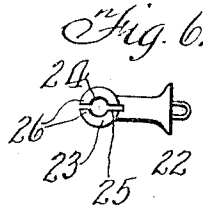
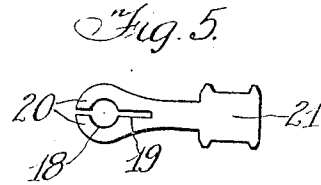
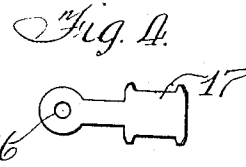
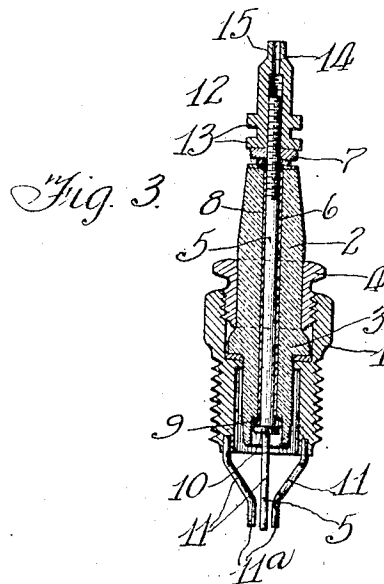
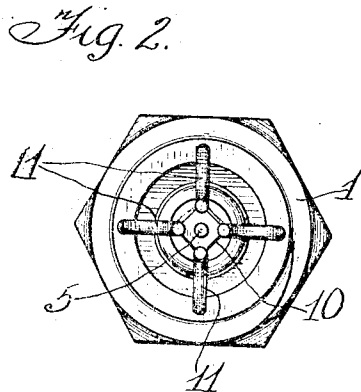
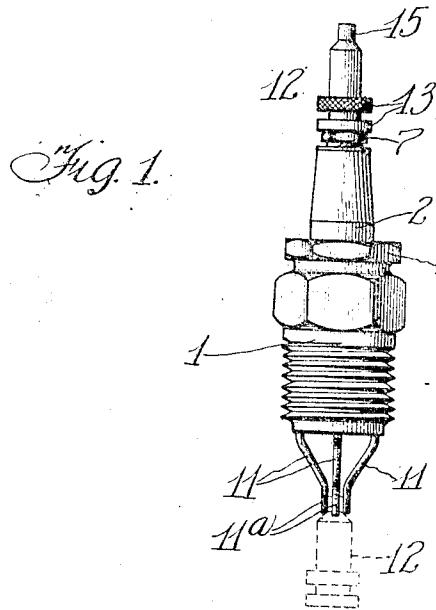


C. F. JOHNSTON.
SPARK PLUG.
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1,061,915.

Patented May 13, 1913.



Witnesses:
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UNITED STATES PATENT OFFICE.

CHARLES F. JOHNSTON, OF MARSHALLTOWN, IOWA, ASSIGNOR OF ONE-HALF TO
CHARLES C. ELDRIDGE AND ONE-HALF TO EDWIN J. BEEBE, BOTH OF MAR-
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SPARK-PLUG.

1,061,915.

Specification of Letters Patent.

Patented May 13, 1913.

Application filed February 4, 1911. Serial No. 606,477.

To all whom it may concern:

Be it known that I, CHARLES F. JOHNSTON, a citizen of the United States, residing at Marshalltown, in the county of Marshall and State of Iowa, have invented certain new and useful Improvements in Spark-Plugs, of which the following is a specification.

One of the objects of this invention is to produce an improved spark plug by means of which a considerably larger spark may be obtained than has heretofore been possible.

Another object is to produce a spark plug which will need cleaning less frequently than prior plugs, and which may be more easily cleaned when cleansing becomes necessary.

In the accompanying drawings, Figure 1 is a side elevation of a spark plug embodying the features of my invention. Fig. 2 is a bottom plan view of the plug. Fig. 3 is a longitudinal central sectional view. Figs. 4, 5, and 6 illustrates three forms of clips by means of which electrical conductors may be attached to the plug.

The present embodiment of my invention comprises a casing 1 in the form of a bushing adapted to be screwed into an engine cylinder, said casing having a member 2 therein which is formed of insulating material such as porcelain. The insulating member 2 may be held in place in the casing 1 in any suitable way as by an annular flange 3 on said member engaging an annular shoulder within the casing, and a nut 4 threaded in the casing and engaging the opposite side of said flange. One of the electrodes may be in the form of a rod 5 extending through a central opening 6 in the insulator 2, said rod projecting from the ends of said member, and being threaded at its upper end to receive a nut 7, to hold the electrode in place, and a cap to be later described. A coating of adhesive cement 8 surrounds the rod 5 within the opening 6. The lower end of the opening 6 may be enlarged as shown, and within this enlargement is placed a packing 9 of asbestos or the like, said packing surrounding the rod and being held in place by a shoulder 10 on said rod.

In use, the end of the electrode which lies within the engine cylinder becomes hot and expands. The packing 9 prevents such expansion from cracking the insulating member 2.

The electrodes 11 of opposite polarity to the electrode 5 may be secured in the lower end of the casing 1, said electrodes 11 being herein shown in the form of short wires arranged symmetrically around the central electrode 5 and extending inwardly to lie at a suitable distance from the electrode 5. The outer end portions 11^a of the electrodes 11 are bent to lie parallel with the central electrode, so that instead of a spark being formed at only the points of each of the electrodes 11, a large spark is formed along the entire end portion 11^a. It will be seen that when a current passes through the spark plug, it will jump the gaps from the electrode 5 to the long end portions of each of the electrodes 11 of opposite polarity, thereby producing a much larger spark than has heretofore been obtainable.

