

F. GERKEN.  
SPARK PLUG.  
APPLICATION FILED FEB. 16, 1917.

1,284,309.

Patented Nov. 12, 1918.

Fig. 1.

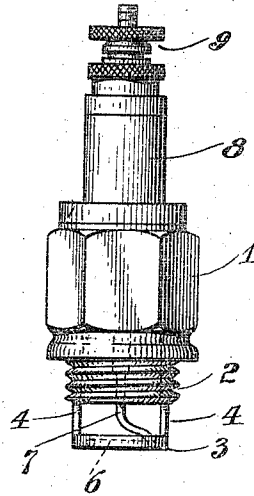


Fig. 2.

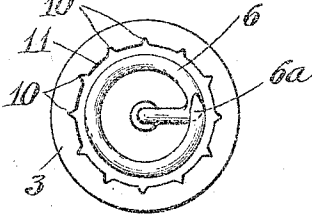


Fig. 3.

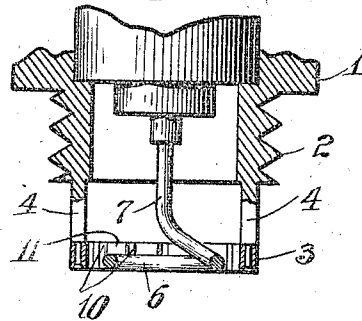


Fig. 4.

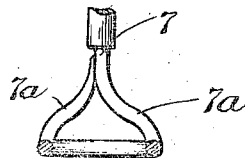
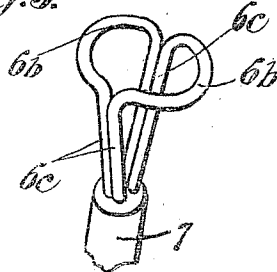


Fig. 5.



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# UNITED STATES PATENT OFFICE.

FREDERICK GERKEN, OF NEW YORK, N. Y.

## SPARK-PLUG.

1,284,309.

Specification of Letters Patent. Patented Nov. 12, 1918.

Application filed February 16, 1917. Serial No. 142,955.

*To all whom it may concern:*

Be it known that I, FREDERICK GERKEN, a citizen of the United States of America, and a resident of New York, county of New York, and State of New York, have invented certain new and useful Improvements in Spark-Plugs, of which the following is a specification.

My invention relates to improvements in so-called "spark-plugs", that is to say, sparking devices employed for igniting the charges of internal combustion engines, and also employed, sometimes, in other connections.

My invention consists in a novel construction of the electrodes or sparking terminals of such plugs, whereby a very high efficiency of operation is obtained, and whereby detrimental collection of carbon deposits and the like on the terminals of the plug is avoided.

The object of my invention is to improve the efficiency of spark plugs of the type described, and to avoid the troubles heretofore experienced with spark plugs.

I will now proceed to describe my invention with reference to the accompanying drawings, and will then point out the novel features in claims. In said drawings:

Figure 1 shows a side elevation of my improved spark plug;

Fig. 2 shows an end view thereof, on a larger scale than Fig. 1;

Fig. 3 a detail elevation and partial vertical section of the lower portion of the spark plug;

Fig. 4 shows an elevation and partial section of an alternative form of central electrode; and

Fig. 5 is a perspective inverted elevation of a still further alternative form of central electrode.

In the drawings, 1 designates the outer shell of the spark plug, provided, as usual, with a threaded lower portion 2 adapted to be screwed into the usual spark-plug port of an engine. The lower portion of the shell 1 is recessed, as indicated in Figs. 1 and 3, and as is common in many spark plugs of the present day.

3 designates one of the sparking terminals or electrodes of the plug; said terminal 3 being a ring or annulus connected to the portion 2 of the plug by struts or "ligaments" 4, there being, therefore, wide spaces 5 be-

tween the ring 3 and the lower portion 2 of the shell.

6 designates the other sparking terminal or electrode of the plug, having the form of an open-center ring, formed by bending the wire 7 forming the central conductor of the plug into a ring; the extreme end 6<sup>a</sup> of this wire may be brazed or soldered or otherwise secured to the initial portion of the ring, or may be left loose, as desired. If left loose it is obvious that the diameter of the ring 6 may be varied slightly by increasing or decreasing the extent of the over-lap, so varying the spark gap. It will be understood that the ring 6 is spaced, as nearly as may be uniformly away from the ring 3, and that it is supported by the central conductor or post 7.

It is to be understood that this post 7 is insulated in the usual manner from the shell 1, 8 (Fig. 1) designating a portion of the insulating material; and that this post 7 is provided at its upper end with means, such as a screw nut 9, whereby one conductor of an electric circuit may be connected to said post 7. I do not illustrate in detail the structure whereby the post 7 is insulated from the shell 1, as such construction forms no portion of the present invention, and ordinary means for effecting such insulation may be employed.

