April 19, 1949. J. T. OSTERMAN 2,467,534

IGNITION UNIT

Filed Nov. 9, 1946 2 Sheets-Sheet 1

Fig. 1.

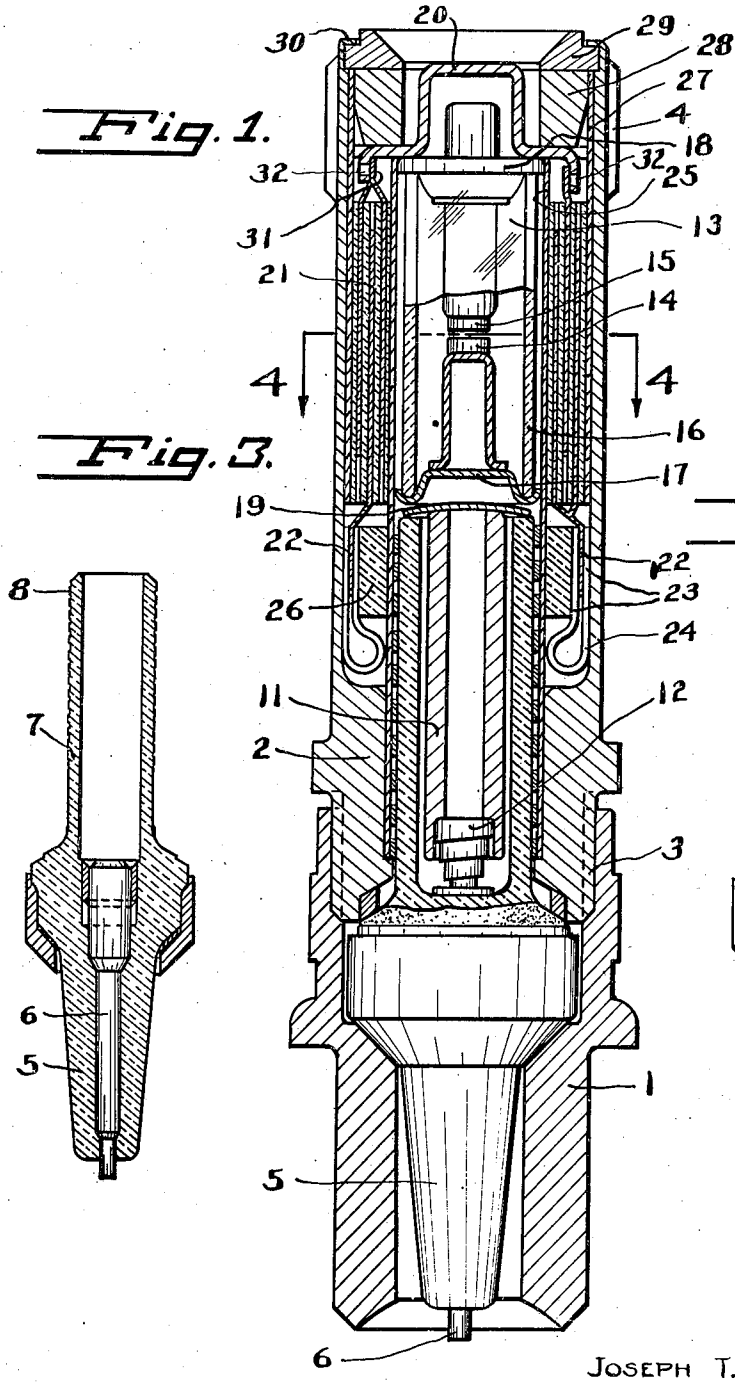
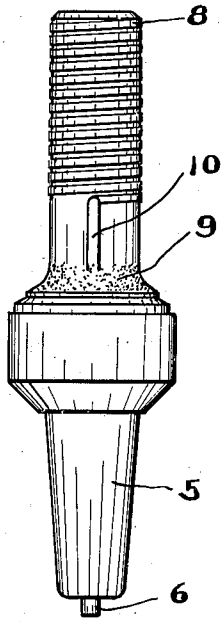


Fig. 3.

Fig. 2.



