H. M. GRIMES.

SPARK PLUG.

APPLICATION FILED APR. 29, 1918.

1,359,591. **Patented Nov. 23, 1920.**

FIG. 1.

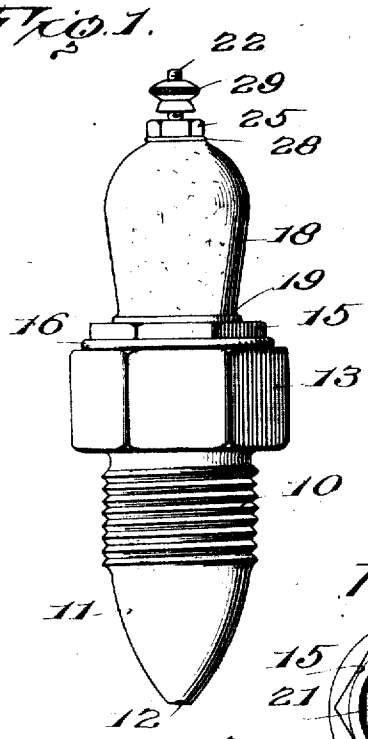


FIG. 2.

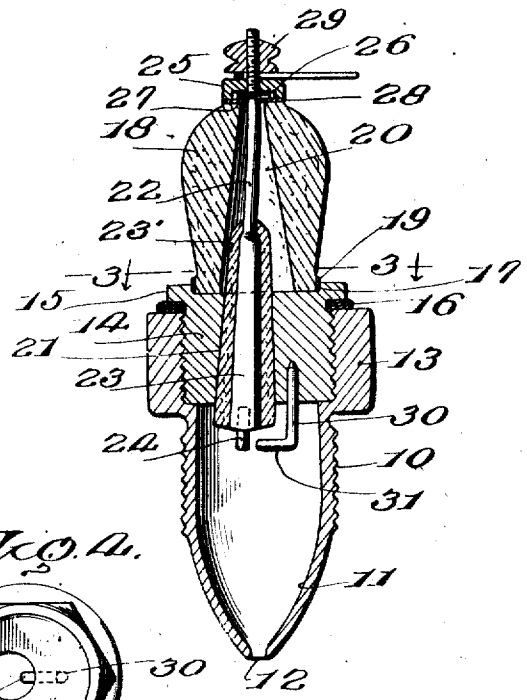


FIG. 4.

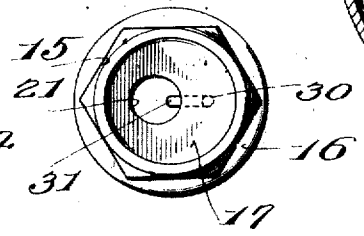


FIG. 5.

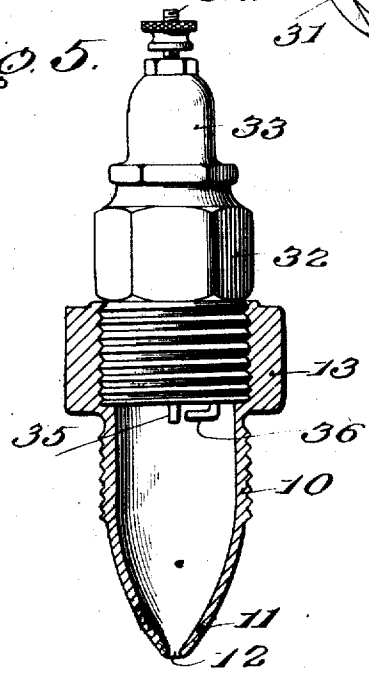
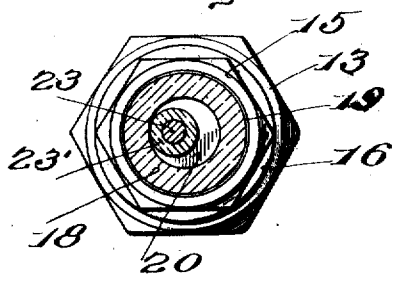


FIG. 3.



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SPARK-PLUG.

1,359,591. Specification of Letters Patent. Patented Nov. 23, 1920.

Application filed April 29, 1918. Serial No. 231,518.

To all whom it may concern:

Be it known that I, HARRY M. GRIMES, a citizen of the United States, residing at Kokomo, in the county of Howard and State of Indiana, have invented certain new and useful Improvements in Spark-Plugs, of which the following is a specification.

This invention relates to an improved spark plug and has as its primary object to provide a device of this character employing a hollow shell providing a firing chamber adapted to communicate with the firing chamber of an engine cylinder to which the plug is connected so that upon the passage of an electric current through the plug, fuel mixture contained within the firing chamber of the shell will be ignited and expelled therefrom as a jet of flame into the firing chamber of the cylinder for thus effectually igniting the fuel charge.

