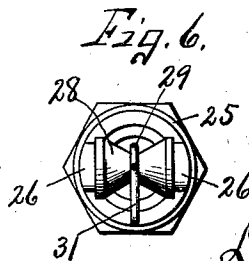
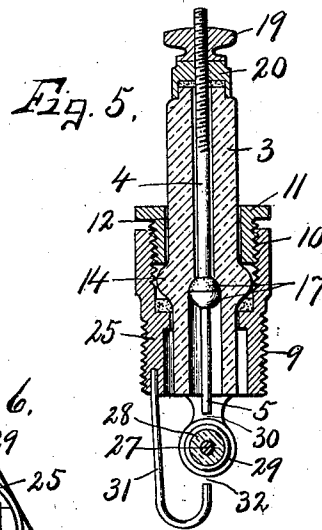
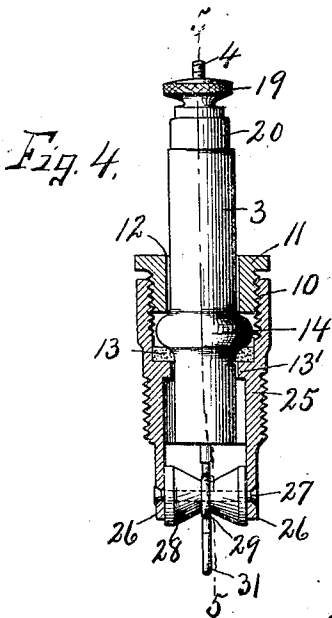
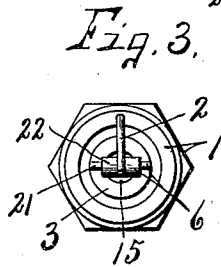
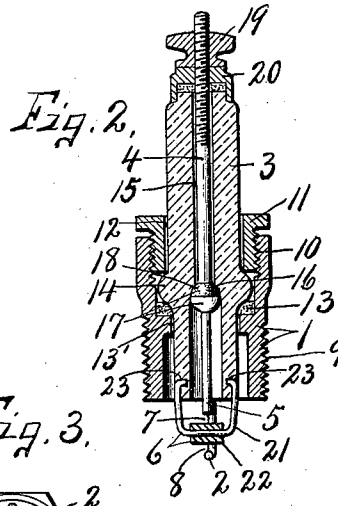
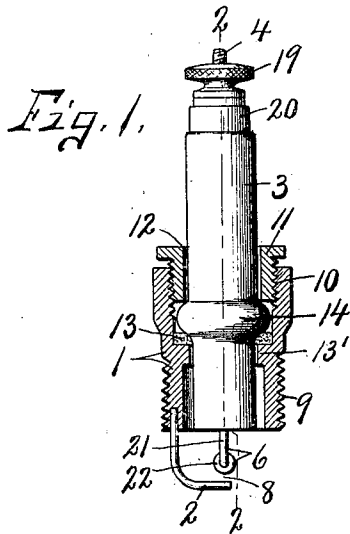


D. M. TUTTLE.
SPARK PLUG.
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968,612.

Patented Aug. 30, 1910.



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UNITED STATES PATENT OFFICE.

DANIEL M. TUTTLE, OF CANASTOTA, NEW YORK.

SPARK-PLUG.

968,612.

Specification of Letters Patent.

Patented Aug. 30, 1910.

Application filed December 6, 1907. Serial No. 405,450.

To all whom it may concern:

Be it known that I, DANIEL M. TUTTLE, of Canastota, in the county of Madison, in the State of New York, have invented new and useful Improvements in Spark-Plugs, of which the following, taken in connection with the accompanying drawings, is a full, clear, and exact description.

This invention relates to certain improvements in spark plugs for gas engines. These spark plugs are made as separate articles of manufacture and are screwed or otherwise secured to the cylinder so as to bring the spark terminals in the explosion chamber of the cylinder.

