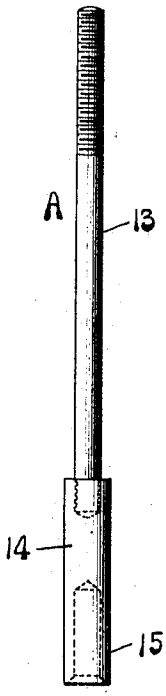
L. S. FLATAU.

SPARK PLUG.

APPLICATION FILED OCT. 28, 1918.

1,352,592. Patented Sept. 14, 1920.

Fig. III.



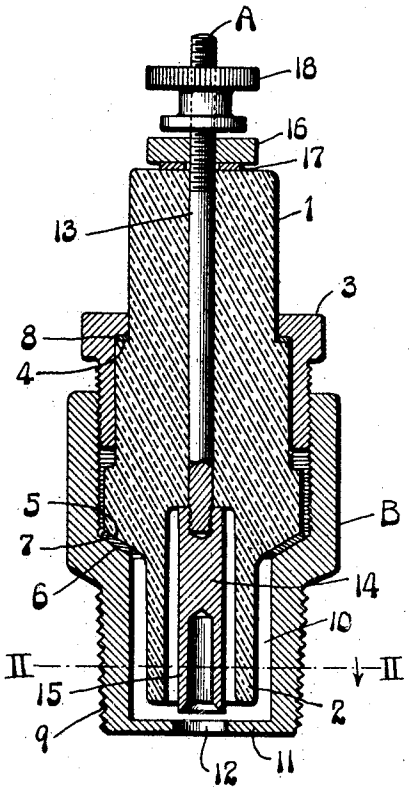
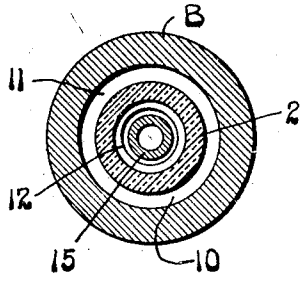


Fig. I.

Fig. II.



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SPARK-PLUG.

1,352,592. Specification of Letters Patent. Patented Sept. 14, 1920.

Application filed October 28, 1918. Serial No. 260,046.

To all whom it may concern:

Be it known that I, LOUIS S. FLATAU, a citizen of the United States of America, a resident of the city of St. Louis, in the State of Missouri, have invented certain new and useful Improvements in Spark-Plugs, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

My invention relates to improvements in spark plugs, one of the objects being to provide a highly efficient spark plug having its electrodes so formed and arranged that the current passing from the inner electrode is distributed around the lower margin of said electrode and then discharged across an annular spark gap between the inner and outer electrodes. With this object in view, the new device comprises a particular combination and arrangement of elements which most effectively coöperate with each other, as will be hereinafter described. Another object is to enable the inner electrode to properly coöperate with the outer electrode in forming the annular spark gap, even though the inner electrode is not accurately located at the center of the outer electrode.

With the foregoing and other objects in view the invention comprises the novel construction, combination and arrangement of parts hereinafter more specifically described and illustrated in the accompanying drawings wherein is shown the preferred embodiment of the invention; however, it is to be understood that the invention comprehends changes, variations and modifications which come within the scope of the claims hereunto appended.

Figure I is a vertical section of a spark plug embodying the features of this invention.

Fig. II is a horizontal section taken approximately on the line II—II, Fig. I.

Fig. III is a detail view of the inner electrode.

The spark plug herein shown comprises an insulator 1 having a tubular lower portion 2, an inner electrode A extending through said insulator and projecting downwardly from the lower portion thereof, and a tubular outer electrode B in which the insulator is secured by means of a bushing 3. The insulator has a shoulder 4 adjacent to the bushing 3 and a shoulder 5 adjacent to a corresponding shoulder 6 on the outer electrode. A gasket 7 may be interposed between the shoulders 5 and 6, and a gasket 8 is preferably located between the bushing 3 and the shoulder 4. The bushing is screwed into the outer electrode, and it may be tightened to firmly secure the insulator. The lower portion of the outer electrode B is threaded at 9 for a purpose well understood in this art.

The lower portion of the outer electrode B is provided with an ignition chamber 10 and an annular web 11 forming an annular bottom wall for said chamber. This annular web 11 is preferably formed integrally with the outer electrode, and its central opening 12 is preferably formed at the center line of the spark plug.

The inner electrode A comprises a solid wire-like member 13 closely fitted to the insulator, and a relatively large portion 14 extending through and projecting downwardly from the tubular lower portion of the insulator. This relatively large member 14 is provided with a hollow cylindrical lower margin 15 having a sharpened annular lower edge which lies within the ignition chamber 10 at a point adjacent to the circular wall of the opening 12, so as to provide an annular spark gap between said sharpened lower edge and said circular wall. It is important to observe that the lower edge of the central electrode lies entirely above the web 11, and that said electrode may therefore occupy a position eccentric to the outer electrode, without short circuiting the electrodes and without materially impairing the efficiency of the plug. The lower portion of the inner electrode is rigid and can not be easily adjusted by a bending operation, but being entirely above the web 11 it cannot contact with the outer electrode. This is desirable for the reason that the inner electrode will usually occupy a position slightly eccentric to the outer electrode.

