April 19, 1949. R. W. LAMPHERE ET AL 2,467,531

IGNITION SYSTEM AND SPARK PLUG

Filed July 4, 1945

Fig. 1

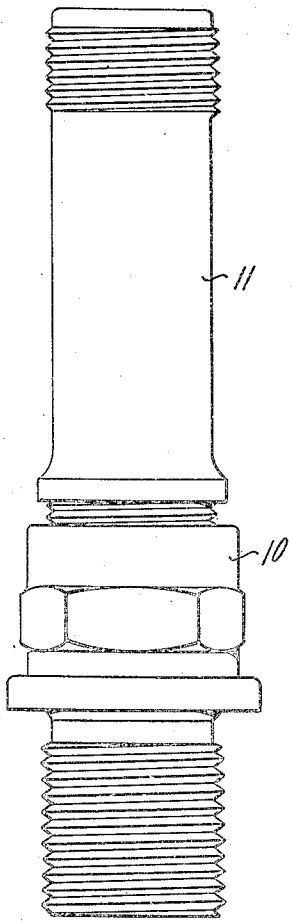


Fig. 2

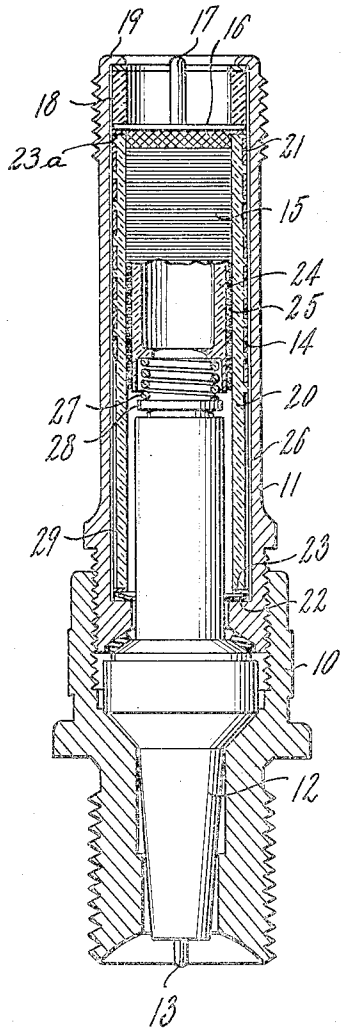
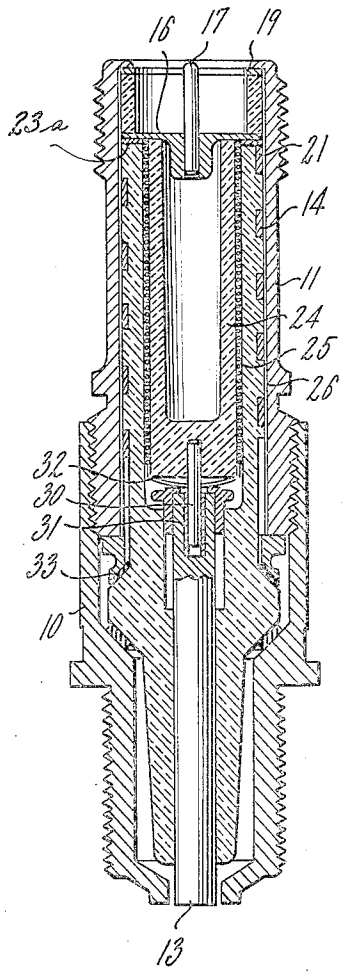


Fig. 3



INVENTORS
RICHARD W. LAMPHERE
JOSEPH T. OSTERMAN

BY
Raymond A. Laguerin
ATTORNEY

Patented Apr. 19, 1949

2,467,531

UNITED STATES PATENT OFFICE

2,467,531

IGNITION SYSTEM AND SPARK PLUG

Richard W. Lamphere, Wilbraham, and Joseph T. Osterman, Northampton, Mass., assignors to American Bosch Corporation, Springfield, Mass., a corporation of New York

