Feb. 18, 1947. E. K. VON MERTENS 2,415,979

COMBINED SPARK PLUG AND OSCILLATORY CIRCUIT

Filed April 24, 1945

Fig. 1.

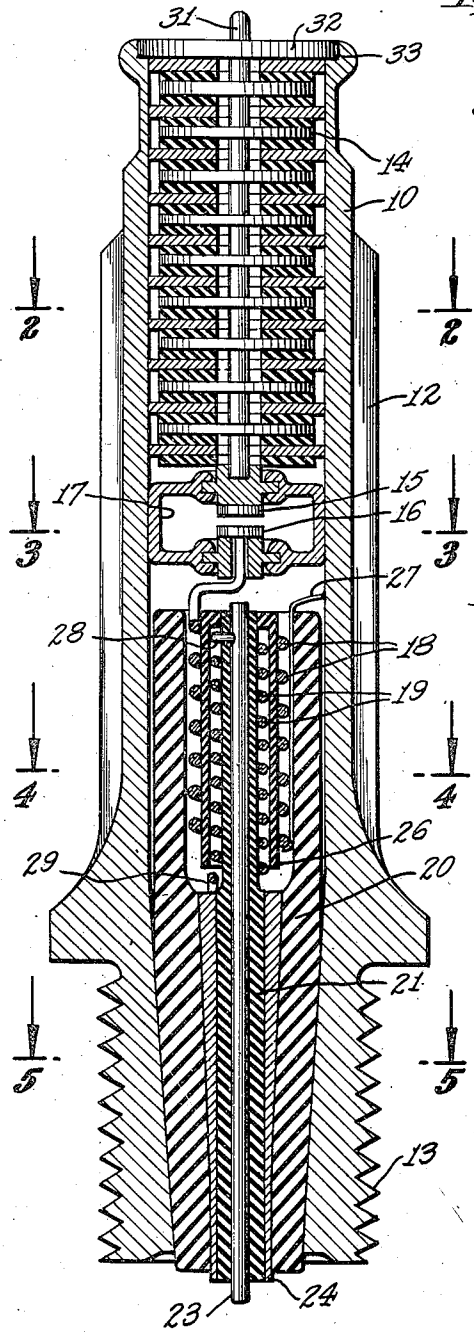


Fig. 2.

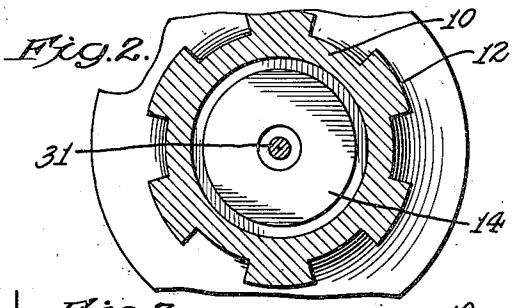


Fig. 3.

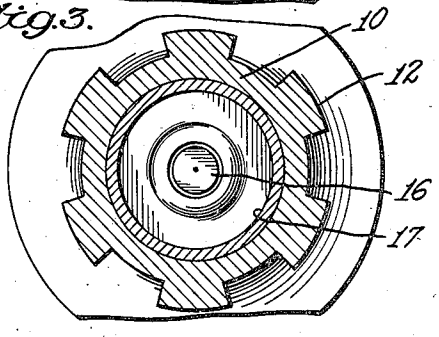


Fig. 4.

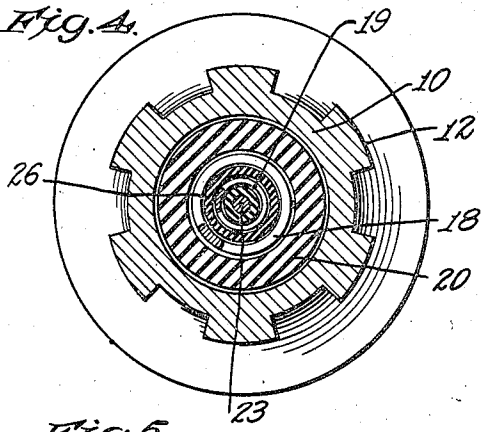
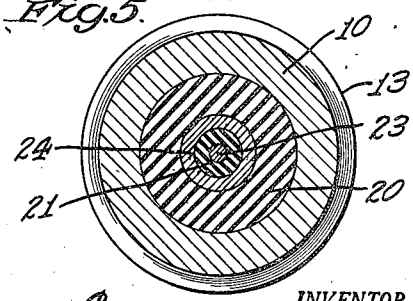


Fig. 5.



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COMBINED SPARK PLUG AND OSCILLATORY CIRCUIT

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2 Claims. (Cl. 315—35)

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This invention relates to spark plugs for high frequency ignition systems of internal combustion engines and it has for its object to improve the construction and operating characteristics of such devices.

Another object of the invention is to provide a novel and improved spark plug having all the elements of a high frequency oscillatory circuit.

Another object is to simplify the construction and increase the operating efficiency of a spark plug of the above type so that it may be made of smaller and lighter parts than heretofore and will enable a complete high frequency circuit to be contained within a plug of approximately the same size as the conventional spark plugs now in use.

Various other objects and advantages will be apparent as the nature of the invention is more fully disclosed.

The spark plug of the present invention contains all the elements of a high frequency oscillatory circuit, viz. a discharge condenser, a sealed spark gap and a high frequency induction coil, arranged in a small compact unit.

