F. T. H. BACON.

SPARK PLUG.

APPLICATION FILED JAN. 25, 1907.

1,066,979.

Patented July 8, 1913

Fig. 1

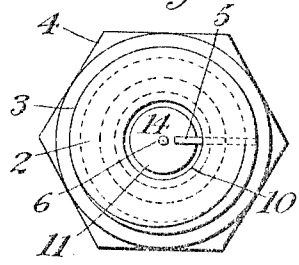


Fig. 3

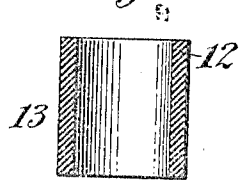


Fig. 2

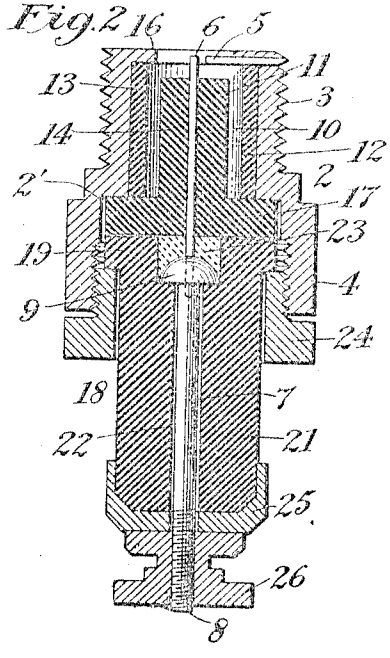


Fig. 4

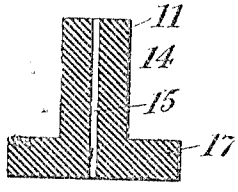
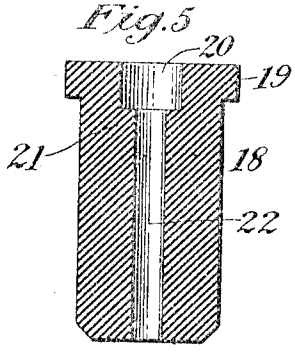


Fig. 5



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UNITED STATES PATENT OFFICE.

FREDERICK T. H. BACON, OF NEW YORK, N. Y.

SPARK-PLUG.

1,066,979. Specification of Letters Patent. Patented July 8, 1913.

Application filed January 25, 1907. Serial No. 354,006.

To all whom it may concern:

Be it known that I, FREDERICK T. H. BACON, a subject of the King of England, and resident of New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Spark-Plugs, of which the following is a specification.

This invention relates to spark plugs for igniting combustible gaseous charges in internal combustion engines; and the main object of the invention is to provide an improved device of this kind which can be readily assembled and disassembled and in which the creeping distance to be traversed by accumulations of carbon or other partially conductive material is so great that the device can not be short circuited.

Other features of my invention not hereinbefore referred to will be hereinafter described and are illustrated in the accompanying drawings, in which—

Figure 1 is an end view of a spark-plug embodying my invention showing the parts about twice the natural size. Fig. 2 is a central longitudinal section of the same. Figs. 3, 4 and 5 are central longitudinal sections of insulating members of the spark-plug which will be hereinafter described in detail.

Similar characters designate like parts in all the figures of the drawing.

The main element of my spark-plug will preferably be a conducting plug adapted to be secured in place in a wall of an internal combustion engine. The construction of this element need not depart from established practice, and in the drawings a conventional type of plug is designated by 2, it having at the inner end thereof external screw-threads 3 by which it is secured in place in the well-known manner in a corresponding internally-threaded opening in the wall of the engine, and having at the outer end a nut 4 by means of which the spark-plug may be turned. This conducting plug 2 has secured thereto substantially in the usual manner, one electrode 5, which is the outer electrode of the spark-plug. The other or central electrode of the spark-plug may be, as illustrated, substantially of the usual construction, it being here shown as a rod or wire 6 of uniform cross section with its free end disposed in the proper relation to the free end of the outer electrode 5, that is, separated therefrom by a small air-gap across which the electric discharge will take place and form a spark. The central electrode 6 may be connected with its metallic support or terminal in any suitable manner, it being in the construction illustrated driven into an axial aperture in the head of a long screw 7 having a long smooth shank and a short threaded end 8. The head of the screw is designated by 9.

