J. E. RICH.

SPARK PLUG.

APPLICATION FILED MAR. 5, 1919.

1,347,874.

Patented July 27, 1920.

Fig. 1.

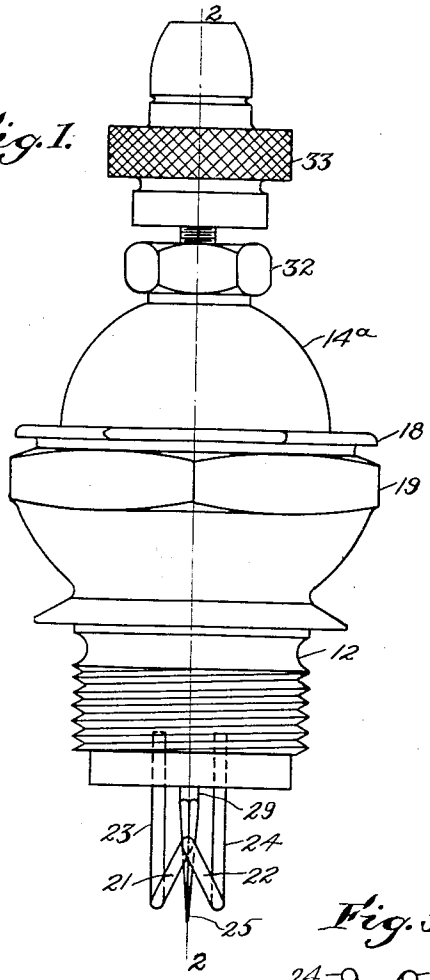


Fig. 2.

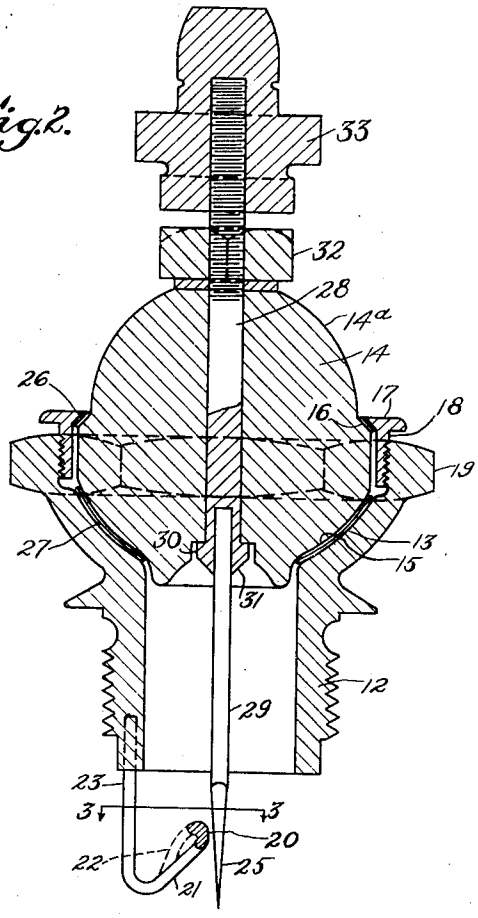


Fig. 5.

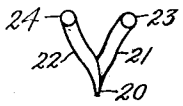
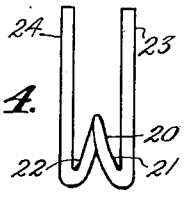


Fig. 4.



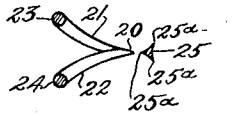


Fig 3

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SPARK-PLUG.

1,347,874. Specification of Letters Patent. Patented July 27, 1920.

Application filed March 5, 1919. Serial No. 280,772.

To all whom it may concern:

Be it known that I, JAMES E. RICH, a citizen of the United States, residing at Boston, in the county of Suffolk and State of Massachusetts, have invented new and useful Improvements in Spark-Plugs, of which the following is a specification.