The spark plug thus formed constitutes an improvement upon the spark plug of my application for Letters Patent filed January 15, 1917, Serial No. 142,335. In that application I have illustrated and described a spark plug similar to that shown herein, except that the central electrode is a disk, which in some cases is perforate and in other cases is imperforate; it being stated in that application that the perforate electrode is employed, preferably, if the engine in which the spark plug is used be one in which high compression and high temperatures are experienced, also if the engine be one in which battery ignition is used (battery ignition tending to produce high temperatures). I have found that the plug herein illustrated and described, and in which the central electrode is an open center wire ring, is desirable if the engine in which the plug is to be used be one having a very high compression pressure or be one in which very high temperatures obtain.

As in the plug of my said prior application, the inner surface of the electrode 3 is of scalloped form; that is to say, grooves or notches 10, with intervening blunt projections 11, are provided.

In the construction shown in Figs. 1, 2 and 3, the ring 6 is supported on one side only. If desired, and as shown in Fig. 4, a support may be provided for the other side of the ring by brazing on to member 7 and ring 6, a second support 7<sup>a</sup>.

Or, if desired, the central electrode of the plug may consist of two semi-circular loops 6<sup>b</sup> (Fig. 5) joined by the wires 6<sup>c</sup> to the central conductor or post 7.

In all of these various constructions, the same essential feature of construction is embodied, viz:—an outer ring-shaped electrode, and an inner open-center ring shaped electrode, the latter formed to present a minimum of heat-absorbing surface.

In the operation of this spark plug, the point at which sparking occurs varies greatly and changes continually; so much so that there appears to be a stream of sparks passing from the one electrode to the other, all around the plug; thereby giving a wide distribution of spark, such as greatly facilitates quick ignition and rapid flame propagation through the charge in the engine cylinder. Moreover, experience has shown that the same engine, fitted with this spark plug, tends to develop materially more power than when fitted with an ordinary spark plug the terminals of which are two or more sparking points of ordinary construction. It has been found impossible in practice to foul the spark terminals of this plug with carbon deposits, formed in the operation of the engine; carbon simply does not deposit, or, at least, does not remain deposited on the sparking terminals 3 and 6 to such an extent as to cause fouling, or to interfere with the operation of the engine. It appears that the grooves 10 in the inner surface of the outer sparking terminal, and very likely the openings 12 in the central electrode, have much to do with the prevention of formation of material carbon deposits on these terminals. It appears that the portion of the charge which, during the compression stroke, collects in the chamber within the portion 2 of the plug, and then, upon ignition, blows out past the sparking terminals 3 and 6, passes as jets through the notches 10, clearing the sparking terminals of the plug; and that the jets passing through these notches 10 have greater clearing efficiency than would be possessed by the thinner annular jet of such gases which alone would exist at such time between terminals 3 and 6, if the notches 10 were not present.

Furthermore, it has been found that engines fitted with spark plugs such as shown herein, start more readily and more quickly, under conditions which normally cause difficult starting, than when the ordinary pointed spark plugs are used. So true is this, that it has been found that engines fitted with this spark plug will run very satisfactorily on kerosene, and without producing smoke, such engines being merely started on gasoline and then immediately switched over to the use of kerosene, and this without any heating up run on gasoline.

It seems to be important that the inner electrode 6 shall be within the outer electrode 3, and not outside thereof, as has been the case in some prior spark plugs. Also, it seems to be important that the outer electrode shall not be a tube continuous with the portion 2 of the spark plug; the separation of the terminal 3 from the tubular portion 2 of the spark plug (except for the connecting ligaments 4) so that openings 5 are existent between portions 2 and 3 of the plug, seems to be essential.

It has also been found that, when using this spark plug, a leaner mixture may be used in the engine than when ordinary spark plugs are used. This results in great economy in the use of fuel.

This spark plug is an improvement upon the plug of the patent to Walter No. 812,622, and embodies improvements over that Walter plug which have been found to be important in practice and to give greatly improved results.

What I claim is:—

1. In a spark plug, the combination with an outer ring-shaped terminal, of an inner ring-shaped terminal spaced approximately uniformly from the inner surface of said outer terminal and having an open center; and supports for said terminals.

2. In a spark plug, the combination with an outer ring-shaped terminal, of an inner ring-shaped terminal spaced approximately uniformly from the inner surface of said outer terminal and having an open center; and supports for said terminals, said inner terminal formed of wire bent to form a ring.

3. In a spark plug, the combination with an outer ring-shaped terminal, of an inner ring-shaped terminal spaced approximately uniformly from the inner surface of said outer terminal and having an open center; and supports for said terminals, the outer terminal having an interior scalloped surface.

4. In a spark plug, the combination with an outer ring-shaped terminal, of an inner ring-shaped terminal spaced approximately uniformly from the inner surface of said

outer terminal and having an open center; specification in the presence of two subscri-  
and supports for said terminals, the outer ing witnesses.  
terminal having an interior surface com- FREDERICK GERKEN.  
prising a plurality of blunt projections sepa-  
5 rated by grooves.

Witnesses:

H. M. MARBLE,  
PAUL H. FRANKE.

In testimony whereof I have signed this