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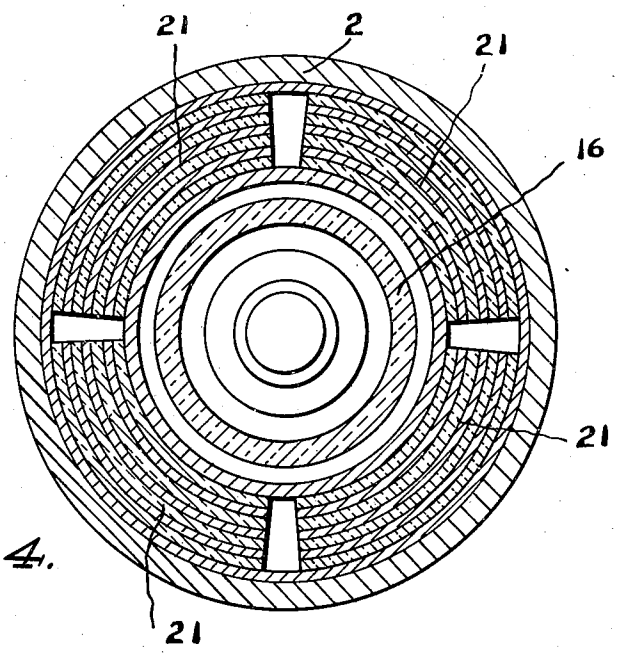
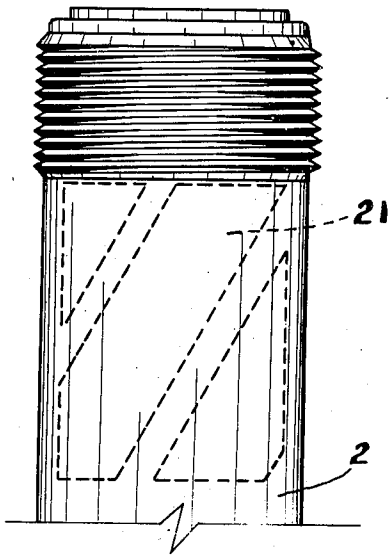


Fig. 4.

Fig. 5.



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IGNITION UNIT

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8 Claims. (Cl. 315—57)

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This invention relates to ignition systems for internal combustion engines and the like and has particular reference to a new and improved unitary spark plug and converter for high frequency ignition systems of the type described in Patent 1,376,846 to Whisler and wherein a magneto or battery energized induction coil charges a condenser which then discharges rapidly through a spark gap and through the primary winding of a transformer. A surge of current is thereby produced in the primary winding causing a rapid change in the magnetic flux linking the secondary winding of the transformer and producing a sufficiently high voltage from the secondary winding to result in a spark across the combustion gap of the spark plug.

An object of the present invention is to provide a new and improved unitary spark plug, spark gap and transformer unit for use in high frequency ignition systems, which unit is of relatively small dimensions yet highly efficient in operation and capable of producing satisfactory operation over a relatively long period.

Another object of the invention is to provide such a unit that is capable of withstanding a relatively wide range of temperature changes and the high degree of vibration encountered by such as aviation and truck engines.

Another object of the invention is to provide a new and improved unit of the type set forth which is relatively simple and economical in construction yet highly efficient in operation.

Other objects and advantages of the invention will be apparent from the following description taken in connection with the accompanying drawings. It will be understood that many changes may be made in the details of construction and arrangement of parts without departing from the spirit of the invention as expressed in the accompanying claims. I, therefore, do not wish to be limited to the exact details of construction and arrangement of parts shown and described, as the preferred forms have been given by way of illustration only.

Referring to the drawings:

Fig. 1 is a sectional view of a unit embodying the invention;

Fig. 2 is a side view of the spark plug electrode and transformer primary member;

Fig. 3 is a sectional view through the member shown in Fig. 2;

Fig. 4 is a sectional view taken on line 4—4 of Fig. 1 looking in the direction of the arrows; and

Fig. 5 is a fragmentary side view of a modified form of the invention.

Referring more particularly to the drawings, wherein similar reference characters designate corresponding parts throughout the several views, the device shown embodying the invention comprises a spark plug housing member 1 having an elongated tubular metal casing 2 secured thereto by the threaded connection or the like 3. The housing 1 is provided with the usual threaded portion for securing the spark plug in position on the cylinder or other combustion chamber of an engine and the casing 3 has the threaded portion 4 adapted to be secured to a shielded lead of the ignition system.

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Within the housing 1 and casing 2 is positioned the insulator member 5 of porcelain or other suitable material having a bore adapted to contain the spark plug electrode 6 and also being provided with the integral tubular extension 7 on which is formed the primary winding 8 of the transformer and the grounding terminal 9 for the primary which are electrically connected by the lead 10 which is formed in a manner similar to the winding 8 and terminal 9. The primary winding 8, grounding terminal 9 and connector 10 are formed on the outer surface of the member 5 by first metallizing these portions over the areas to be conducted and then plating over said metallized areas with a conducting material to desired thickness to form the desired conducting areas on the surface of the member 5.