This invention relates to a spark plug including a tubular nipple attachable to the wall of a combustion chamber, and provided at its inner end with a grounded electrode, an insulator secured to the nipple and projecting from the outer end thereof, and a conducting electrode adapted to be connected with a source of electricity, and extended through the insulator and separated from the grounded electrode by a spark gap, the insulator being confined between a seat within the nipple and a clamping device engaged with the outer end portion of the nipple.

The invention is embodied in certain improvements hereinafter described and claimed, looking to increased strength and durability of the insulator, a gas-tight construction of the spark plug, the maintenance of a spark gap of predetermined length without liability of accidental variation, and other desirable results.

Of the accompanying drawings forming a part of this specification,—

Figure 1 is a side elevation of a spark plug embodying the invention.

Fig. 2 is a section on line 2—2 of Fig. 1.

Fig. 3 is a section on line 3—3 of Fig. 2.

Fig. 4 is a side view of the grounded electrode separated from the nipple, looking toward the inner side of the electrode.

Fig. 5 is a top plan view of the electrode as shown by Fig. 4.

The same reference characters indicate the same parts in all of the figures.

In the drawings, 12 represents a tubular nipple adapted to be engaged with the wall of a combustion chamber, and to project through said wall, the nipple being preferably provided with an external screw-thread adapted to engage the tapped opening in a combustion chamber wall.

The outer end portion of the nipple is enlarged and provided with an internal outwardly facing annular seat 13.

14 represents an insulator, which is a body composed of any suitable hard and tough insulating material such as steatite. The inner end portion of the insulator is provided with an annular face 15 opposite and conforming to the seat 13. The outer end portion of the insulator projects from the outer end of the nipple, and preferably, has a dome-shaped external face 14^a, the purpose of which will hereinafter appear.

The insulator is provided between its inner and outer end portions with an outwardly facing shoulder 16 which is overhung by a flange 17 projecting inwardly from an annular nut 18, having a screw-thread engagement with the outer end portion of the nipple, the body of the nut as here shown, being externally threaded and engaged with an internal thread in the outer end portion of the nipple, said outer end portion being externally of hexagonal or other suitable form, to provide a wrench seat 19.

The dome-shape of the face 14^a of the insulator protects the projecting portion from liability to breakage, resulting, for example, from a blow accidentally delivered upon the projecting portion by a wrench employed in screwing the nipple into a combustion chamber wall, or in screwing the nut 18 into the nipple. Owing to the said dome-shape a wrench brought accidentally in contact with the projecting portion of the insulator will glance off without liability of breaking or cracking the insulator.

Fixed to the inner end of the nipple 12 is a grounded electrode, composed of a length of wire, which is bent to form a neck 20, arms 21 and 22 diverging from the neck, and legs 23 and 24 bent at an angle to the arms, and extending parallel to each other and inserted in holes drilled for their reception in the inner end of the nipple. The neck 20 constitutes the terminal portion of the grounded electrode, and is firmly supported at an exact predetermined distance from the terminal portion 25 of the conducting electrode 29 hereinafter described, the two terminal portions being separated by a spark gap. The legs 23 are substantially parallel with and equidistant from the axis of the conducting electrode, so that they may be bent simultaneously to move the neck 20 edgewise toward and from the conducting electrode and thus vary the length of the spark gap, the two legs and

the two arms coöperating in firmly supporting the neck or terminal portion of the grounded electrode in any position to which it may be adjusted. I prefer to arrange the neck 20 so that it is substantially or approximately parallel with the axis of the conducting electrode, as shown by Fig. 2, thus suitably elongating the terminal portion formed by said neck. I prefer also to reduce the outer portion of the neck to give it a salient angle, as best shown by Figs. 3 and 5, said angle facing the terminal 25 of the conducting electrode.

The terminal 25 is preferably triangular in cross section, so that it presents a plurality of salient acute angled edges 25ª, either of which may face the terminal portion of the grounded electrode.

The legs 23 are adapted, by their arrangement relatively to the conducting electrode terminal 25, to resist pressure tending to so bend them as to move the neck 20 sidewise relatively to the said terminal.

