S. B. FOWLER.

SPARK PLUG.

APPLICATION FILED APR. 21, 1909.

950,847. Patented Mar. 1, 1910.

Fig. 1.

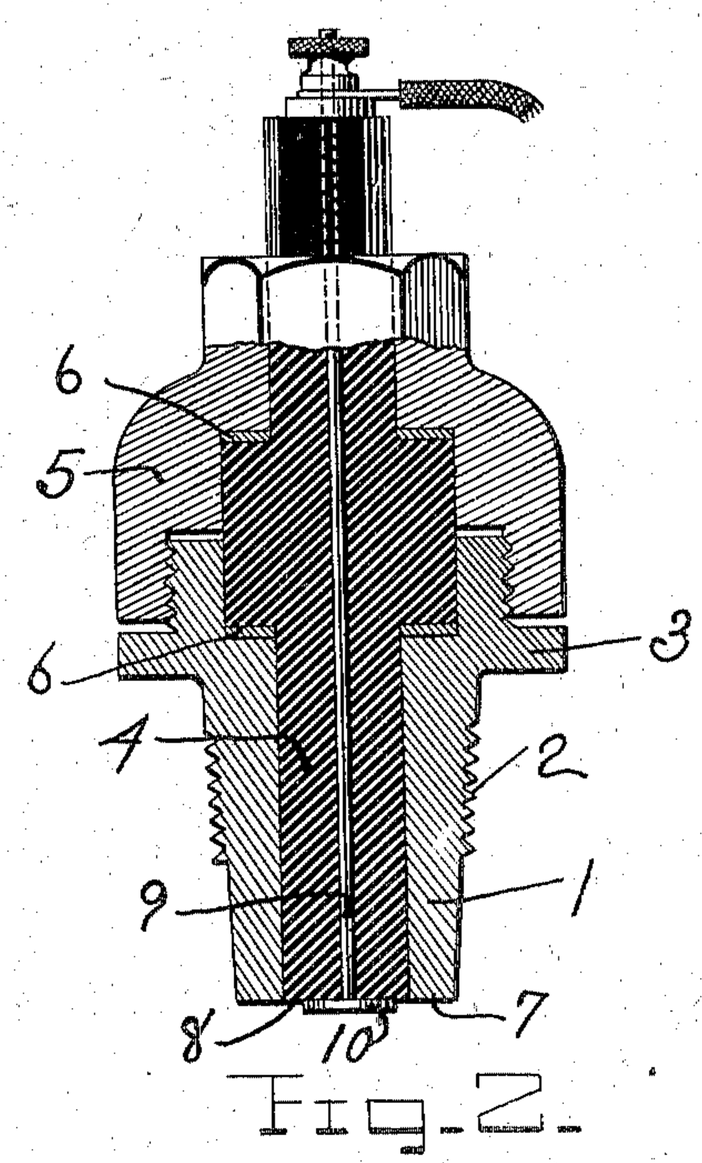
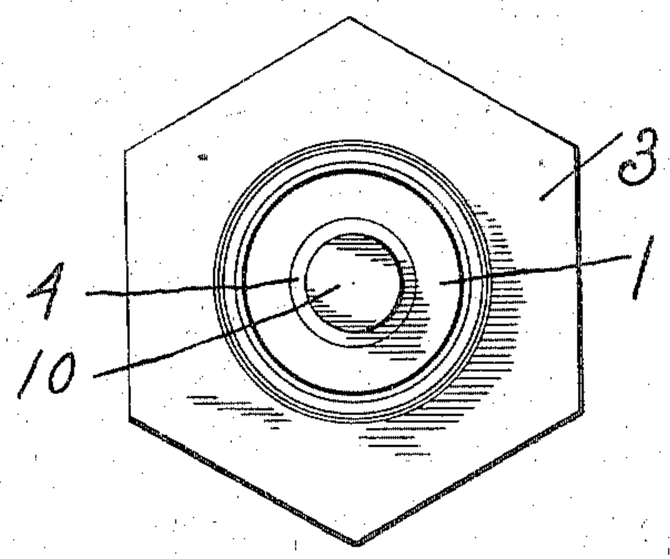



Fig. 2.

