March 3, 1953 L. McK. FIELD 2,630,107

SPARK PLUG

Filed Dec. 15, 1949

FIG. 1

FIG. 2

FIG. 3

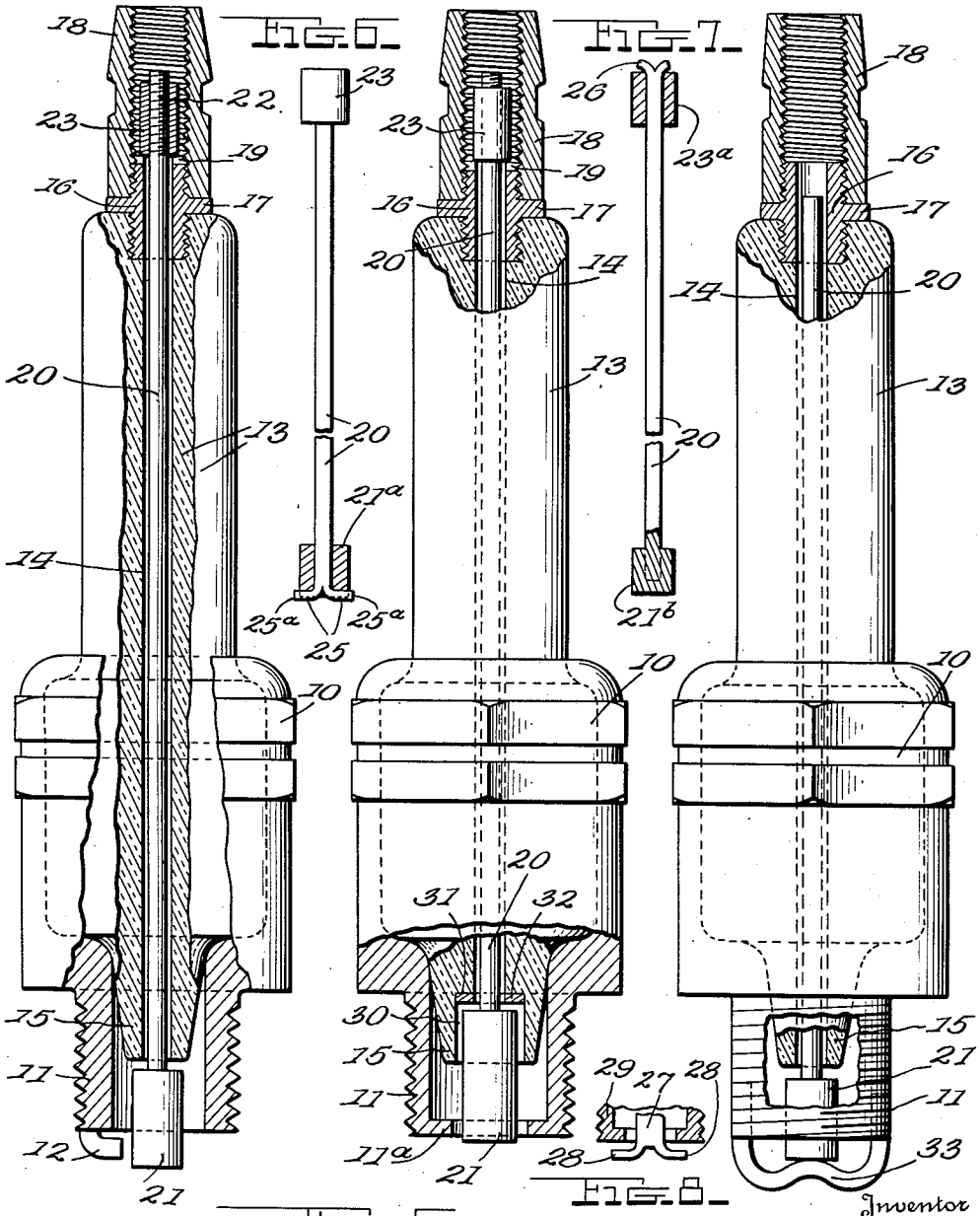


FIG. 6

FIG. 7

FIG. 8

FIG. 4

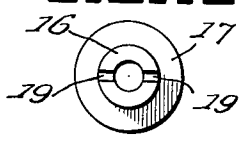
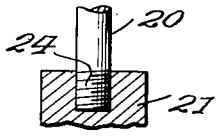