In the operation of gas engines, and particularly the liquid hydrocarbon type, it frequently happens that the explosive mixture which is introduced into the explosion chamber is improperly mixed and ununiformly distributed so that some parts of the mixture may be correctly proportioned while other parts will be too rich or contain an excess of air and furthermore it is customary in the spark plugs heretofore employed to use a single spark gap which, of course, is necessarily located at one fixed point in the explosion chamber and it not infrequently happens that the portion of the mixture which is in the immediate vicinity of the sparking terminals is too weak to be ignited by the spark thereby causing the engine to miss firing at regular cycles of operation. Furthermore where a single spark gap is employed the intensity of the spark particularly under a weak electric current may be insufficient to ignite the explosive mixture thus producing the same result of missing fire at regular cycles of operation.

The object of my invention is to overcome these difficulties by providing the spark plug with a plurality of spark gaps or arcs for the purpose of not only intensifying the spark at each break of the circuit but also to bring the arcs in different localities of the explosion chamber so as to increase the probability of ignition at each cycle of operation of the engine and thereby reduce the liability of misfiring.

Another object is to render the electrodes self-cleaning by allowing one of them to rotate relatively to the others.

Other objects and uses relating to the specific construction of the spark plug will be brought out in the following description. 55

In the drawings—Figure 1 is an elevation, partly in section, of one form of spark plug for carrying out the objects stated. Fig. 2 is a sectional view taken on line 2—2, Fig. 1. Fig. 3 is an inverted end view of the spark plug seen in Figs. 1 and 2. Fig. 4 is an elevation similar to Fig. 1 of a modified form of spark plug also adapted to carry out the same objects. Fig. 5 is a sectional view taken on line 5—5, Fig. 4. Fig. 6 is an inverted end view of the spark plug seen in Figs. 4 and 5. 60 65

The device shown in Figs. 1, 2 and 3 comprises essentially a tubular metallic sleeve —1— having a spark terminal or electrode —1— having a spark terminal or electrode 70 —2—, a tubular bushing —3— of insulating material passing through the sleeve —1—, an electric conductor —4— passing centrally through the bushing —3— and provided with a terminal or electrode —5— 75 and a conductor —6— interposed between the electrodes or terminals —2— and —5— forming intervening spark gaps —7— and —8—. The sleeve —1— is provided at one end with a male thread —9— and at its opposite end with a female thread —10—, the male thread —9— being adapted to be screwed into the cylinder of the engine, not shown, while the female thread —10— receives a threaded cap or follower —11— 85 having a central opening —12— there-through for the reception of the insulating bushing —3—, said sleeve —1— being also provided with an annular shoulder —13— substantially midway between its ends forming a seat for a suitable packing or buffer —13—. The insulating bushing —3— is preferably made of porcelain or equivalent material and is inserted into the sleeve —1—, it being provided with an annular 95 enlargement —14— for engagement with the packing —13— to limit the inward movement of the bushing relatively to the sleeve —1—, said enlargement being located between the ends of the sleeve and held against 100 outward movement by the follower —11—, the inner end of which is engaged with the annular enlargement —14—. This insulating bushing —3— serves to electrically