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## SPARK-PLUG.

950,847. Specification of Letters Patent. Patented Mar. 1, 1910.

Application filed April 21, 1909. Serial No. 491,237.

*To all whom it may concern:*

Be it known that I, SAMUEL B. FOWLER, a citizen of the United States, residing at La Fayette, in the county of Tippecanoe, State of Indiana, have invented certain new and useful Improvements in Spark-Plugs, of which the following is a description, reference being had to the accompanying drawings, forming a part hereof.

My invention relates to spark plugs for igniting the combustible mixture supplied to an internal combustion engine; and the object thereof is to provide a spark plug which will be more reliable, and one less likely to fail to ignite the charge, than spark plugs at present upon the market.

Spark plugs for internal combustion engines when they fail to ignite the charge generally do so because of a deposit of carbon or grease which is found to have collected upon the surface of the insulation exposed to the burning gases within the cylinder thereby establishing a path along which the current of electricity will flow in preference to jumping across the spark gap, the resistance of such deposit or coating of carbon being much less than the resistance of the spark gap.

The object of my invention, more specifically stated, is to provide a spark plug in which the surface of the insulation exposed to the burning gases will be reduced to a minimum, and a plug in which a deposit of carbon upon such surface will not accumulate when the plug is in use, such deposit as occurs being continually removed by the action of the current as each successive spark takes place. This action according to my understanding of the forces involved is due in part to the action of the current in burning up the carbon and in part to the mechanical action of the current as the successive sparks occur, although it is not asserted that other forces may not contribute to the result attained, which result is a spark plug in which in actual use it has been found that no deposit of carbon accumulates upon the surface of the insulation.

In the accompanying drawing: Figure 1 is a view showing a vertical central section of my improved spark plug, the upper end thereof with which my invention is not concerned being shown in elevation to complete the view. Fig. 2 is a view showing my spark plug as seen from a point beneath it.

In the drawing 1 is a bushing designed to be secured in the wall of the working cylinder of an internal combustion engine to which end it is shown threaded as at 2, and with a hexagonal portion at 3. This bushing it will be understood forms one of the electrodes of my improved spark plug, and it is provided with a passage extending longitudinally thereof and within which is located a cylinder 4 of insulating material, the insulating material being secured in place by a cap 5 which engages a threaded portion of the bushing 1, suitable packing washers 6 being employed as is usual in spark plugs. The bushing 1 projects into the working cylinder of the engine with which the spark plug is used and the insulating material 4 and bushing 1 terminate in the same plane in the embodiment of my invention illustrated and as shown in Fig. 1 where the end 7 of the bushing 1 will be seen to be in the same plane as the end 8 of the insulating cylinder 4. 9 is the second electrode of my improved spark plug, and a disk 10 is preferably provided at the inner end of said electrode which disk is in contact with the end of the insulating cylinder 4.

In my improved spark plug a current of electricity in passing between the electrodes 1 and 9 will traverse the path of least resistance, which path, when the plug is used under the conditions normally occurring in internal combustion engines will be across the surface of the end 8 of the insulating cylinder 4, the length of such path being a minimum and the material thereof being commonly a better conductor than the gases surrounding the end of the electrode. This analysis will not, of course, exclude a condition if such a condition may exist, in which the current flows through the gases but close to the surface referred to, the essential consideration being that the flow of current takes place along the same path in which a deposit of carbon tends to accumulate. This continual flow of current over and close to if not upon the surface upon which a deposit of carbon tends to accumu-

late will prevent the formation of a deposit of carbon upon such surface according to my experience, my theory being that the results observed are due to the fact that the carbon is in part burned up by the current as fast as it forms and in part dissipated or torn off and thrown away from such surface by the well known mechanical action observed when a current of electricity of high tension flows along a path upon which loose particles lie.

