Feb. 10, 1925. 1,526,054

E. T. CURRAN

SPARK PLUG

Filed May 22, 1924

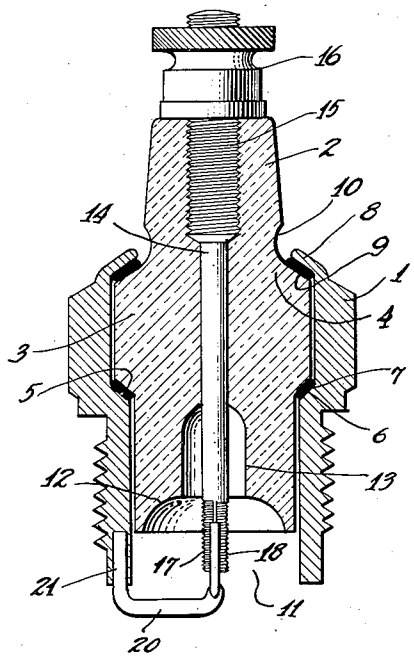


Fig. 1

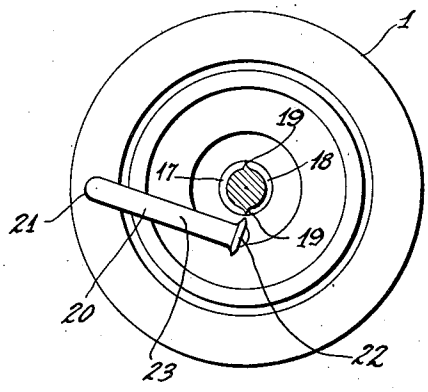
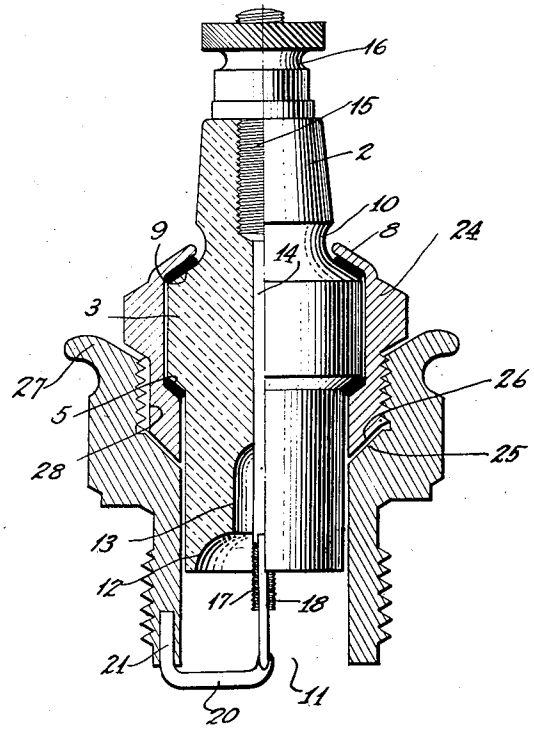


Fig. 2

Fig. 3



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UNITED STATES PATENT OFFICE.

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SPARK PLUG.

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To all whom it may concern:

Be it known that I, EDWARD T. CURRAN, a citizen of the United States, residing at Albany, county of Albany, and State of New York, have invented a certain new and useful Spark Plug, of which the following is a specification.

This invention is a spark plug and the object of the invention is to provide a simple, efficient and economical construction capable of ready adjustment and of prolonged use.

Generally speaking, it may be stated that there are two distinct types of plugs well known. The first type is the one wherein the sparking gap is positioned below the lower end of the plug, this type depending upon lateral flame propagation only. The second type is the one wherein the gap is positioned within the chamber in the lower portion of the plug and in which type the flame propagation is fundamentally in a downward direction.

In the second mentioned type, the primary explosion takes place within the plug chamber and reacts against the upper surfaces of the chamber to cause a downward spurt of flame into the explosive mixture within the associated cylinder.

In the majority of plugs of the second type that are found on the market, the central electrode extends downwardly and depends beneath a downwardly tapering skirt which constitutes the lower portion of the porcelain. This skirt usually has an appreciable taper and is at its lower end of a diameter appreciably smaller than the diameter of the plug chamber. As a result of this construction, there is formed in the lower portion of the plug an annular tapering space which forms a cul-de-sac for carbon deposits and from which it is very difficult to clean the carbon. As a result carbon deposits accumulate in such a plug to such extent that during continued operation of the engine pre-ignition is not uncommon.