The invention has as a further object to provide a spark plug wherein a spark will be created within the firing chamber of the shell so that ignition will initially occur within the mass of fuel mixture in the shell for thus driving the ignited mixture from the shell as a jet of flame.

A still further object of the invention is to provide a construction wherein the sparking terminals of the plug will be housed within the shell and thus protected from the cooling influences of inflowing fuel mixture into the firing chamber of the engine cylinder, and wherein a portion of the incoming mixture entering the cylinder will be trapped within the shell to be heated by the wall thereof so that such trapped fuel mixture will readily ignite within the shell.

The invention has as a still further object to provide a spark plug having the main electrode thereof so mounted that compression occurring within the engine cylinder will act to more firmly seat the said electrode to provide a sealed joint between the such electrode and its supporting member so that leakage through the plug will be prevented.

And the invention has as a still further object to provide a plug which will be particularly characterized by simplicity of construction to the end that the plug may be readily produced.

Other and incidental objects will appear as the description proceeds. In the drawings wherein I have illustrated the preferred embodiment of the invention, and wherein similar reference characters designate corresponding parts throughout the several views:

Figure 1 is an elevation of my improved spark plug,

Fig. 2 is a vertical sectional view more particularly showing the details of construction of the plug,

Fig. 3 is a transverse sectional view taken on the line 3—3 of Fig. 2 and looking in the direction of the arrows,

Fig. 4 is a plan view showing the closure plug for the shell of the device removed, and

Fig. 5 is a fragmentary sectional view showing the firing shell of the present improved structure used in connection with a conventional type of spark plug.

In carrying out the invention I employ a hollow cylindrical elongated firing shell 10 provided at its lower end with a substantially conical reduced nose or nozzle 11 in the apex of which is formed a restricted passage 12. The shell is externally threaded to detachably engage within the conventional spark plug opening of an internal combustion engine cylinder, communicating at its inner end with the firing chamber of the said cylinder, and formed on the upper end of the shell is an enlarged wrench receiving portion 13 so that the shell may be readily connected with or removed from such cylinder. Threaded into the upper end of the shell axially thereof, is a closure plug 14 for the shell provided at its upper end with a radial flange 15. This flange is, as particularly shown in Figs. 1 and 3 of the drawings, provided at its periphery with flat faces so that a wrench may be applied to the said flange for screwing the plug into position and interposed between the said flange and the upper end of the shell is a suitable gasket 16. This gasket is preferably formed with an asbestos core inclosed within a copper jacket and is adapted to provide a sealed joint between the plug and the shell. Formed in the upper end of the plug 14 is, as particularly shown in Fig. 4, an annular recess or seat 17 and snugly fitting at its lower end within this seat is a porcelain 18. For the purposes of the present invention this term porcelain shall be held to include a body of any suitable insulating material similar to the porcelain 18.

Surrounding the lower end of the porcelain to engage the circumferential wall of the seat 17 is a protecting band or collar 19 and formed through the porcelain axially thereof is an opening 20 tapering from the lower or inner end of the porcelain toward its upper end.

Formed through the plug 14, eccentrically thereof, is an opening 21 tapering from the lower end of the plug toward its upper end. This opening is inclined with respect to the axis of the plug and fitted through said opening is a main electrode 22. This electrode is formed with a longitudinally tapered cylindrical body 23 having its small end presented upwardly and surrounded by a similarly tapered jacket 24 of suitable insulating material. This jacket is preferably formed of mica and is adapted to snugly fit within the opening 21 of the plug to electrically insulate the main electrode with respect thereto. Fixed in the lower end of the body 23 of the said electrode axially thereof is a sparking terminal 24 projecting longitudinally from the said body and threaded upon the upper end of the electrode to confront the upper end of the porcelain 18 is a clamping nut 25. This nut, upon its lower side, is formed with a concentric annular recess 26 and surrounding the main electrode within this recess is a spring locking washer 27 bearing between the nut and a washer 28 interposed therebeneath. Thus, the nut 25 may be adjusted upon the main electrode for drawing the said electrode up through the plug 4 to bind within the opening 21 thereof and accordingly rigidly connect the porcelain 18 with the plug. The plug 14, therefore, provides the body of my improved device while the nut 25 provides a single element connecting the main electrode and the porcelain with the said body. Upon the adjustment of the nut 25 the washer 27 will, of course, coact therewith for holding the said nut at adjustment and preventing accidental displacement or loosening of the nut while, at the same time, the said washer will be protected and housed within the nut. Threaded upon the upper end of the main electrode is a thumb nut 29 adjustable for clamping a circuit wire therebeneath to connect the said wire with the electrode and depending from the plug 14 at the inner end of the said electrode, is a ground electrode 30 provided with a laterally directed sparking terminal 31 confronting the sparking terminal 24 of the said main electrode. Thus, upon the energization of the plug, current will flow through the main electrode to the sparking terminal 24 to then jump to the sparking terminal 31 for creating a spark within the shell 10 when the current will ground through the ground electrode 30.