The secondary member 11 comprises a tubular insulating member having terminals formed adjacent its opposite ends by depositing conducting material thereon and having said terminals connected by the secondary winding as described in application of Lamphere and Osterman, Serial Number 603,170, filed July 4, 1945. The lower end of the secondary member 11 has a countersunk portion which is also metallized to form the terminal of the secondary and which terminal is adapted to contact the helical flat spring 12 which has one end engaging the upper end of the spark plug electrode 6 and its opposite end in engagement with the secondary terminal for conducting current from said secondary to said spark plug electrode.

The spark gap 13 has the electrodes 14 and 15 positioned within a chamber formed by the tubular glass wall 16 and the opposite end plates 17 and 18 which are secured to said wall 16 adjacent the opposite ends thereof to position said electrodes 14 and 15 within said spark gap.

The end plates 17 and 18 support the electrodes 14 and 15 as previously described and also serve as terminals for the spark gap, the terminal 17 engaging the spring connector 19 which overlies the conducting ends of the primary 8 and secondary 11 thereby connecting said primary and secondary together with the terminal 17 on the spark gap. The terminal 18 on the spark gap 13 engages the terminal 20 on the spark plug which is adapted to receive current through a lead from the engine ignition system.

Surrounding the spark gap 13 are located the

condenser sections 21 of which four are shown but which could be a single condenser if desired. These condenser units are formed of alternate layers of diametric material such as glass and conducting material such as foil and are preferably curved to conform with the circular shape of the inner wall of the spark plug barrel or casing 2 to thereby allow the obtaining of increased capacitance with a smaller dimensioned barrel. These condenser sections 21 are of the type shown in Patent Number 1,376,846 except that they are bent to conform to the wall of the spark plug barrel as previously described.

The condenser sections 21 each have terminals 22 adapted to be retained between the ears 23 of the spring clips 24, one of which is provided for each condenser section and which are retained in engagement with the inner wall of the casing or barrel 3 to ground said condensers to said barrel or casing 3.

Surrounding the spark gap 13 and primary winding 8 is the insulating tube 25 adapted to insulate the ground portion of the condenser from the primary. The ceramic ring 26 is provided between said tube 25 and ears 23 of the clips 24 to retain said clips in engagement with the wall of the casing and also with said terminals 22 on the condenser.

The upper terminals 31 on each of the condenser units 21 are secured to the depressed ears on the terminal member 20 as shown, by solder placed in the openings 32 in said ears. Said condensers 21 are adapted to receive current through the terminal 20 from the usual current source for charging the condensers as hereinafter described.

The insulating tube 27 is positioned between the condenser and inner wall of the casing 2 to insulate the condenser from said wall.

The ceramic spacer 28 surrounds the terminal portion of the terminal 20 engaging the peripheral edges of said terminal to retain said terminal in position and the steel retaining washer 29 overlies said spacer 28 and the upper ends 30 of the casing or barrel 2 are flanged or turned to permanently retain the parts in operative relation.

In the modified form of the invention shown in Fig. 5, the condenser sections 21 are helically positioned within the barrel 2 and shaped to conform with the circular shape of the inner wall of the spark plug barrel 2 to thereby make possible a longer bending radius for the condenser sections within the barrel 2. In all other respects the construction of this modified form of the invention is similar to the preferred form previously described.

In operation the condensers 21 are charged by current from the ignition system reaching said condensers through the terminal 20 and said condensers then discharge through the spark gap 13 to the primary 8 and secondary 11 which are inductively coupled, and the secondary 11 is electrically connected to the electrode 6 of the spark plug to thereby provide high frequency current to the spark plug in the usual manner.

From the foregoing it will be seen that I have provided simple, efficient and economical means for obtaining all of the objects and advantages of the invention.

Having described my invention, I claim:

1. In a unitary spark plug and high frequency converter unit, a housing, an insulator in said housing, said insulator supporting the spark plug electrode and having a hollow portion there beyond, a transformer primary winding on said hollow portion of said insulator, a transformer secondary within said hollow portion, a spark gap in aligned relation with said primary and secondary and connected therewith, a condenser adapted to discharge through said spark gap, and a resilient member between said secondary and said spark plug electrode, said resilient member being adapted to load said secondary against said spark gap and electrically connect said secondary and said spark plug electrode, spring terminal clip means for grounding said condenser to said housing, and a spacer ring of insulating material surrounding said hollow portion of said insulator and adapted to compress said clip against said housing.