Application July 4, 1945, Serial No. 603,170

4 Claims. (Cl. 315—57)

1

This invention relates to electric ignition systems and more particularly to a spark plug and transformer unit for use in an electric ignition system of the capacity discharge type for internal combustion engines and in which a magneto or battery-energized induction coil charges a condenser or condensers which then discharge rapidly through a spark gap or spark gaps and through the primary winding of the spark plug 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 that secondary winding to result in a spark across the combustion gap of the spark plug. Such capacity discharge ignition systems are now being proposed and used for aircraft engines in place of prior magneto and battery systems because the capacity discharge systems are inherently better for firing fouled spark plugs on account of the greatly increased time rate of voltage rise across the electrodes on account of the reduced energy in the sparks occurring there.

An object of the invention is to provide a new and improved spark plug and transformer unit for capacity discharge ignition systems, which unit is relatively compact in size, simple in construction yet efficient in operation.

Another object of the invention is to provide such a spark plug and transformer unit wherein the transformer unit is enclosed within a radio-shielded spark plug and which embodies an improved electrical and a simplified mechanical design.

Another object of the invention is to provide a new and improved spark plug and transformer unit which is adapted for use at high altitudes without electrical flashover.

Another object of the invention is to provide a new and improved spark plug and transformer unit which embodies a solderless transformer primary.

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 appended claims. We, therefore, do not wish to be limited to the exact details of construction and arrangement of parts shown and described as the preferred arrangement has been given by way of illustration only.

2

Referring to the drawing wherein similar reference characters designate corresponding parts throughout the several views, the device shown embodying the invention comprises a spark plug base member 10 and a tubular casing 11 which may be integral with said base member 10 or which may be connected to said base member 10 by any suitable manner as by the threaded connection shown wherein the externally threaded portion on the tubular casing 11, makes connection with the internal threaded portion adjacent the end of the base 10.

The tubular casing 11 is also provided with a threaded portion adjacent its end opposite that making connection with the base 10, for making connection with a radio-shielded lead of an ignition system.

Within the base 10 and extending into the tubular casing 11 is the spark plug insulator 12 having the center electrode 13.

The spark plug transformer consists of the telescoping auto-connected primary coil 14 and secondary coil 15 with a mutual connector 16 located at the top of the coil forms and recessed in a well in the tubular casing 11 to provide adequate flashover distance and protection from mechanical damage. The connector 16 has the connector member 17 for connection to an ignition lead, and the member 16 is retained in the well or recess by the annular spacer member 18 of insulating material which is held in position by the rolled or spun end 19 of the tubular member 11.

The primary coil 14 is made by electroplating helically coiled conducting material so applied to a suitable coil form and consists of a tubular core 20 of insulating material with the continuous metalized and plated winding 21 thereon, formed as previously stated, with integral terminals 23a and 23 on the coil form open ends.

For making contact with the terminal 23 on the lower end of the primary 14, the annular blade spring 22 is provided on the internal flange on the tubular casing 11 and this spring 22 is compressed by the primary 14 and retained in contact with the terminal 23 by its resiliency.

The entire completed primary form is coated with a silicone resin to help secure the winding to the form and to provide insulation between the adjacent turns of the winding.

The secondary coil is of single layer type, close wound with "Ceroc" or other suitable high temperature resistant, insulation coated fine wire. It comprises the core 24 with the winding 25 thereon. The connections have been provided on the ends of the coil as set forth in the application of

Osterman and Ericksberg, Patent No. 2,434,511. The entire assembly is dip coated with silicone resin to help secure the winding and to add insulation to prevent adjacent turn flashover.

To further insulate the transformer from flashover at high altitudes and to provide means for filling all voids within the plug and thereby removing all air therefrom to prevent deterioration from air and to stop engine gas leakage, the plug has been filled with a silicone rubber by pressure into the plug body through slots and holes and then cured under pressure to a heat stable, void and volatile free mass capable of withstanding temperatures of 450–500 degrees F.

