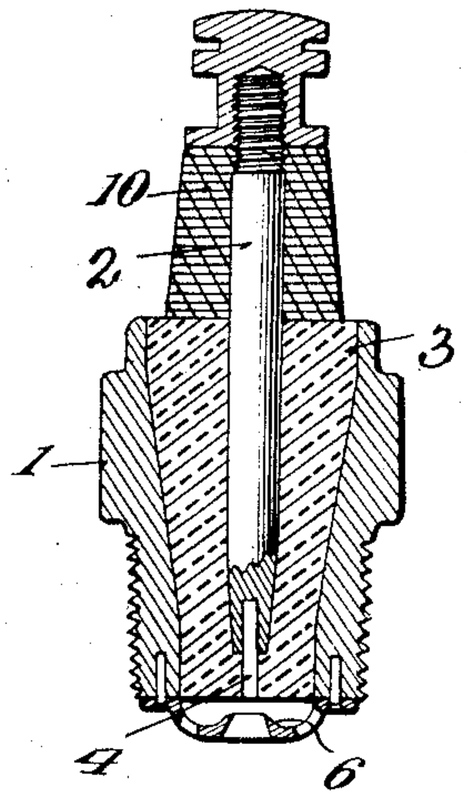
J. C. ANDERSON.

SPARK PLUG.

APPLICATION FILED SEPT. 23, 1909.

979,242. Patented Dec. 20, 1910.

Fig. 1.



3

Fig. 2.

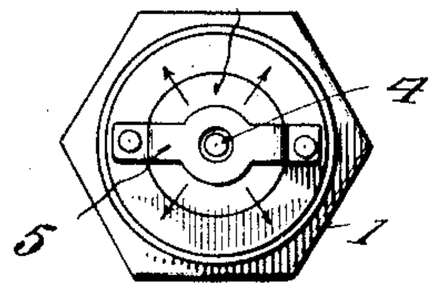
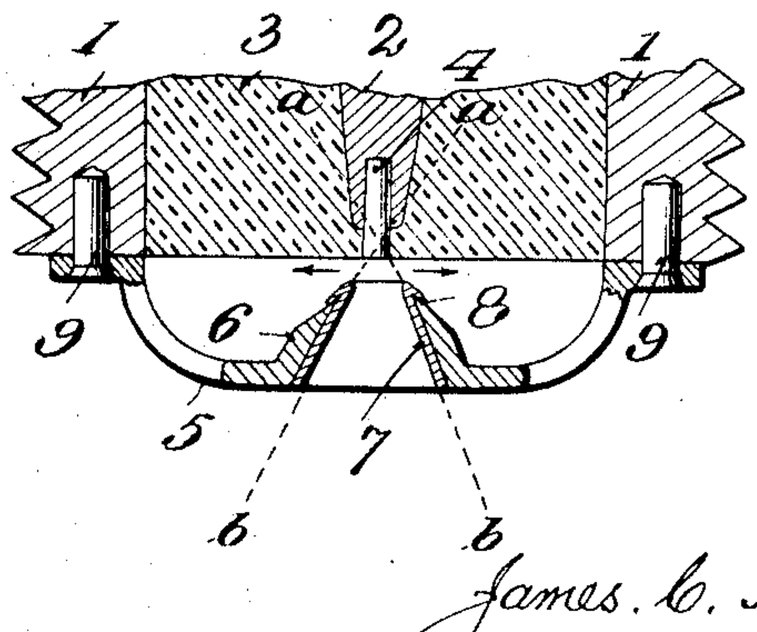


Fig. 3.



Witnesses
Helga M. Murray.
Floyd P. Comwall.

Inventor
James C. Anderson
By Wm. C. W. Entire
Attorney

UNITED STATES PATENT OFFICE.

JAMES C. ANDERSON, OF WASHINGTON, DISTRICT OF COLUMBIA.

SPARK-PLUG.

979,242. Specification of Letters Patent. Patented Dec. 20, 1910.

Application filed September 23, 1909. Serial No. 519,283.

To all whom it may concern:

Be it known that I, JAMES C. ANDERSON, a citizen of the United States, residing at Washington city, 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, and while especially applicable to that type described and claimed in Letters Patent No. 732,812, granted to me July 7, 1903, in which the insulation is composed of glass welded to the shell or casing and the longitudinally disposed electrode, is also applicable to other types in which the insulation may be of any other well known character.

In all explosive engines in connection with which spark plugs are used the oil employed for the lubrication of the piston constitutes an insulating body whenever it becomes installed between the electrode terminals, and all the residuums of the exploded gases constitute short circuiting bodies, and therefore spark plugs frequently fail to spark either because of the installation of lubricating oil between the electrodes which effectually prevents the passage of the electric current, or because the residuums of the exploded gases are deposited upon the insulation and in contact with the insulated electrode and the shell or casing, which necessarily produces a short circuiting of the current.