The relatively large portion 14 of the inner electrode may be screwed onto the lower end of the wire-like member 13, as shown in the drawings. A shoulder is thus formed at the upper end of the large member 14, and this shoulder engages the insulator to limit the upward movement of the inner electrode relative to the insulator.

designates a nut mounted on the extended upper end of the wire-like member 13 and coöperating with the enlarged lower member 14 to secure the inner electrode to the insulator. A washer 17 may be interposed between the nut 16 and the upper end of the insulator. 18 designates an ordinary binding nut mounted on the threaded upper end of the inner electrode.

As shown most clearly in Fig. I, the inner electrode is solid throughout its length, excepting at its lower margin where it is preferably drilled to form the cylindrical portion 15. The electric current passes downwardly through the solid portion of the inner electrode and thence to the cylindrical lower portion 15, where it is distributed from the center of the electrode and transmitted to the annular lower end thereof. Owing to this manner of distribution and delivery of the current, or to some resultant electric phenomenon which I am unable to fully explain, the sparks pass from the lower end of the inner electrode so as to form an annular frame in the annular spark gap. The sparks do not merely jump across the path of least resistance, as is usually the case where a solid electrode is surrounded by an annular shoulder. Comparative tests have clearly shown that a spark gap formed as herein shown is far more efficient than a sparking device having a solid central electrode. I have also found that the sharp lower edge of the central electrode increases the efficiency of the device. Furthermore, the inner electrode having its lower end arranged entirely within the ignition chamber 10 may be accidentally displaced transversely of the plug without very materially impairing the efficiency of the plug. When a plug of this kind is applied to an internal combustion engine, some of the explosive mixture will be forced into the ignition chamber 10, where it will be quickly ignited by the sparks, with the result of producing a flame at the opening 12, thereby facilitating the complete ignition of the charge.

I claim:

1. A spark plug comprising an insulator, an inner electrode extending through said insulator, an outer electrode in which said insulator is secured, the lower portion of said outer electrode being provided with an ignition chamber and an annular web forming an annular bottom wall for said chamber, said inner electrode having a hollow lower end which lies entirely within said ignition chamber at a point above, but adjacent to, the circular wall of the opening in said annular web, so as to provide an annular spark gap between said hollow lower end and said annular bottom wall.

2. A spark plug comprising an insulator, an inner electrode extending through said insulator, and an outer electrode in which said insulator is secured, the lower portion of said outer electrode being provided with an ignition chamber and an annular web forming an annular bottom wall for said chamber, said inner electrode having a relatively large lower portion provided with a hollow cylindrical lower margin which lies within said ignition chamber and above said annular web, said cylindrical lower margin being above, but adjacent to, the circular wall of the opening in said annular web, so as to provide an annular spark gap between said cylindrical lower margin and said annular bottom wall.

3. A spark plug comprising an insulator, an inner electrode extending through said insulator, an outer electrode in which said insulator is secured, the lower portion of said outer electrode being provided with an ignition chamber and an annular web forming an annular bottom wall for said chamber, said inner electrode comprising a solid wire-like upper member closely confined in said insulator and a relatively large lower member extending downwardly from said solid upper member, said relatively large member being provided with a cylindrical lower end portion having an annular lower edge which lies entirely within said ignition chamber and above, but adjacent to, the circular wall of the opening in said annular web, so as to provide an annular spark gap between said annular lower edge and said annular bottom wall.

4. A spark plug comprising an insulator having a tubular lower portion, an inner electrode extending through said insulator and projecting downwardly from the tubular lower portion thereof, an outer electrode in which said insulator is secured, the lower portion of said outer electrode being provided with an ignition chamber and an annular web forming an annular bottom wall for said chamber, the lower portions of said insulator and inner electrode being inclosed by said ignition chamber, said inner electrode having an enlarged lower end portion provided with a hollow cylindrical lower margin and a relatively sharp annular lower edge which lies entirely within said ignition chamber and above, but adjacent to, the circular wall of the opening in said annular web, so as to provide an annular spark gap between said sharp annular lower edge and said annular bottom wall.

5. A spark plug comprising an insulator having a tubular lower portion, an inner electrode extending through said insulator and projecting downwardly from the tubular lower portion thereof, an outer electrode in which said insulator is secured, the lower portion of said outer electrode being provided with an ignition chamber and an annular web forming an annular bottom wall for said chamber, the lower portions of said

insulator and inner electrode being inclosed by said ignition chamber, said inner electrode comprising a solid wire-like upper member closely confined in said insulator and provided with a screw threaded lower end, and a relatively large lower member screwed onto said threaded lower end, said relatively large member having a hollow cylindrical lower margin and a relatively sharp annular lower edge which lies entirely within said ignition chamber and above, but adjacent to, the circular wall of the opening in said annular web, so as to provide an annular spark gap between said sharp annular lower edge and said annular bottom wall.

6. A spark plug comprising an insulator, an inner electrode extending through said insulator and projecting downwardly from the lower portion thereof, and a hollow outer electrode in which said insulator is secured, the lower portion of said outer electrode being provided with an annular bottom wall, and said inner electrode being provided with a hollow lower end having a sharp lower margin located adjacent to the circular inner edge of said annular bottom wall to form an annular spark gap.

In testimony that I claim the foregoing I hereunto affix my signature.

LOUIS S. FLATAU.