Surrounding the outer surface of the primary 14 is wound a sheet mica insulation 26 for further insulating the primary winding from the tubular casing 11.

The spring 27 acts as a conductor from the high tension end of the secondary 15 to the contact 28 of the electrode 13 of the spark plug and also acts to spring load the secondary 15.

It will be noted that the primary 14 has the lead 29 completing the circuit from the top to the contact 23 through the spring washer 22 to the body of the plug to thereby complete the circuit.

The construction shown in Fig. 1 and Fig. 2, shows the invention adapted to a conventional type spark plug for aircraft engines, while in Fig. 3 is shown a generally similar arrangement but employing an integral spark plug insulator and primary core 25 which corresponds to the spark plug insulator 12 and core 20 of the primary 14 of the construction shown in Fig. 2.

In this construction the center electrode 13 has an opening or bore in its upper end for receiving a pin 30 which makes connection between the secondary 15 and the high tension terminal 31 through the spring contact washer 32. 33 is a spacer or support for the insulator 25.

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

Having described our invention, we claim:

1. A high frequency spark plug and transformer unit including a casing, a spark plug insulator in said casing, said insulator having an integral extension portion having a bore adjacent an end thereof, a spark plug electrode within said insulator and extending from said bore to the opposite end of said insulator, a primary winding on said extension portion of said insulator surrounding said bore, a separate, integral secondary winding member in said bore, said secondary member being formed and inserted into said primary member as a separate unit, said secondary member being supported on the upper end of said electrode and electrically connected at its adjacent ends to said electrode and a terminal member, said terminal member being electrically connected to the adjacent ends of said primary and secondary windings.

2. A high frequency spark plug and transformer unit including a spark plug casing, a hollow shielded housing connected to said casing, a spark plug insulator containing a spark plug electrode in said casing and having an integral tubular portion extending into said housing, said electrode extending through said insulator, a primary winding in said housing surrounding the tubular portion of said insulator, a separate, integral secondary member in said housing within said tubular portion of said insulator and in telescoping relation with said primary and electrically connected to said electrode, said secondary member being formed and inserted into said primary member as a separate unit, and a terminal member connected to the adjacent ends of said primary and secondary windings and adapted to be connected to a lead of an ignition system.

3. A high frequency spark plug and transformer unit including a spark plug casing, a hollow shielded housing connected to said casing, a spark plug insulator containing a sparkplug electrode in said casing and having an integral hollow end portion extending into said housing, said electrode extending to said hollow end portion, a primary winding in said housing surrounding the hollow end portion of said insulator, a separate, integral secondary winding in said housing within said hollow end portion of said insulator and in telescoping relation with said primary and supported on and electrically connected to said electrode, said secondary member being formed and inserted into said primary member as a separate unit, and a terminal member electrically connected to the adjacent ends of said primary and secondary windings and adapted to be connected to a lead of an ignition system.

4. A high frequency spark plug and transformer unit including a casing, a spark plug insulator in said casing, a spark plug electrode extending through and supported by said insulator, a primary member in said casing and comprising a hollow core member integral with and extending from said insulator and having a primary winding thereon, a separate secondary member within said hollow core of said primary winding and comprising an insulating member with a secondary winding thereon, said secondary member being formed and inserted into said primary member as a separate unit, a terminal member, said secondary winding being supported on and electrically connected to said electrode and to said terminal member and said primary member being electrically connected to said terminal member and grounded to said casing.

RICHARD W. LAMPHERE.
JOSEPH T. OSTERMAN.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,302,308	Cavanagh	Apr. 29, 1919
1,624,951	Holthouse	Apr. 19, 1927
2,180,358	Hooven	Nov. 21, 1939
2,266,614	Robinson	Dec. 16, 1941
2,392,171	Marsh	Jan. 1, 1946
2,414,692	Harkness	Jan. 21, 1947