FIG. 5



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2,630,107

SPARK PLUG

Lloyd McKinsey Field, New London, Ohio; Floyde Josephine Field Karcher, Pueblo, Colo., executrix of said Lloyd McKinsey Field, deceased, assignor, by mesne assignments, to Andrew R. Cochrane, Pittsburgh, Pa., as trustee

Application December 15, 1949, Serial No. 133,027

9 Claims. (Cl. 123—169)

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This invention relates to certain new and useful improvements in spark plugs of the type generally disclosed in applications for patents filed by Lloyd M. Field on April 7, 1947, Serial No. 739,811, now Patent No. 2,488,972, a second application for patent filed on October 17, 1949, Serial No. 121,763, now Patent No. 2,597,718, and embodies improvements in the art thereover.

In the applications above identified, the salient feature of the invention related to a spark plug having a renewable or replaceable negative electrode, and it is the primary object of the present invention to provide a spark plug with a completely and readily renewable center or positive electrode.

A further object of the invention is to provide a spark plug with a full floating center positive electrode freely extending through the entire length of a center bore in the spark plug body, and to provide such electrode with means associated with it for limiting its reciprocating floating movement in said bore and with the sparking end or head of the center electrode maintained in proper sparking relation with respect to the negative electrode of the spark plug.

A further object of the invention is to provide a full floating center positive electrode for spark plugs wherein the shank of the electrode freely extends through a longitudinal bore in the spark plug body with a sparking head in the firing end of the electrode that may be secured thereto in any suitable manner, such as by a threaded engagement, welding or the splitting of the end of the shank to provide oppositely directed furcations that are preferably welded, but may be otherwise secured to the sparking head.

A still further object of the invention is to provide a spark plug of the foregoing character wherein the renewable or replaceable full floating center positive electrode embodies a shank with a seating head at its sparking end and a cap at the upper end of the electrode cooperating with the head for confining the electrode in the body of the spark plug and with the cap attached to the upper end of the shank of the electrode as by threading, crimping, welding, an upsetting operation on the shank to form the head or by splitting the upper end of the shank above the head and spreading the furcations, but wherein either the lower head or the top cap will be attachable by hand tools.

It is a still further object of the invention to provide a spark plug with a replaceable center positive electrode of full floating character

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wherein the electrode includes an elongated shank formed of a highly conductive alloy with a sparking head at the lower end of the shank formed of high heat resisting alloy and with sparking fingers struck from the lower end of the head and directed outwardly therefrom into properly spaced relation with respect to the negative electrode of the spark plug.

With the above and other objects in view that will become apparent as the nature of the invention is better understood, the same consists in the novel form, combination, and arrangement of parts hereinafter more fully described, shown in the accompanying drawing, and claimed.

In the drawing:

Figure 1 is a side elevational view, partly in section, of a spark plug constructed in accordance with the present invention and illustrating a longitudinal bore in the spark plug body of the electrode and the full floating center positive electrode mounted in the bore and retained therein by a sparking head at the lower end and a cap at the upper end, the sparking head of the electrode being disposed below the lower end of the porcelain and adapted to engage the lower end of the porcelain for closing the bore at the lower end thereof,

Figure 2 is a side elevational view, partly in section, of another form of the invention wherein the sparking head at the lower end of the center positive electrode has its upper end extending into a chamber in the lower end of the porcelain,

Figure 3 is a side elevational view, partly in section, of another form of spark plug wherein the full floating center positive electrode has the sparking head at the lower end thereof retained in the porcelain by a transversely extending negative electrode spanning the lower open end of the threaded stem of the spark plug body,

Figure 4 is a top plan view of the tubular nut threaded into the upper end of the porcelain and having radial notches in its upper edge to facilitate the passage of fluid through the bore of the porcelain,

Figure 5 is a fragmentary sectional view showing the shank of the center positive electrode threaded into the sparking head at the lower end thereof,

Figure 6 is a side elevational view of another form of replaceable center electrode wherein the lower end of the shank of the electrode is bifurcated to provide fingers underlying the sparking head for the retention of the latter on the shank of the electrode.

Figure 7 is a side elevational view of another form of center positive electrode wherein the cap at the upper end of the electrode is retained thereon by spreading the upwardly extending end of the shank above the cap, and

Figure 8 is a fragmentary sectional view showing sparking points projected outwardly of the sparking head at the lower end of the center positive electrode.

