C. L. FITZ.

SPARK PLUG FOR INTERNAL COMBUSTION ENGINES.

APPLICATION FILED SEPT. 4, 1917.

1,356,349. **Patented Oct. 19, 1920.**

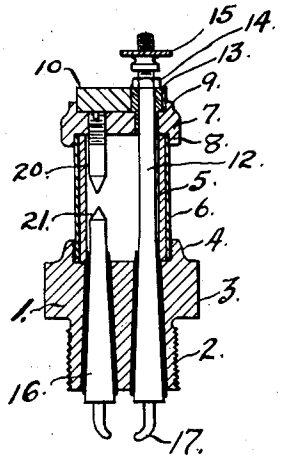


FIG. 1.

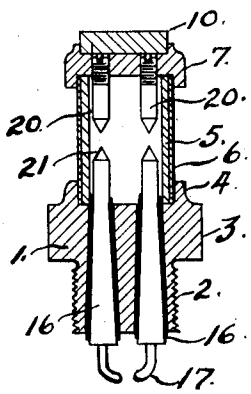


FIG. 3.

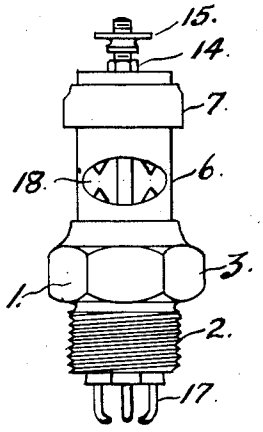


FIG. 4.

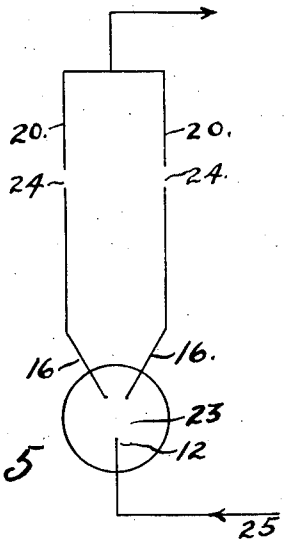


FIG. 5

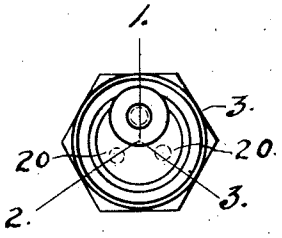


FIG. 2.

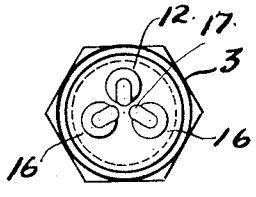


FIG. 6.

WITNESSES:

Brennan Wahl.

Evelyn Gregory

INVENTOR.

CHAS. L. FITZ.

BY Daniel A. Brennan.

ATTORNEYS.

UNITED STATES PATENT OFFICE.

CHARLES LEO FITZ, OF CHICAGO, ILLINOIS, ASSIGNOR TO VISIBLE SPARK PLUG CO., A CORPORATION OF ILLINOIS.

SPARK-PLUG FOR INTERNAL-COMBUSTION ENGINES.

1,356,349. Specification of Letters Patent. Patented Oct. 19, 1920.

Application filed September 4, 1917. Serial No. 189,522.

To all whom it may concern:

Be it known that I, CHARLES L. FITZ, a subject of the Emperor of Austria-Hungary, residing at Chicago, county of Cook, and State of Illinois, have invented certain new and useful Improvements in Spark-Plugs for Internal-Combustion Engines, of which the following is a specification.

This invention relates to improvements in spark plugs for internal combustion engines.

It is an object of the invention to combine with a plurality of electrodes or electrode portions of spark plugs means adapted to indicate the passage of current through the electrodes without making it necessary to remove the plug from its seat and to test it after removal in special apparatus.

Another object of the invention is to provide in combination with a spark plug a plurality of electrodes inserted into the core or body of the plug in such manner that the force of explosion occurring in each operative cycle of the engine will have a tendency to force the electrodes more firmly into the core.

Another object of the invention is to place several electrodes of the same polarity into opposition to a single electrode of opposite polarity, providing thereby means for preventing the interruption of the spark if one of these electrodes should be covered by carbon, while in ordinary spark plugs the settlement of carbon on one electrode decreases the gap and leads to disturbance in the proper functioning of the plug and cannot be seen without testing.

With these and other objects in view, an embodiment of the invention is illustrated in the accompanying drawing, and described in the following specification and claims:

Figure 1 is a longitudinal section through the spark plug, taken on line 1—2 of Fig. 2, showing two electrodes of different polarity in elevation;

Fig. 2 is a top plan view of the spark plug illustrated in Fig. 1;

Fig. 3 is a longitudinal section on line 2—3 of Fig. 2, the electrodes being shown in elevation;

Fig. 4 is a side elevation of the spark plug;

Fig. 5 is a circuit diagram, and

Fig. 6 is a bottom plan view of the spark plug and electrodes.

The spark plug comprises a body or core 1 of metal or other suitable material, having a reduced portion 2 with an outer thread and a shoulder portion 3, which is provided with a hexagonal surface similar to that of an ordinary bolt nut. An annular ring 4, projecting from the upper surface of the nut portion, serves to inclose the lower end of a ring or bushing 5 made of insulating and transparent material, like glass; this bushing 5 is surrounded by a metallic sleeve 6, which serves for protecting the bushing against breakage or the like. The top of the bushing 5 is covered by a cap 7 having a downwardly projecting flange 8, which surrounds the upper margin of the bushing; an upwardly projecting flange 9 of the cap 7 surrounds a disk 10, which serves for introducing portions of the electrodes.