The conducting plug 2 and the screw 7 thus constitute in the construction illustrated the conducting supports for the respective electrodes 5 and 6. These two conducting supports must, as in the case of all other spark-plugs, be separated by electrical insulating material having high resistance, and I prefer to employ for this purpose material of the lava type, which not only has high resistance but is dense and is practically unaffected by any degree of temperature to which it may be exposed in an internal combustion engine. This insulating material must not only separate the conducting supports carrying the electrodes 5 and 6, but in this case will be so formed as to lie in close contact with the inner wall of the conducting plug, surround the central electrode 6, and form around said central electrode and between it and the inner wall of the conducting plug at least one deep space surrounding such electrode. In the construction illustrated a single deep space is formed in the insulating material, and this space surrounds and is concentric with the central electrode 6. Said space is designated by 10. Both walls of this space are insulating walls, one wall being indicated at 11 and the other at 12. The two insulating walls thus formed are separated by a space 10 of considerable width and are usually, as shown, substantially parallel with each other and with the axis of the central electrode 6. The space 10 formed in the insulating material is here illustrated as annular and completely surrounds the central electrode, and at all points about its axis the electrode 6 is separated from the insulating plug 2 by at least two insulating walls spaced a considerable distance apart. The depth of the space 10 surrounding the central electrode and formed by two insulating walls, one surrounding the other, may vary considerably, but in all cases it should be a deep space, and a considerable distance should separate the two walls thereof, in order that deposited carbon and other partially conductive material may fill the space gradually

from the closed to the open end thereof and not bridge the open end of the space until the closed end is filled with such material. When the space is of the depth illustrated, which is approximately equal to the internal diameter of the conducting plug 2, it will be seen that the insulating material separating the central electrode from the conducting plug 2 has a plurality of insulating walls which form a creeping surface of great length, the aggregate length being approximately a multiple of the internal diameter of the conducting plug 2. The length of this insulating creeping surface depends partly upon the depth of the insulating walls formed in the insulating material and partly upon the number of walls so formed. With two walls, such as 11 and 12, the length of the insulating creeping surface is approximately twice the internal diameter of the conducting plug 2, whereas in spark-plugs of other types heretofore used the length of the insulating creeping surface between the central electrode and the outer conducting plug has usually been approximately the same as or less than the internal diameter of the conducting plug.

The insulating material used is here illustrated as divided as a matter of convenience and economy into several parts, though whether the insulating material considered as a whole be formed in one piece or in several pieces, is unimportant. That portion of the whole body of insulating material which is adjacent to the inner end of the spark-plug and inclosed within the externally-threaded portion of the conducting plug may to advantage be made in two parts, each having an opening lengthwise thereof, and constituting a hollow body, preferably cylindrical. One such insulating cylinder is indicated at 13, the opening therethrough being of large diameter to receive the other. The second of these cylinders has a bore of small diameter extending therethrough, and its outer surface or wall, when the parts are assembled, is surrounded by the inner wall of the cylinder 13 but separated therefrom by a deep and relatively wide space. The opening through this cylinder 14 is indicated at 15. It preferably is of such diameter as to lie in close contact with the surface of the central electrode 6, which passes through it. In a similar manner the outer wall of the cylinder 13 is shown as covering the inner wall of the conducting plug 2, thus making close contact with such inner wall. It will be seen that the inner wall of the cylinder 13 and the outer wall of the cylinder 14 constitute the separated insulating walls 11 and 12 hereinbefore referred to. The relative positions of the two cylinders when assembled are clearly illustrated in Fig. 2. The insulating cylinder 13 is in this construction slightly shorter than the main portion, that is the inner end, of the conducting plug 2, and may abut against and be stopped by an internal annular flange 16 at the extreme inner end of the conducting plug. This flange also provides an additional body of metal through which the outer electrode 5 may be driven and by which said electrode may be held firmly. The cylinder 14 may also have an annular flange 17 of the same material by means of which it will be located in position lengthwise of the spark-plug. Here this flange abuts against an annular shoulder 2′ in the conducting plug 2.