The internal seat 13 of the nipple is preferably concave, and forms a zone of a spherical internal surface. The face 15 of the insulator is preferably convex, and forms a zone of a spherical external surface. The shoulder 16 of the insulator and the inner face of the nut flange 17, are frusto-conical, each being inclined at an angle of about 45°, as shown by Fig. 2. I am enabled by the described form of seat 13, face 15, shoulder 16, and nut flange 17, to secure a uniform pressure between all parts of the opposed surfaces of the shoulder 16 and the nut flange 17, notwithstanding any inaccuracies in the form of the opposed surfaces. I am thereby enabled to provide a gas-tight joint between the shoulder 16 and the nut flange 17 by interposing an annular packing-ring 26 between said shoulder and flange. When the nut 18 is screwed down to clamp the insulator, the insulator face 15 is adapted to rock or tilt slightly, relative to the seat 13, in case the nut flange does not first come to an even bearing at all points. A concavo-convex compressible packing-ring 27 is preferably interposed between the seat 13 and insulator face 15, this being compressed by the action of the clamping nut, and aiding to maintain a gas-tight joint.

The conducting electrode is preferably composed of an outer section 28, extending through the insulator, and an inner section 29 on which the terminal 25 is formed, the inner section being composed of a highly refractory alloy, and the outer section of a relatively inexpensive conducting metal. The outer section 28 is provided with an enlargement 30 at its inner end, said enlargement containing a socket receiving an end portion of the section 29. The enlargement is provided with a tapered outer face 31, forming a thin edge surrounding the socket, and adapted to be compressed to confine the section 29 in the socket. The enlargement 30 forms a shoulder which bears on a seat formed on the inner end portion of the insulator. The outer end portion of the section 28 is screw-threaded and engaged by a confining nut 32 seated on the outer end of the insulator. The section 28 is extended above the nut 23 and provided with a binding nut 33 adapted to secure a conducting wire.

The grounded electrode, formed as shown, is enabled by the parallel legs 23 and 24 to be made of any length that may be desired, so that the neck portion 20 may be supported at any desired distance from the inner end of the nipple without being liable to be accidentally bent from its predetermined position. In some cases it is desirable to have the grounded electrode project well into the ignition chamber, while in other cases this projection is objectionable. The length of the legs may be suited to the requirements of the motor.

I claim:

1. A spark plug comprising a tubular nipple engageable with a combustion chamber wall, and having a grounded electrode composed of a length of wire bent to form a neck constituting the terminal portion of the electrode, arms diverging from the neck, and two substantially parallel legs arranged at an angle to said arms and inserted in the inner end of the nipple, an insulator secured in the nipple, and a conducting electrode extending through and secured to the insulator, and having a terminal portion separated from said neck by a spark gap, the said arms and legs firmly supporting the terminal portion formed by said neck, and the legs being substantially parallel with and equidistant from the conducting electrode, the said neck being substantially parallel with the axis of the conducting electrode, and its outer portion being reduced to form a salient angle, the apex of which faces the conducting electrode.

2. A spark plug substantially as specified by claim 1, the terminal portion of the conducting electrode being angular in cross section and presenting a salient edge to the said neck.

3. A spark plug comprising a tubular nipple adapted for engagement with a combustion chamber wall, and having a concave outwardly facing internal seat forming a zone of a spherical internal surface, an insulator having at its inner end a convex face conforming to said seat and forming a zone of a spherical external surface, said insulator having an annular outwardly facing frusto-conical shoulder between its inner and outer ends, an annular clamping nut engaged by screw-threads with the nip-

ple, and having a flange with a frusto-conical inner face conforming to and overhanging said shoulder, a conducting electrode extending through and secured to the insulator, and a grounded electrode attached to the inner end of the nipple, the convex face of the insulator being movable relative to the concave seat of the nipple to insure a uniform pressure at all parts of the opposed surfaces of the insulator shoulder, and the flange of the clamping-nut.

In testimony whereof I have affixed my signature.

JAMES E. RICH.