Both of the electrodes are well insulated against the material of the body 1. As in other spark plugs, one of the electrodes preferably is grounded and the other one is connected with a conductor supplying the electric current. The ungrounded electrode 12 is shown in Fig. 1 as a wire with an enlarged tapering end, the taper projecting through the body portion 1 of the plug and the upper cylindrical portion of the electrode projecting through the bushing 5, through the cap 7, and through the disk 10 inserted in the cap. In order to insulate this non-grounded electrode against the cap 7, a bushing 13 of insulating material is introduced into the cap 7 and disk 10, the head portion of the bushing resting in the disk, while the neck portion projects into the cap. That end of the ungrounded electrode 12 which projects from the disk 10 outwardly is provided with an external thread to receive a lock nut 14 and a clamping nut 15 with a knurled flange, whereby the conductor (not shown) may be detachably but firmly secured to this electrode.

In the present invention two grounded electrodes are provided, the lower portions 16 of which are constructed similar to the lower portion of the non-grounded electrode 12 described above. They consist of a tapering piece of metal insulated against but firmly inserted into the body of the plug in such manner that a withdrawal of this electrode can be effected only in downward direction (as seen in Figs. 1 and 3).

The explosions occurring in the combustion chamber (below the plug) therefore will have the tendency to force the electrodes

upwardly into the body 1 of the plug, and to press the electrodes against their seats in this part.

Two of these grounded electrodes being provided, it is obvious that if a layer of carbon or other sediment should be formed on one of these electrode portions 16, the spark will cease to jump over between the non-grounded electrode 12 and both of these grounded electrode portions 16, and the operation of the plug will be interrupted. At the same time, however, the current will pass through the plug without producing a spark at both the desired points in the combustion chamber while a stronger spark will be produced at the under portion of the plug as described below.

The lower or enlarged end of each electrode is provided with a bent wire or tip 17, as clearly shown in Figs. 1 and 3, the ends of these tips being sufficiently close to each other to permit the passage of a spark and to cause thereby the ignition of the combustible gases in the cylinder.

The protecting sleeve 6 surrounding the transpartnt bushing 5 is provided with an aperture, so as to form a window 18 through which the electrodes may be observed. The grounded electrodes, as may be seen from Figs. 1, 3, and 4, are not formed as one-piece electrodes, but are each formed of two members 16 and 20, which are separated from each other a distance sufficiently large to permit the current to pass from one of these pieces to the other piece in the form of a spark, bridging the gap. The upper one of these members for each of the grounded electrodes consists of a pointed screw in threaded engagement with a suitable opening in the cap 7 of the plug, the pointed or lower end being in close or direct opposition with a similarly pointed upper end 21 of the tapering lower portion 16 of the electrode.

It is obvious, therefore, that the passage of current through the spark plug may be observed through the window 18. When the operation of the plug is disturbed by formation of carbon, a stronger spark will pass from the upper portions 20 of the grounded electrodes to the lower portions 16 of the same. It is therefore not necessary to remove the plug from the cylinder and to place it in a special apparatus in order to test the same. It is also obvious that in a multiple cylinder engine the proper timing of the explosion may readily be noticed by observing the appearance and disappearance, and the intensity of the luminous spark in each of the spark plugs (pertaining to the various cylinders) through the observation windows 18 of the plugs.

Fig. 5 illustrates the circuit diagram wherein the double sparks are indicated at 23 and 24 respectively. The non-grounded conductor 25 leads to the electrode 12, from which a double spark 23 jumps to the electrodes 16, the other portions of which are connected in multiple. The test spark gap 24 may be observed through the window 18.

I claim:

1. In a spark plug, the combination of a body, a non-grounded electrode inserted in said body, an electrode portion inserted in said body, a grounded electrode portion in opposition to and alinement with said first named electrode portion, another electrode portion inserted in said body, a second grounded electrode portion in opposition to and alinement with said last named other electrode portion, a bushing, a cap mounted on said bushing, the grounded electrode portions being secured to said cap, a disk overlying said cap, and means in said disk for insulating the first named electrode against the cap and grounded electrode portions.

2. In a spark plug, the combination of a body, a non-grounded electrode inserted in said body, a cap secured to said body and spaced therefrom, two grounded electrode portions secured in said cap and extending from said cap parallel to each other to other grounded electrode portions in opposition to said first named electrode portions, the interspaces between grounded electrode portions secured to the cap and grounded electrode portions secured to the body being at equal distance from the cap, and a bushing provided with a window through which both of the interspaces between the grounded electrode portions are visible.

3. A spark-plug including a body, a non-grounded electrode embodied in the body, an electrode-portion also embodied in the body, a grounded electrode-portion associated with and in opposition to the first-named electrode-portion, another electrode portion embodied in the body, a second grounded electrode-portion associated with and in opposition to the last-named other electrode-portion, a cap-element associated with the upper ends of the electrodes and to which the grounded electrode-portions are connected, and means juxtaposed to the first-named electrode for insulating it against the grounded electrode-portions.

4. A spark-plug including a body, a non-grounded electrode embodied in the body, a cap arranged in spaced-apart relation to the body, a plurality of grounded electrode-portions extending into the cap, a corresponding number of electrode-portions associated with and in opposition to the plurality of electrode-portions, the interspaces between the grounded electrode-portions which extend into the cap and those embodied in the body being equi-distant from the cap, and a window-element associated with the body and cap and through which the interspaces are visible.

CHAS. LEO FITZ.