The cylinder 14 with its annular flange 17 constitutes in the construction illustrated one member of the insulating core of my improved spark-plug. As illustrated said insulating core is made in two pieces, the other member being a cylinder 18 of larger diameter than the cylinder 14 and formed at its inner end with an annular flange 19. This insulating member has a central longitudinal bore of two diameters, one portion 20 being short but of large diameter to receive the head 9 of the screw 7 and form a stop-shoulder 21 for said head, while the other portion of the bore is long and of smaller diameter, as shown at 22, to receive the smooth shank of the screw 7. By dividing the insulating core into two parts the parts may be made more cheaply and the spark-plug more readily assembled. The two members of the insulating core will usually be united by a body of cement 23 after the electrode 6 and the screw 7 have been placed in the respective parts of said insulating core and the electrode 6 has been driven into the head of said screw.

The insulating core with its assembled central electrode and screw may be held in place in the conducting plug 2 in any suitable manner. A hollow screw-cap 24 of well-known type may be employed for the purpose. This cap has external screw-threads which fit into corresponding internal threads in the outer end of the conducting plug 2. When this cap is screwed home, the enlarged flanged portions of the members 14 and 18 of the insulating core are held firmly between the inner end of said screw-cap and the shoulder 2′.

The outer end of the spark-plug may be finished substantially in the usual manner by means of a conducting cap such as 25 and a nut 26 on the threaded end 8 of the screw 7.

In use, a spark-plug constructed in accordance with my invention, having a central electrode coöperating with an outer electrode fastened in a conducting plug and also having between the central electrode and the conducting plug insulating material embodying deep insulating walls surrounding the central electrode and spaced a considerable distance apart to increase the

creeping distance, will have a considerably greater average life than any spark-plug in which only a single deep insulating wall surrounding the central electrode is separated from such electrode or from the wall of the conducting plug by an air-gap. When the single longitudinal line of travel of deposited carbon or other partially conductive material along an insulating surface found in many of the best types of spark-plugs heretofore devised is multiplied substantially in the manner disclosed herein, the creeping distance in the resulting spark-plug is correspondingly multiplied without any complication in the construction, the chief elements of which are, as heretofore, the metallic conducting portion of the spark-plug, the high-resistance insulating material complementary to the conducting portion of the spark-plug and of any usual material and construction except as to the number and separation of its insulating walls, and at least one deep air-gap surrounding the central electrode and surrounded by the conducting plug.

What I claim is:

1. A spark-plug, comprising a conducting plug having a bore of large diameter at one end and of considerably smaller diameter at the other end, an outer electrode attached to said conducting plug, a substantially central coöperating electrode forming with the outer electrode a spark-gap, and insulating material constructed to have movement lengthwise of the conducting plug to assembled and disassembled positions, said material separating said conducting plug and central electrode and having a deep wall covering the inner surface of and extending far into the conducting plug and also having a second deep wall which surrounds said central electrode and extends far into said conducting plug and is separated from said first deep wall by an air-space that also extends far into said conducting plug.

2. A spark-plug, comprising a conducting plug having a bore of widely differing diameters with the smallest diameter adjacent to the spark-gap, an outer electrode attached to said conducting plug, a substantially central coöperating electrode forming with the outer electrode a spark-gap, and insulating material consisting of a plurality of parts and constructed to have movement lengthwise of the conducting plug to assembled and disassembled positions, said material separating said conducting plug and central electrode and having a deep wall covering the inner surface of and extending far into the conducting plug and also having a second deep wall which surrounds said central electrode and extends far into said conducting plug and is separated from said first deep wall by an air-space that also extends far into said conducting plug.

3. A spark-plug, comprising a conducting-plug having a bore of widely different diameters with the smallest diameter adjacent to the spark-gap, an outer electrode attached to said conducting-plug, a substantially central coöperating electrode forming with the outer electrode a spark-gap, a conductor of large diameter to which said central electrode is secured, a two-part insulating core movable into and out of assembled position through the end of the conducting-plug farthest from the spark-gap and having axial openings which surround, and the diameters of which correspond respectively to those of, said central electrode and the conducter connected thereto, and an insulating cylinder between said insulating core and the conducting-plug and separated from said core by a deep air-space.

Signed at New York, in the county of New York, and State of New York, this eleventh day of January, A. D. 1907.

FREDERICK T. H. BACON.

Witnesses:
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ROBERT CHAMPION.