My invention has for its object to effectually prevent either of the above named conditions and to produce a spark plug which will be effective at all times.

My invention has also for its object to insulate that portion of the longitudinally disposed electrode which extends beyond the outer extremity of the shell or casing from said shell or casing by a series of disks of mica in such manner that they shall constitute a continuation of the insulation between the electrode and the shell or casing and at the same time permit the sparking of the plug and the explosion of the gases within the cylinder of an engine to be readily observed.

With these objects in view my invention consists in the details of construction hereinafter more particularly 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 to 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; and Fig. 3 is a central longitudinal section on enlarged scale of the inner end and showing a modification of the secondary electrode.

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

1 is the ordinary metallic shell or casing adapted to be connected by the usual screw thread with the cylinder of an explosive engine.

2 is a longitudinally disposed electrode located within the shell or casing and insulated therefrom preferably by a body of glass 3 welded to the shell and the electrode 2, and terminating in the same plane with the lower extremity of the shell or casing 2, and also with the outer end thereof. The electrode 2 is reduced at its inner end as shown at 4, and to about the usual cross-sectional area, and 5 is the secondary electrode connected with the shell or casing and bridging the longitudinal electrode 2, as clearly shown. This electrode 5 is formed with a funnel-shaped extension 6 in axial alinement with the electrode 2, and terminates at its inner extremity in substantially a knife edge, and of an area somewhat greater than the area of the reduced extremity of the electrode 2 in order that the spark occurring between the two electrodes shall traverse obliquely, as indicated by the broken lines *a*, and thus sweep in all radial directions that portion of the insulation 3 immediately adjacent to and in contact with the electrode 2, and thus remove or prevent the deposition of any short circuiting or insulating material.

The converging wall of the funnel-shaped projection 6 of the secondary electrode leads the compressed gases and any bodies held in suspension therewith in a converging direction toward the axis of the electrode 2, as indicated by the lines *b*, from which point it

is deflected radially, thus penetrating and scattering any mobile insulating material which might be temporarily installed between the electrodes or upon the insulation 3, adjacent to the electrode 2, after one spark has been made and before the time for the making of another, thus coöperating with the oblique traverse of the spark to keep the arc between the electrodes free and unobstructed by any foreign matter. In order to still further and effectually produce this result I equip the funnel-shaped extension 6 with a similarly shaped lining or thin skin 7, of metal of greater resistance than the bodies of the electrodes 2 and 5, in order that a greater degree of heat will be generated by the making of the spark and thus cooperate with the lateral oblique path of the same and the concentrated and axial pressure of the gases before ignition, in the elimination of any and all short circuiting or false insulating bodies which might be temporarily deposited adjacent to or between the electrodes. The lining or skin 7 of higher resistance metal is preferably secured in position by swaging and returning its inner extremity over the knife edge of the inner extremity of the funnel-shaped extension of the electrode 5, as clearly shown at 8. This construction, as will be readily understood, will permit of the ready renewal of the lining or skin at any time when it may become worn or impaired, and the superficial area of the wall of the funnel-shaped extension is such that the contact surface between it and the lining or skin 7 may be such as to compensate for the difference in conductivity of the two and thus not retard or reduce the voltage of the current passing through the electrode 5, while the resistance offered at the inner constricted terminus of the lining or skin 7 will as heretofore explained intensify the heat of the spark at such locality. The returned inner extremity of the lining or skin 7 is extended upwardly a sufficient distance to avoid any tendency of the spark jumping to the funnel-shaped wall of the extension 6 of the electrode 5 in overcoming the resistance offered by the lining or skin.

While I have described the lining or skin 7 as composed of a highly resisting material, I do not wish to be confined to any particular characteristics of such lining as it may be in some instances desirable to employ a lining of high conductivity or one having a non-oxidizable character. Neither do I wish to be confined to the use of any lining whatever, as the gist of my invention in so far as it relates to the construction of the secondary electrode 5 resides in providing it with the funnel-shaped extension having the constricted terminus in sparkling distance from the longitudinally and axially disposed electrode.

As the secondary electrode is connected with the shell or casing at diametric points only it will be readily seen that free escape is provided for any short circuiting or mobile insulating bodies which may be scattered or driven off by the coöperative action of the obliquely traveling spark and the projectile force of the compressed gases, forced through the constricted inner terminus of the funnel-shaped extension 6 directly against the surface of the insulation 3, which is in substantially the same plane as the terminus of the inner end of the shell or casing. The secondary electrode 5 consists of a simple flat bar connected at its extremities with the shell or casing by metal pins 9, or in any other suitable manner, and its central portion is enlarged or expanded, as clearly shown in Fig. 2, in order to provide the necessary area for the formation of the funnel-shaped extension at that locality.