Referring more in detail to the accompanying drawing and particularly to Figure 1, the spark plug body comprises a metallic shell 10 having a tubular externally threaded stem 11 projecting from the lower end thereof and a negative electrode 12 carried by the stem and projecting inwardly thereof. The metallic shell 10 of the spark plug carries the elongated insulator 13 that has a central longitudinal bore 14 extending completely therethrough, the lower end of the insulator tapering into a nipple 15 that extends downwardly into the tubular stem 11. A tubular nut 16 is threaded into the upper end of the insulator 13 and has an annular flange 17 intermediate its upper and lower ends that rests upon the upper end of the insulator 13, while the usual binding post head 18 is threaded onto the upper end of the tubular nut 16 and into engagement with the flange 17. As clearly shown in Figures 1 and 4, the upper end of the tubular nut 16 has a pair of diametrically opposite radial grooves 19 formed therein for purposes presently to appear.

The center positive electrode 20 is of full floating character and freely extends through the longitudinal bore 14 in the insulator, the electrode 20 which will be hereinafter referred to as the shank of the electrode carries at its lower end a sparking head 21 positioned in the threaded stem 11 of the spark plug shell and extending slightly below the stem and properly positioned in sparking relation to the negative electrode 12. The upper end of the shank 20 of the electrode extends above the tubular nut 16 and is threaded as at 22 for the mounting of the tubular collar 23 which will hereinafter be referred to as the cap of the positive electrode. The cap normally rests upon the upper end of the tubular nut 16 with the radial grooves laterally exposed for fluid passage through the bore 14 of the insulator. It will be observed that the center positive electrode is permitted limited reciprocatory movements, the electrode being freely mounted in the insulator and upon a compression stroke in an engine cylinder the sparking head 21 moves upwardly to close and seal the lower end of the bore 14 to prevent the escape of heat and gases.

The cap 23 was described as being threaded upon the upper end of the shank of the positive electrode, since it is the upper end of the shank which is preferred to be made attachable for replacement, but it is understood that various methods of attaching the cap may be employed, such as undercutting the upper end of the shank 20 of the electrode to form an integral head beneath which an enlarged cap may be readily crimped. As illustrated in Figure 5, the lower end of the shank of the center electrode 20 is shown as being threaded as at 24 for threaded engagement in the socket in the upper end of the sparking head 21. In a like manner the lower end of the shank of the positive electrode may be welded to the sparking head or attached thereto in various other ways.

As illustrated in Figure 6, the shank of the center positive electrode may have the cap 23 formed integral therewith or attached thereto in any suitable manner, while the lower end of the shank 20 passes through an opening in the sparking head 21^a with the extended end of the shank bifurcated and with the furcations 25 bent outwardly into the grooves formed in the lower side of the sparking head 21^a and with the furcations extending laterally of the head 21^a to provide sparking points 25^a cooperating with negative electrodes.

As illustrated in Figure 7, the shank 20 of the center positive electrode may have the sparking head 21^b secured thereto in any suitable manner, such as by welding or the like, while the upper end of the shank that passes through the cap 23^a is split and swaged as at 26 to overlie the upper end of the cap and at which points the cap may be welded to the upper end of the shank 20 if desired.

A further modification of the center positive electrode is illustrated in Figure 8 wherein the sparking head 27 at the lower end of the electrode shank carries diametrically opposite outwardly directed firing points or terminals 28 at its lower end coacting with the threaded stem 29 of the spark plug shell that constitute the negative electrode.

In the form of invention illustrated in Figure 2, the nipple 15 of the insulator has an enlarged chamber 30 formed therein that defines an upper abutment shoulder 31 and the sparking head 21 at the lower end of the electrode shank 20 is engageable with said shoulder to limit movement of the positive electrode and to seal the bore 14 through the insulator 13. If desirable, a metallic washer or other gasekt 32 may be placed in the chamber in contact with the shoulder 31 to form an abutment for the upper end of the sparking head 21. The open end of the threaded stem 11 of the spark plug shell is flanged inwardly as at 11^a to constitute the negative electrode of the sparking system.

As illustrated in Figure 3, the tubular collar or cap 23 has been omitted and the upper end of the shank of the center positive electrode 20 freely extends into the tubular nut 16, the insulator 13 being of the form illustrated in Figure 1, with the sparking head 21 at the lower end of the electrode shank being engageable with the lower end of the nipple 15 of the insulator. The upper end of the shank of the positive electrode being unsupported, the lower end of the threaded stem 11 carries a U-shaped negative electrode 33 that spans the open end of the tubular stem and is detachably mounted thereon, the negative electrode 33 providing a support for the center positive electrode 20 during the suction stroke in an engine cylinder.