Upon the upper end of the electrode 5 is threaded a cap 12 having two annular flanges 13 near its lower end. The upper end of the cap 12 has an opening 14 therein of a size adapted to fit upon the lower end of the central electrode 5. Said upper end may be reduced as at 15 to a suitable size. In case the electrodes 11 get burned off or bent out of position slightly in cleaning, the opening 14 in the cap 12 may be slipped upon the lower end of the electrode 5, as shown in dotted lines in Fig. 1, and the electrodes 11 bent inwardly against the reduced end 15 of said cap. The cap 12 thus forms a convenient and ready means for spacing the electrodes 11 at the proper distance from the central electrode 5.

It will be observed that, in the plug herein shown, the electrodes project outwardly a considerable distance from the casing and the spark is made at the outer end portion of the electrodes. In spark plugs in which the electrodes are inclosed or partially inclosed by a housing or casing, burnt gases remain in the housing around the electrodes, the housing preventing good access of the fresh charge of gas to the electrodes, and imperfect ignition is the result. This imperfect ignition causes a rapid deposit of carbon upon the electrodes, which necessitates their frequent cleaning.

In my spark plug, the electrodes project a relatively great distance beyond the casing of the plug and the parallel portions 11^a where the spark is formed are at the extreme ends of the electrodes. A large spark is therefore drawn at a point well away from

the wall of the engine cylinder where there is nothing to hinder the incoming fresh charge of gases from sweeping the burnt gases away from the electrodes. Owing to the provision of four electrodes arranged as herein disclosed, the stream of incoming gases, upon striking the electrodes, will be broken up into a multitude of eddy currents which will sweep around and among the electrodes in various directions and thus tend to remove any deposit of carbon therefrom. Inasmuch as a large spark is drawn at a point freely accessible to the incoming charge of fresh gases, the very best ignition is obtained. When the ignition is good, the deposit of carbon on the electrodes is correspondingly small, and the electrodes do not require cleaning so frequently. The four outer electrodes form a screen to prevent carbon from bridging the space between said central electrode and any of said outer electrodes. If one or even three of the electrodes should become coated with soot so as to render them unserviceable, a spark would still be drawn at the remaining electrode. The period between the times at which the plug demands cleaning is thus further prolonged. However when it becomes necessary to clean the electrodes, they are readily accessible and easily cleaned. If they become deranged in cleaning they may be again properly positioned by means of the cap 12, as hereinbefore explained, or in any other suitable way.

In Fig. 4, I have shown an electric-wire-attaching member consisting of a flat strip having an eye 16 therein adapted to fit over the upper end of the electrode 5, and be held in place by the cap 12, said member comprising a portion 17 around which a wire may be bent and soldered if desired.

In Fig. 5 is shown a clip having an opening 18 therethrough and a slot 19 extending through said opening to provide two arms 20. This clip may be sprung around the cap 12 between the flanges 13, the cap lying within the opening 18. A portion 21 is adapted to have an electric wire bent therearound for supplying current to the spark plug.

Fig. 6 illustrates another form of clip comprising a ball 23 having an opening 24 therethrough, and a slot 25 forming spring arms 26, said ball being adapted to be slipped over the upper end of the cap 12. An electric wire may be attached to the opposite end of the clip.

It will be understood that none of the clips shown in Figs. 4, 5 and 6 is necessary. If desired, a wire may be wound about the upper end of the electrode 5, and the cap turned down upon the wire to make a good

contact and hold the wire in place. The forms of clips illustrated in Figs. 4, 5 and 6 are at present upon the market.

It will be seen that I have provided a plug which is adapted to have an electric wire attached thereto in any one of several of the methods at present in use. This feature has been found a great convenience in practice.

I claim as my invention:

1. An improvement in spark plugs comprising a casing adapted to be screwed into an engine cylinder, an insulating sleeve supported by said casing, a central electrode extending through said sleeve and projecting from one end thereof, and four electrodes of opposite polarity to said central electrode and arranged substantially symmetrically around the latter, the outer electrodes being each fixed at one end to the inner end of the casing, the free ends of said outer electrodes being bent to lie approximately parallel to said central electrode to form a screen to prevent carbon from bridging the space between said central electrode and any of said outer electrodes, said parallel ends creating a large spark and serving to break up the incoming charge of fresh gases into eddy currents, whereby the electrodes will be scoured at each cycle of the engine.

2. An improvement in spark plugs comprising a casing adapted to be screwed into an engine cylinder, an insulating sleeve supported by said casing, a central electrode extending through said sleeve and projecting from one end thereof, and four electrodes of opposite polarity to said central electrode and arranged substantially symmetrically around the latter, the outer electrodes being each fixed at one end to the inner end of the casing, the free ends of said outer electrodes being bent to lie approximately parallel to said central electrode to form a screen to prevent carbon from bridging the space between said central electrode and any of said outer electrodes, said parallel ends creating a large spark and serving to break up the incoming charge of fresh gases into eddy currents, whereby the electrodes will be scoured at each cycle of the engine, said electrodes being uninclosed and all extending far enough from said casing and said insulating member respectively to project beyond the zone of dead gases normally within the engine cylinder, whereby prompt ignition is insured.

In testimony whereof I hereto affix my signature in the presence of two witnesses.

CHARLES F. JOHNSTON.

Witnesses:-

L. L. MILLER,
JOSEPH R. BARSE, Jr.