Attention is now directed to the fact that the sparking terminals 24 and 31 of the plug will be housed within the shell 10, so that when the plug is connected with an engine cylinder and this shell projects into the firing chamber of the said cylinder, the said shell will protect the said sparking terminals from the cooling influences of fuel mixture flowing into the said chamber. The dependability of the plug will, therefore, be enhanced accordingly. Furthermore, it will be seen that the hollow shell 10 will provide a firing chamber about the said sparking terminals. Upon the introduction of the fuel charge into the engine cylinder, a portion of such charge will, of course, enter through the passage 12 into the chamber to be trapped therein. This trapping of a portion of the charge within the shell will, as will be readily understood, result in such trapped portion of the charge becoming heated from the wall of the shell and forming a primer charge within the firing chamber of the shell. Therefore, when the plug is energized, ignition of the primer charge will readily occur and the dependability of the plug thus further enhanced. In this connection, it is to be noted that the sparking terminals 24 and 31 are located within the firing shell to give off a spark and cause initial ignition of the primer charge within the mass thereof so that the primer charge will be expelled from the shell through the reduced passage 12 of the firing chamber thereof as a jet of flame into the charge of fuel mixture in the engine cylinder. Positive ignition of the fuel charge within the cylinder will thus be rendered practically certain. Owing to the provision of the reduced nose or nozzle 11 of the shell the ignited primer charge within the firing chamber will, as it flows through the said nozzle, be attenuated thereby to issue from the nozzle with unusual force in a jet of flame. This jet of flame will, therefore, tend to pierce the mass of the fuel charge in the engine cylinder to provide a thorough ignition thereof. This forcible ejection of the jet of flame from the shell will, furthermore, tend to maintain the passage 12 free of any soot or carbon while, owing to the restricted nature of the said passage, fouling of the sparking terminals by lubricant within the engine cylinder will be reduced to a minimum. It is also to be noted that the compression within the engine cylinder will tend to more firmly wedge the main electrode in the opening 21 of the plug 14 and thus maintain a sealed joint between the said electrode and the plug so that leakage through the plug will be prevented.

It will, therefore, be seen that I provide a particularly effective construction for the purpose set forth. At the same time the plug is characterized by simplicity of construction, it being noted in this connection

that the shell 10 may be readily detached from the plug 14 or body of the device so that access may be easily had to the sparking terminals while, should it be so desired, the main electrode may be readily detached from the said plug or body and the porcelain displaced.

In Fig. 5 of the drawings I have illustrated a slight modification of the invention showing the use of my improved firing shell in connection with a conventional type of spark plug. In this figure the body of the plug is indicated at 32. Fitted through this plug is a porcelain 33 which carries a main electrode 34 having a sparking terminal 35. Depending from the plug body to coöperate with this electrode is a ground electrode having a sparking terminal 36. The opening in the upper end of the shell is of a diameter to receive the lower threaded end of the ordinary plug body, so that the conventional plug thus described may be readily threaded into the upper end of the shell for connecting the plug therewith. The terminals 35 and 36 will then be disposed to give off a spark within the firing chamber of the shell, it being understood, of course, that the shell shall be threaded into an engine cylinder, as described in connection with the preferred construction. My improved firing shell may, therefore, be readily employed in connection with the usual spark plug. In this connection it is to be noted that the opening in the upper end of the shell is enlarged within the wrench receiving portion 13 thereof to overhang the wall of the shell below the said wrench receiving portion so that the diameter of the said opening corresponds to the major diameter of the shell. Consequently, since the threads of the said opening are formed to coact with the threads upon the lower end of the body of an ordinary spark plug, plugs of various different types may, without the necessity for any structural change therein, be readily engaged with the shell while, at the same time, the shell, by being threaded to engage within the ordinary spark plug opening of an engine cylinder, may be readily used in connection with various different types of engines without the necessity for any modification in the plug openings of the cylinders thereof.

Having thus described the invention, what is claimed as new is:

I claim:

A spark plug including a shell externally threaded for engagement in the spark plug orifice of an engine cylinder and provided with an elongated frusto conoidal lower end portion having a minute opening at its apex, the inner face of the wall of the shell being smooth and of unbroken continuity, there being an internally threaded wrench receiving portion formed on the shell at its upper end, a plug threaded into the wrench receiving portion of the shell and provided with an opening therethrough located eccentrically with respect to the axis of the shell, a poreclain rested upon said plug, a main electrode extending through the plug and porcelain and having a tapered body, a tapered insulating packing fitting around the body of said electrode and coacting with the wall of the opening of the plug, a sparking terminal projecting from the lower end of the body of the main electrode, and a ground electrode depending from the plug and provided with a sparking terminal to coact with said first mentioned terminal.

In testimony whereof I affix my signature.

HARRY M. GRIMES. [L. S.]