With these considerations in mind and others, the present invention embodies a plug wherein the objections referred to are obviated by the formation of the lower portion of the porcelain of such contour and dimension that it will project downwardly into the plug chamber and substantially fill the upper portion thereof after the manner of a cork so that the accumulation of carbon deposits between the porcelain and the shell of the plug cannot occur as no space is left for the lodging of such deposits.

The plug is of the second type referred to wherein the spark gap is positioned within the plug chamber and by forming the lower portion of the porcelain of a section substantially co-extensive with the section of the shell, a more efficient re-action of the primary explosion may be obtained. The action may be improved by forming a dome shaped recess in the lower end of the porcelain to provide a dome like background against which the primary explosion may act efficiently. In order however to preclude any possibility of short circuiting of the plug by oil deposits which might occur in very oily cylinders, a subchamber is formed in the top of the dome and surrounding the central electrode. This subchamber is relatively deep and during the operation of the plug constitutes a dead air space in which the gases are compressed during the explosion so that, in practice, it is found that this subchamber keeps absolutely clean and free from oil or carbon deposits.

Aside from the features which have been referred to, the plug also embodies efficient insulated and grounded electrodes made in accordance with the improved methods of manufacture which I have evolved. The plug is such that it may be economically manufactured in large quantities without sacrificing its efficiency of operation.

Features of the invention, other than those specified, will be apparent from the hereinafter detailed description and claims, when read in conjunction with the accompanying drawings.

The accompanying drawings illustrate different practical embodiments of the invention, but the constructions therein shown are to be understood as illustrative, only, and not as defining the limits of the invention.

Figure 1 is a central section through a plug embodying the present invention.

Figure 2 is an underneath plan view of the plug shown in Figure 1, and,

Figure 3 is a central section of a modified form of construction.

Referring to the drawings, and more particularly to Figures 1 and 2, 1 designates the shell of the plug and 2 the porcelain. The porcelain is provided intermediate its ends

with an enlarged portion 3 having upper and lower shoulders 4 and 5 which enable it to be tightly gripped and maintained rigid within the shell.

In the figures referred to, the plug is of the well known two piece variety, and, accordingly, is provided with a shoulder 6 on which the shoulder 5 of the porcelain may seat through the intermediary of an interposed gasket 7. The upper end of the shell is in the form of a flange 8 adapted to be bent in over a gasket 9 positioned on the shoulder 4 and when the parts are assembled this flange will serve to tightly clamp the parts in position. I have found that in making two piece plugs, many porcelains have heretofore been broken due to the engagement of the free edge of the flange 8 with the porcelain. This places an undue strain on the porcelain and causes its breakage.

By providing an annular channel 10 in the porcelain as shown in Figure 1 at the upper edge of the seat 4, the engagement of the flange 8 directly with the porcelain is precluded and breakage is negligible.

The interior of the shell below the shoulder 6 is made cylindrical and that portion of the porcelain below the shoulder 5 is correspondingly formed and of a diameter adapting it to have a relatively snug fit within the shell. The depending portion of the porcelain extends downwardly in practice for about or a little more than one-half the length of the shank of the shell to provide a plug chamber 11 below its lower end.

Said lower end of the porcelain is provided with a dome like depression 12, the lower end of which is of a diameter substantially the same as the diameter of the plug chamber 11 so that the chamber 11 may be said to have a dome like top.

Formed within the porcelain and extending upwardly from the dome 12 is a subchamber 13 made relatively deep so as to extend upward substantially to the plane of the shoulder 7. The central electrode 14 extends downwardly through the central electrode and coaxially through the subchamber 13 and terminates within the plug chamber 11. This electrode may be anchored within the porcelain in any suitable way, but is shown as provided with an upper threaded portion 15 which screws into a correspondingly formed portion in the upper part of the porcelain. 16 is a binding screw for attaching the ignition lead.

The lower end of the central electrode 14 may be screw threaded to present to the grounded electrode a series of knife edges to facilitate proper sparking at the gap but inasmuch as a threading operation with the use of rotary dies is expensive from a commercial standpoint, I find in practice that very good results may be obtained by swaging the threads in the electrode by two cooperating semicircular dies. This operation produces two complementary threaded portions 17 and 18 on the opposite half sections of the electrode as shown in Figure 1 and leaves vertical fins 19 having substantially knife edges at the lines of meeting of the dies. This method of manufacture is very inexpensive and in practice produces efficient results since if the vertical fins 19 are juxtaposed with the grounded electrode a satisfactory knife edge results this side of the gap while if either of the fins do not come at the gap, the threaded portions of the electrode will present the desired knife edges.