While I have illustrated my invention as embodied in a spark plug having concentric electrodes and one in which the flow of current is expected to take place along a straight line lying in a plane, I do not consider my invention as limited to a spark plug necessarily having such structural features; and I consider my invention as comprehending spark plugs in which the path along which the current is designed to flow lies in or substantially in the surface of the insulating material exposed to the burning gases and upon which a deposit of carbon will accumulate if such a deposit occurs, or, as stated differently, spark plugs in which the surface of the insulating material exposed to the burning gases embraces or substantially embraces the path traversed by the current as a spark is produced.

Having thus described my invention and explained the mode of operation thereof, I claim and desire to secure by Letters Patent:—

1. In a spark plug for internal combustion engines an outer electrode consisting of a hollow body portion terminating in an annular surface, an inner electrode extending through the hollow body portion of the outer electrode and terminating in substantially the plane of the annular surface of the outer electrode, insulating material filling the space between the two electrodes and terminating in substantially the plane of said annular surface, said inner electrode having its end of greater diameter than its body portion whereby a spark gap is secured of less length than the thickness of the insulating material between the body portions of the two electrodes.

2. In a spark plug for internal combustion engines an outer electrode consisting of a hollow body portion terminating in an annular surface, an inner electrode extending through the hollow body portion of the outer electrode and terminating in substantially the plane of the annular surface of the outer electrode, insulating material filling the space between the two electrodes and terminating in substantially the plane of said annular surface, said inner electrode having at its end an annular enlarged portion concentric with the annular surface at the end of the outer electrode whereby a spark gap is secured of less length than the thickness of the insulating material between the body portions of the two electrodes.

3. In a spark plug for internal combustion engines an outer electrode consisting of a hollow body portion terminating in an annular surface, an inner electrode extending through the hollow body portion of the outer electrode and terminating in substantially the plane of the annular surface of the outer electrode, insulating material filling the space between the two electrodes and terminating in substantially the plane of said annular surface, said inner electrode having at its end a disk concentric with the annular surface at the end of the outer electrode and in contact with the end of the insulating material.

4. In a spark plug for internal combustion engines, a bushing adapted to be secured in the wall of the working cylinder of an engine and which bushing forms one electrode; a second electrode located within said bushing and arranged concentric therewith; and a body of insulating material filling the space between said bushing and said second electrode, said inner electrode having an enlarged portion at its extremity in contact with the inner end of said body of insulating material, the surface of said insulating material exposed to the gases within the cylinder, the inner end of said bushing, and the end of said second electrode being substantially in one plane whereby the path traversed by a current of electricity as a spark is produced between the electrodes will extend across the surface of said insulating material exposed to the burning gases.

5. In a spark plug for internal combustion engines, a bushing adapted to be secured in the wall of the working cylinder of an engine and which bushing forms one electrode; a second electrode located within said bushing; and a body of insulating material surrounding said second electrode and filling the space between said electrodes, said inner electrode having an enlarged portion at its extremity in contact with the inner end of said body of insulating material, the arrangement of said insulating material relatively to said electrodes being such that the path followed by a current of electricity as a spark is produced between said electrodes will traverse the surface of said insulating material exposed to the burning gases.

6. In a spark plug for internal combustion engines, an outer electrode consisting of a hollow body portion terminating in an annular surface, an inner electrode consisting of a rod within the body portion of the

outer electrode and parallel therewith, insulating material filling the space between the two electrodes and terminating in a flat surface in the same plane with the annular surface at the end of the outer electrode, and a flat disk on the end of the inner electrode in contact with the end of the insulating material, of greater diameter than the inner electrode arranged concentric with the annular surface on the end of the outer electrode.

This specification signed and witnessed this fifteenth day of April A. D. 1909.

SAMUEL B. FOWLER.

In the presence of—
PERRY F. WRIGHT,
G. W. ILGENFRITZ.