In order to insulate that portion of the electrode 2, extending beyond the outer surface of the main body of insulation 3, from the outer terminus of the shell or casing, I compress and confine a series of disks 10, of mica cemented together (and surrounding and in contact with the electrode), between the outer surface of the glass insulation 3 and the binding post 9 which is threaded onto the end of the electrode 2, as clearly shown in Fig. 1. This body of mica is turned into truncated cone-form, as clearly shown, and with its base of less diameter than the glass insulation 3, with which it is in insulating contact, thus leaving an annular space of glass between the mica and the inner circumference of the shell or casing in order that the sparking of the plug and the explosion of the gases within the cylinder of an engine may be readily observed. From this construction it will be seen that while the electrode 2 and the shell are thoroughly insulated by an insulating body confined between the two, that portion of the electrode extending beyond the outer surface of the said insulating body is also insulated from the extremity of the shell or casing by a secondary body of insulating material confined between the binding post and the outer surface of the main insulating body, thus providing a continuous and practically concrete insulation of the electrode from the shell through the entire extent of the former, and in contradistinction to any construction in which the electrode may be surrounded within the confines of the shell with laminæ of mica and at the outer extremity by mica disks in contact with a metallic surface, and also in contradistinction to any construction in which mica disks surrounding the outer portion of the electrode are brought into contact with mica insulation within the body of the shell by confining and compressing the two sev-

eral bodies of insulation between heads or flanges at the two extremities of the electrode, which construction necessitates surrounding the electrode with an insulating sleeve of mica wound around the same, in order to prevent short circuiting through, or between the disks of mica as the same necessarily become separated by the expansion and contraction of the electrode under the action of the heat generated in an engine cylinder.

Particular attention is called to the fact, that as the insulation within the shell or casing according to my invention is composed of glass which is a nonconductor of both electricity and heat, and which is secured in fixed and immovable relation with the electrode and the shell, that consequently the body of glass constitutes a solid and fixed base upon which the exterior body of mica is held in permanent insulating contact. The glass within the shell, and the body of mica surrounding and in contact with the outer portion of the electrode thus constitutes an integral, fixed, and continuous insulation from one extremity to the other of the electrode.

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

1. In a spark plug, in combination with a shell or casing and a longitudinally disposed electrode within said shell, a body of insulation between the electrode and the shell terminating in coincidence with the inner end of the shell or casing; a secondary electrode connected with the shell, said secondary electrode at the locality of axial alinement with the longitudinally disposed electrode formed with a funnel-shaped extension, the inner constricted extremity of which is within sparking distance from the terminus of the longitudinally disposed electrode.

2. In a spark plug such as described, in the combination with a shell or casing and a longitudinally disposed electrode therein and terminating in reduced area, and a body of insulating material between such electrode and the shell and terminating with the inner end of the latter; a secondary electrode connected with the shell or casing and terminating at the axial alinement with the longitudinally disposed electrode, in a funnel-shaped projection in sparking distance from the longitudinally disposed electrode, the constricted terminus of said projection having a greater area than the area of the terminus of the longitudinally disposed electrode, whereby the sparks produced will travel in a path oblique to the axes of the electrode.

3. In a spark plug such as described and embodying in its organization a shell or casing; a longitudinally disposed electrode; a body of insulating material between the shell and the electrode and terminating with the inner end of the shell or casing; a secondary electrode connected with the shell and formed in axial alinement with the longitudinally disposed electrode, with a funnel-shaped extension having its inner extremity in sparking distance from the longitudinally disposed electrode; a skin or lining within the funnel-shaped extension in the secondary electrode, said skin or lining of less conductivity than the body of the secondary electrode, whereby the heat produced by the spark is intensified, substantially as and for the purpose set forth.

4. In a spark plug such as described, in combination with a shell or casing and a longitudinally disposed electrode therein insulated from the casing or shell, a secondary electrode connected with the shell or casing and terminating in axial alinement with the longitudinally disposed electrode in a funnel-shaped extension provided with a lining of highly resisting material secured in position by the return of the same upon the outer surface of the constricted terminus of said funnel-shaped extension, substantially as hereinbefore set forth.

5. In a spark plug such as described, and embodying a shell or casing and a longitudinally disposed electrode within the same, and a body of glass welded with the electrode and shell or casing and terminating in substantial coincidence with the outer extremity of the shell or casing; a body of mica surrounding and embracing the outer extremity of the electrode and confined in fixed and immovable relation with the outer extremity of the body of glass and in contact only with said glass, whereby the electrode is confined within a continuous and immovable insulation from one extremity to the other.

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

JAMES C. ANDERSON.

Witnesses:
C. M. FORREST,
HENRY C. HAZARD.