The grounded electrode may be of any suitable form, but a very satisfactory arrangement is shown. As illustrated, the grounded electrode 20 is substantially U-shaped. One arm of the U is of circular cross section and is forced with a relatively tight fit into a hole in the lower edge of the plug shell. The other arm 22 of the U is swaged substantially flat and is provided with knife edges. The electrode is of such length that the part 22 will properly cooperate with the lower end of the central electrode and by virtue of the arrangement shown the grounded electrode may be adjusted in either direction as shown by the arrow 23 in Figure 2 to obtain the desired adjustment of the gap.

In Figure 1, the invention is shown as embodied in a two piece plug while in Figure 3, a three piece plug arrangement is shown with priming and cleaning features.

In Figure 3, the porcelain, instead of being clamped directly within the shell, is mounted on a valve member 24, which has threaded engagement with the upper interior portion of the shell. Below the threads of the shell a valve seat 25 is formed and the lower end of the part 24 is tapered as at 26 to cooperate with this seat. The upper portion of the shell is provided with an outwardly flared annular lip 27 to allow for the reception of gasoline, kerosene, water or the like and the member 24 has one or more vertical channels 28 extending from the surface 26 upwardly through the threaded periphery of said member, so that when the member 24 is slightly unscrewed to unseat the valve, the liquid introduced on the lip will work through into the plug. In this form of the invention, the lower cylindrical portion of the plug is made so as to substantially fill the cross section of the cylindrical portion of the shell, but there will be sufficient space in practice to allow the liquid thus introduced to readily flow between the porcelain and the shell into the plug chamber.

The plug of this invention embodies many important features. In the first place, it can

be manufactured very economically, and, secondly, it will give remarkably good results in use. For example, the subchamber 13 forms a dead air space and keeps that portion of the porcelain directly adjacent the central electrode clean and unencumbered of carbon or oil deposits so that short circuiting cannot occur. While the dome like depression 12 constitutes a broad and extensive background against which the primary explosion reacts to produce a downward spurt of flame into the associated cylinder so that another flame propagation through the explosive charge will result. There are no inaccessible spaces or cul-de-sacs for the accumulation of carbon as heretofore and actual practice has demonstrated that the plug will remain free from such deposits indefinitely. I may here state that in order to insure a good tight grip between the gaskets and the porcelain, the shoulders 4 and 5 are left unglazed as they are thereby adapted to better engage with and grip the gaskets with which they cooperate and produce a leak tight joint at these points.

It will be noted that the plug which I have described embodies numerous novel features some of which may in practice be employed without necessarily employing all and the invention is therefore to be considered as fully commensurate with the appended claims.

Having thus fully described the invention, what I claim as new and useful is:

1. A spark plug embodying a hollow shell, the lower portion of the interior of which is cylindrical, a porcelain mounted on the shell provided with a lower portion of cylindrical cross section substantially equal to the interior cross section of the cylindrical portion of the shell and extending downwardly into said portion of the shell, the lower end of said porcelain being provided with a dome like depression, the surface of which forms the top of a plug chamber in the lower portion of the shell, a central electrode extending coaxially through the porcelain and into said plug chamber, and a grounded electrode carried by the shell and extending into cooperative relation with the central electrode, that portion of the central electrode which extends into the plug chamber being swaged to provide semicircumferentially disposed relatively sharp ridges and diametrically opposite longitudinal knife edge fins.

2. A spark plug embodying a hollow shell, the lower portion of the interior of which is cylindrical, a porcelain mounted on the shell provided with a lower portion of cylindrical cross section substantially equal to the interior cross section of the cylindrical portion of the shell and extending downwardly into said portion of the shell, the lower end of said porcelain being provided with a dome like depression at the top of which is formed a relatively deep subchamber constituting a dead air space, a central electrode extending through the porcelain and through the subchamber and terminating below the porcelain, and a grounded electrode carried by the shell and extending into cooperative relation with the central electrode.

3. A spark plug embodying a hollow shell, the lower portion of the interior of which is cylindrical, a porcelain mounted on the shell provided with a lower portion of cylindrical cross section substantially equal to the interior cross section of the cylindrical portion of the shell and extending downwardly into said portion of the shell, the lower end of said porcelain being provided with a dome like depression at the top of which is formed a relatively deep subchamber constituting a dead air space, a central electrode extending through the porcelain and through the subchamber and terminating below the porcelain, and a grounded electrode carried by the shell and extending into cooperative relation with the central electrode, the lower end of said central electrode being swaged to provide substantially knife edge semicircumferential ridges and vertical fins and the grounded electrode being provided with a substantially knife edge at the spark gap between said electrodes.

In testimony whereof I have signed the foregoing specification.

EDWARD T. CURRAN.