From the above detailed description of the invention, it is believed that the construction and operation thereof will at once be apparent, it being noted that the center positive full floating electrode is readily replaceable when worn or otherwise damaged, and in the form of invention illustrated in Figures 1 and 2, the positive electrode may be readily removed from the insulator 13 upon removal of the binding post head 18 and unthreading the cap from the shank, or by cutting through the electrode with ordinary cutter pliers. For the replacement of such electrodes as illustrated in Figure 7, the capped end 23^a may be severed from the shank in any suitable manner upon removal of the binding post head 23. Also, it may be noted that the shank of the positive electrode 20 may be formed of a suitable wire of a highly conductive alloy and

that sparking heads are formed from high heat resisting alloys to maintain their shape.

While there are herein shown and described the preferred embodiments of the invention, it is nevertheless to be understood that minor changes may be made therein without departing from the spirit and scope of the invention as claimed.

What is claimed as new, is:

1. A spark plug comprising an insulator having a metal top terminal open at its upper end and an enclosing shell having a threaded stem, a negative electrode carried by said stem, said insulator having a center longitudinal bore extending through the length thereof, a free floating and replaceable center positive electrode of less diameter than the bore extending through the length of said bore to contact the metal top terminal and having restricted reciprocatory movement therein and an enlarged head at the inner terminal end of the center electrode adapted to seat directly on the inner end of the insulator to close and seal the center bore at its inner end during piston compresssion in an associated engine cylinder.

2. A spark plug as in claim 1, wherein the negative electrode extends inward of the open end of the threaded stem to form an abutment for the head of the positive center electrode and to hold said electrode in the insulator.

3. A spark plug as in claim 1, wherein the negative electrode extends inward of the open end of the threaded stem to form an abutment for the head of the positive center electrode and to hold said electrode in the insulator, and said negative electrode being detachably engaged with said stem whereby upon removal thereof the center electrode can be replaced.

4. A spark plug comprising an insulator having a metal top terminal and an enclosing shell having a threaded stem, a negative electrode carried by said stem, said insulator having a metal top terminal and a center longitudinal bore extending through the length thereof, a free floating and replaceable center positive electrode extending through the length of said bore and having restricted reciprocatory movement therein, an enlarged head at the inner terminal end of the center electrode adapted to seat on the inner end of the insulator, and a readily accessible cap at the outer end of said electrode removably mounted on the electrode whereby upon removal of the cap the electrode may be removed through the inner end of the plug.

5. A spark plug as in claim 4, wherein the center positive electrode includes the enlarged head of hard heat resistant metal, a relatively softer shank to promote current flow and the cap at the outer end of the shank of larger diameter than said bore for restricting said reciprocatory movements of the electrode and confining it in said spark plug body.

6. A spark plug as in claim 4, wherein the center positive electrode includes the enlarged head of hard heat resistant metal, a relatively softer shank to promote current flow and the cap at the outer end of the shank of larger diameter than said bore for restricting said reciprocatory movements of the electrode and confining it in said insulator, said head and cap being threadedly engaged with said shank.

7. A spark plug as in claim 4, wherein the center positive electrode includes the enlarged head and the cap at the outer end of the shank of larger diameter than said bore for restricting said reciprocatory movements of the electrode and confining it in said insulator, and said insulator having an enlarged end opening chamber in its inner end with the head on the electrode movable to close the inner end of the insulator bore within the chamber.

8. A spark plug as in claim 4, wherein the center positive electrode includes the enlarged head of hard heat resistant metal, a relatively softer shank to promote current flow and the cap at the outer end of the shank of larger diameter than said bore for restricting said reciprocatory movements of the electrode and confining it in said insulator, said head and cap being replaceably engaged with said shank, and said insulator having an enlarged end opening chamber in its inner end with the head on the electrode movable to close the inner end of the insulator bore within the chamber.

9. A spark plug as in claim 4, wherein the center positive electrode includes the enlarged head of hard heat resistant metal, a relatively softer shank to promote current flow, the cap at the outer end of the shank being of larger diameter than said bore for restricting said reciprocatory movements of the electrode and confining it in said insulator, a nut fixed in the upper end of the insulator below said cap to be engaged by said cap and said nut having grooves therein communicating with said longitudinal bore, and said insulator having an enlarged end opening chamber in its inner end with the head on the electrode movable to close the inner end of the insulator bore within the chamber.

LLOYD McKINSEY FIELD.

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