According to a feature of the invention, the secondary winding of the high frequency induction coil is ungrounded or is left "electrically floating." According to another feature, the electrodes of the plug are arranged coaxially in such a manner that the sparking end of the electrodes coincides with an electrical reflection point of the oscillatory circuit. These structural features, and others hereinafter described, increase the efficiency of the system and enable the plug to be made of smaller and lighter parts, with the result that a complete high frequency oscillatory circuit can be housed within a spark plug which is no larger than a plug of conventional design.

Although the novel features which are characteristic of this invention are set forth more in detail in the claims appended hereto, the nature and scope of the invention may be better understood by referring to the following description, taken in connection with the accompanying drawing forming a part thereof, in which a specific embodiment has been set forth for purposes of illustration.

In the drawing:

Figure 1 is a longitudinal sectional view through a spark plug embodying the invention;

Fig. 2 is a transverse sectional view through the condenser, taken on line 2—2 of Fig. 1;

Fig. 3 is a similar view through the sealed spark gap, taken on line 3—3 of Fig. 1;

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Fig. 4 is a transverse sectional view, taken on line 4—4 of Fig. 1, through the primary and secondary windings of the high frequency induction coil; and

Fig. 5 is a similar view taken on line 5—5 of Fig. 1, through the coaxial electrodes of the spark plug.

In the following description certain specific terms are used for convenience in referring to the various details of the invention. These terms, however, are to be interpreted as broadly as the state of the art will permit.

The spark plug shown in the drawing comprises an outer shell or jacket 10 of aluminum or other suitable conducting material having a spline-type wrench grip 12 and a threaded end 13 of standard design.

Mounted in axial alignment within the shell 10 are all the elements of a high frequency oscillatory circuit, consisting of a discharge condenser 14 having its alternate plates grounded to the shell 10, a sealed spark gap comprising terminals 15 and 16 sealed in an insulating housing 17, and a high frequency induction coil comprising a primary winding 18 and a secondary winding 19, insulated from each other by insulating sleeve 26.

Within the shell 10 of the spark plug is a tapered hollow sleeve 20 of ceramic or other insulating material; and mounted axially within said sleeve 20 is a tube 21 of similar insulating material through the center of which extends the central electrode 23 of the spark plug, and upon the outer cylindrical surface of which is mounted the outer tubular tapered electrode 24 of the spark plug. The coaxial electrodes 23 and 24 may be made of any suitable material such as a platinum-tungsten alloy and they are preferably fired into union with the ceramic tube 21 which is then seated within the insulating sleeve 20 by a taper as shown in Fig. 1.

Attached to the inner end of the ceramic tube 21 is a concentric cylindrical portion 26 upon the outer surface of which is wound the primary winding 18 of the high frequency induction coil, while between said cylindrical portion 26 and tube 21 is wound the secondary winding 19 of said coil.

One end of the primary winding 18 of the induction coil is connected to the terminal 16 of the spark gap, while the other end of said primary winding is grounded through conductor 27 to the outer shell 10 of the spark plug.

One end of the secondary winding 19 of the induction coil is connected at 28 to the central

electrode 23 of the spark plug, while the other end of said secondary winding is connected at 29 to the outer tubular electrode 24 of the spark plug. Thus the secondary winding of the induction coil is left "electrically floating." Due to the foregoing construction, furthermore, it will be noted that the arrangement of the electrodes is coaxial and that the sparking end of the electrodes 23 and 24 therefore coincides with an electrical reflection point of the oscillatory circuit.

The terminal wire 31 of the discharge condenser 14, which is connected to the alternate ungrounded condenser plates and to the terminal 15 of the sealed spark gap, extends through a capping disk 32 which seats in a circular ledge 33 in the upper end of the outer shell 10 of the spark plug, and seals the assembly airtight as shown in Fig. 1.

Although a specific embodiment has been shown and described herein for purposes of illustration, it will be evident to those skilled in the art that the invention is capable of various modifications and adaptations within the scope of the appended claims.

What is claimed is:

1. A spark plug for high frequency ignition systems comprising an outer shell of conducting material, a high frequency oscillatory circuit including a discharge condenser, a sealed spark gap and a high frequency induction coil all housed in said shell, a pair of coaxial sparking electrodes including a central electrode and an outer tubular electrode mounted in said shell and being uniformly spaced from one another throughout their lengths, said condenser having a terminal conductor connected to one terminal of said spark gap, said induction coil including a primary winding having one end connected to the second terminal of said spark gap and the other end grounded to said shell, and a secondary winding having one end connected to said central sparking electrode and the other end connected to said outer tubular electrode.

2. A spark plug for high frequency ignition systems comprising an outer shell of conducting material, a high frequency oscillatory circuit including a discharge condenser, a sealed spark gap and a high frequency induction coil all mounted in axial alignment within said shell, a pair of substantially equally spaced coaxial sparking electrodes including a central electrode and an outer tubular electrode mounted in said shell in axial alignment with the aforesaid elements of the oscillatory circuit and being uniformly spaced from one another throughout their lengths, said condenser including a plurality of spaced condenser plates grounded to said shell and a terminal conductor connecting a plurality of alternate ungrounded plates to one terminal of said spark gap, said induction coil including a primary winding having one end connected to the second terminal of said spark gap and the other end grounded to said shell, and an ungrounded secondary winding having one end connected to said central sparking electrode and the other end connected to said outer tubular electrode.

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