally disposed within the shell and terminating in attenuated form, and at sparking distance from the boundary of the perforation or orifice in the returned end of the shell; and a body of insulating material confined between the shell and the longitudinally disposed electrode and bridging the annular space between said electrode and the boundary of the perforation or orifice in the returned inner end of the shell, and in substantial contact therewith.

3. In a spark plug such as described, a shell returned at its inner end at an angle to its axis to constitute one electrode; a second electrode longitudinally disposed within the shell and terminating in attenuated form, and at sparking distance from the returned inner end of the shell; and an insulating body of glass occupying the entire space between the shell and the longitudinally disposed electrode, and welded to said electrode and shell and in substantial contact with the inner end of the latter and bridging the sparking space between the shell and the electrode.

In testimony whereof, I have signed my name to this specification in the presence of two subscribing witnesses.

JAMES C. ANDERSON.

Witnesses:
D. G. STUART,
HENRY C. HAZARD.