2. In a unitary spark plug and high frequency converter unit, a housing, an insulator in said housing, said insulator supporting the spark plug electrode and having a hollow portion there beyond, a transformer primary winding on said hollow portion of said insulator, a transformer secondary within said hollow portion, a spark gap in aligned relation with said primary and secondary and connected therewith, a condenser adapted to discharge through said spark gap, and a helical spring member between said secondary and said spark plug electrode, said resilient member being adapted to load said secondary against said spark gap and electrically connect said secondary and said spark plug electrode, said condenser comprising alternate layers of glass and a conducting material embedded in said glass and being shaped to conform with the shape of the inner wall of the spark plug housing.

3. In a unitary spark plug and high frequency converter unit, a housing, an insulator in said housing, said insulator supporting the spark plug electrode and having a hollow portion there beyond, a transformer primary winding on said hollow portion of said insulator, a transformer secondary within said hollow portion, a spark gap in aligned relation with said primary and secondary and connected therewith, a condenser adapted to discharge through said spark gap, and a resilient member between said secondary and said spark plug electrode, said resilient member being adapted to load said secondary against said spark gap and electrically connect said secondary and said spark plug electrode, said condenser comprising alternate layers of glass and a conducting material embedded in said glass and being shaped to conform with the shape of the inner wall of the spark plug housing, spring terminal clip means for grounding said condenser to said housing and means for retaining said clip in engagement with said wall.

4. In a unitary spark plug and high frequency converter unit, a housing, an insulator in said housing, said insulator supporting the spark plug electrode and having a hollow portion there beyond, a transformer primary winding on said hollow portion of said insulator, a transformer secondary within said hollow portion, a spark gap in aligned relation with said primary and secondary and connected therewith, a condenser adapted to discharge through said spark gap, and a resilient member, said resilient member being adapted to load said secondary against said spark gap and electrically connect said secondary and said spark plug electrode, said condenser comprising alternate layers of glass and a conducting material embedded in said glass, said condenser comprising a plurality of sections helically disposed within said housing and bent to conform

with the circular shape of the inner wall of the spark plug housing.

5. In a unitary spark plug and high frequency converter unit, a housing, an insulator in said housing, said insulator supporting the spark plug electrode and having a hollow portion there beyond, a transformer primary winding on said hollow portion of said insulator, a transformer secondary within said hollow portion, a spark gap in aligned relation with said primary and secondary and connected therewith, a condenser adapted to discharge through said spark gap, and a resilient member, said resilient member being adapted to load said secondary against said spark gap and electrically connect said secondary and said spark plug electrode, said condenser comprising alternate layers of glass and a conducting material embedded in said glass, said condenser comprising a plurality of sections helically disposed within said housing and surrounding said spark gap and bent to conform with the circular shape of the inner wall of the spark plug housing.

6. In a device of the character described, a housing, a transformer primary member, a condenser, a transformer secondary member and a spark gap in said housing, said condenser being electrically connected to one side of said spark gap, said transformer primary member and said transformer secondary member being electrically connected to the side of said spark gap opposite the connection of said condenser to said gap, said condenser comprising alternate layers of glass and a conducting material embedded in said glass and said condenser being arranged in a plane substantially parallel to the axis of said housing.

7. In a device of the character described, a housing, a transformer primary member, a condenser, a transformer secondary member and a spark gap in said housing, said condenser being

electrically connected to one side of said spark gap, said transformer primary member and said transformer secondary member being electrically connected to the side of said spark gap opposite the connection of said condenser to said gap, said condenser comprising alternate layers of glass and a conducting material embedded in said glass and said condenser being arranged in a plane substantially parallel to the axis of said housing and said condenser being shaped to conform with the shape of the inner wall of the housing.

8. In a device of the character described, a housing, a transformer primary member, a condenser, a transformer secondary member and a spark gap in said housing, said condenser being electrically connected to one side of said spark gap, said transformer primary member and said transformer secondary member being electrically connected to the side of said spark gap opposite the connection of said condenser to said gap, said condenser comprising alternate layers of glass and a conducting material embedded in said glass and said condenser being arranged in a plane substantially parallel to the axis of said housing and comprising a plurality of sections helically disposed within said housing.

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