insulate the conductor —4— from the sleeve —1—, which latter is in electrical connection with the frame or cylinder of the engine and may be electrically connected in any well known manner to a source of electric energy not shown. The electrode —2— is secured to and in electrical connection with the sleeve —1— as best shown in Fig. 1 and extends some distance beyond and is insulated from the electrode —5—, both of which electrodes protrude some distance inwardly from the inner ends of the sleeve —1— and bushing —3— so that the intervening space between the electrodes —2— and —5— is wholly within the explosion chamber of the cylinder, not shown. This insulating bushing —3— is provided with a central lengthwise opening —15— extending therethrough from end to end, the inner end of said opening being enlarged forming an annular shoulder or abutment —16— having a corresponding annular enlargement —17— on the adjacent portion of the conductor —4—, said annular enlargement being provided with a yielding buffer or packing —18— lying next to the shoulder —16— to enable the conductor —4— to be secured in place without liability of breaking the insulator —3—. The conductor —4— consists, in this instance, of a metal rod or stem extending entirely through the opening —15— and beyond the opposite ends of the insulator —3—, the inner end forming the electrode —5— while the outer end is threaded to receive a clamping nut —19—, said nut coacting with a metallic cap —20— on the outer end of the insulating sleeve —3— to receive between them one of the wires of the electric sparking circuit. The conductor —6— consists of a U-shape electric conducting bar —21— and a rotary electric conducting sleeve or electrodes —22—, the U-shape bar —21— having the terminal ends of its arms offset toward each other and seated in sockets —23— in opposite sides of the inner ends of the insulating bushing —3— as best seen in Fig. 2 while the intermediate portion or base of said U-shape bar together with the rotary electrode —22— which is mounted thereon are interposed between the terminal ends of the conductors or electrodes —2— and —5— leaving sufficient intervening space to form the spark gaps —7— and —8— said sleeve being free to rotate by the action of the exploding gases and it is, therefore, self-cleaning. The conducting sleeve or electrode —22— and adjacent portion of the bar —21— are in line with the electrode —5— and serve as a conductor for the current arcing across the gaps —7— and —8— so as to produce in this instance two sparks one at the gap —7— and another at the gap —8—

in different parts of the explosion chamber although it is evident that the number of gaps may be multiplied and otherwise located if desired without departing from the spirit of this invention.

The spark plug shown in Figs. 4 to 6 inclusive is substantially like that shown in Figs. 1 to 3 inclusive except that I have shown a tubular metallic sleeve —25— as provided with pendent arms —26— in which is secured a cross pin or bearing —27— and upon this pin is mounted a rotary sleeve —28— of insulating material such as porcelain spaced apart some distance from the lower end of the insulating bushing —3—. The central portion of this insulating sleeve —28— is smaller than its ends and upon it is mounted an electric conducting ring or electrode —29—, adapted to rotate with or upon the insulator —28—. This conducting ring or electrode —29— is in line with and spaced apart a slight distance from the electrode —5— forming an intervening spark gap —30—. An additional spark terminal or electrode —31— is secured to and in electrical connection to the sleeve —25— and has its inner end terminating a short distance from the inner side of the conducting ring —29— forming an intervening spark gap —32— at the side of the ring —29— diametrically opposite the spark gap —30— thereby forming two spark gaps both of which are always available for producing a spark and igniting the explosive mixture at each break of the sparking circuit in the manner well known, the insulator sleeve —28— and ring —29— being free to rotate on the part —27— by the action of the exploding gases so as to make the electrodes self-cleaning. By introducing these two or a plurality of spark gaps in the manner described the electrical resistance is increased by reason of the double arc thereby increasing the intensity of the spark at both gaps and at the same time multiplying the sparks and locating them in different positions in the explosion chamber so as to insure a more perfect explosion at each cycle of operation of the engine.

What I claim is:

1. A spark plug comprising two spark terminals insulated from each other and held a fixed distance apart forming an intervening air gap, a support extending across the air gap and spaced apart from both terminals, and an electric conductor encircling said support in line with and rotatable relatively to the terminals.

2. A spark plug comprising spark terminals insulated from each other and spaced apart forming an intervening spark gap, a support extending across said gap apart

from both terminals, and a ring of electric conducting material rotatable around said support in line with the terminals but spaced apart therefrom.

5 3. A spark plug comprising two spark terminals insulated from each other and spaced apart forming an intervening spark gap, a rotary insulator extending across the spark gap, a support for the insulator, and

an electric conducting ring encircling the 10 insulator in line with but spaced apart from the terminals.

In witness whereof I have hereunto set my hand this 29th day of November 1907.

DANIEL M. TUTTLE

Witnesses:

H. P. DENISON,
M. M. NOTT.