July 16, 1940. J. A. STAHR 2,208,059

SPARK PLUG

Filed June 19, 1939

Fig. 1.

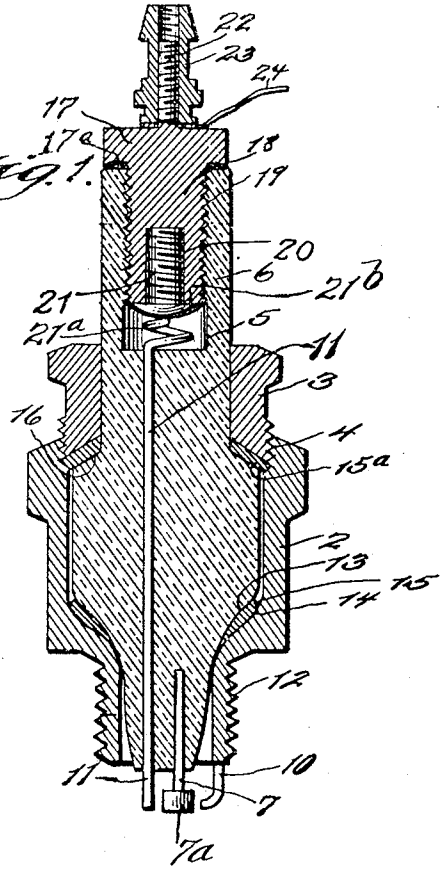


Fig. 2.

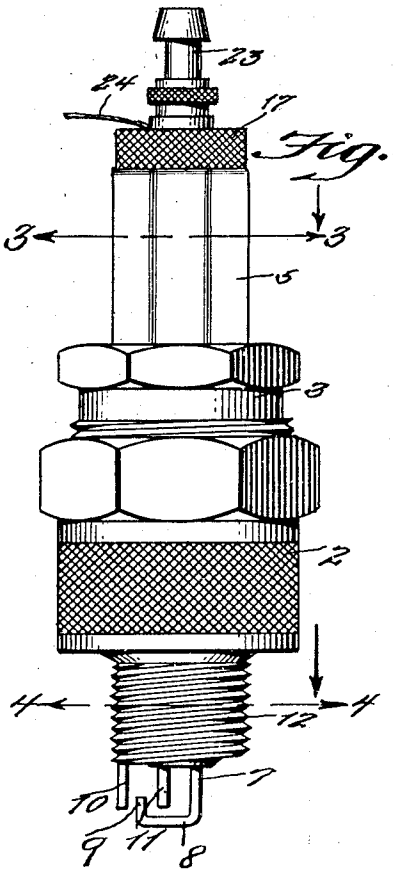


Fig. 3.

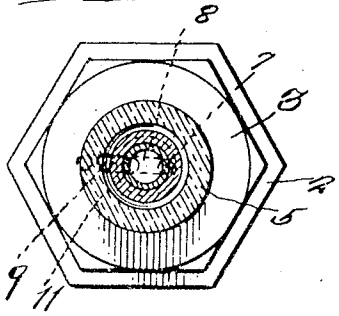
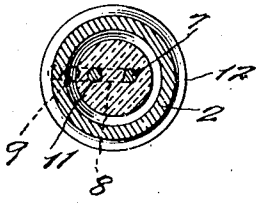


Fig. 4.



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SPARK PLUG

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Application June 19, 1939, Serial No. 279,873

8 Claims. (Cl. 123—169)

This invention relates to an improved spark plug which like many others comprises a casing or shell consisting of two sections made of any suitable metal, said sections being threadingly united for housing and supporting a porcelain core or holder, which in turn carries the usual electrodes, one section may be identified as a bottom or lower section, the other section can be identified as the top or upper section.

It is the purpose of the present invention to provide in a spark plug of this kind, a threaded top terminal for carrying a wire or lead of the engine, said top terminal being threaded or otherwise securely fastened into the porcelain core or insulator, which may have a seat for a spiral, being a bent or otherwise distorted electrode.

Another purpose of the invention is to provide an improved spark plug including an intermediate or neutral electrode, a positive electrode, and a negative electrode, the latter carried by, or integral with, or otherwise supported on the lower, bottom section of the shell or casing, the other two electrodes being carried by or otherwise supported on the porcelain core.

Another purpose of the invention is to provide an improved spark plug having an expansion chamber constructed in the porcelain core for permitting of expansion and contraction of the positive electrode, which is mounted in the core, thus allowing free movement caused by expansion and contraction of the electrode, according to the size of the electrode or heat that the electrode is subjected to, allowing the spark plug to properly function.

Still another purpose of the invention is to provide an improved spark plug wherein the main or positive electrode is not cemented in the porcelain core, thus allowing its free movement and preventing fracture of the porcelain core that receives the main or positive electrode.

A further purpose is to provide, in a spark plug of this character, which has an expansion chamber as a feature of construction of the porcelain core, insuring the expansion and contraction of the positive or main electrode, and insuring free movment of the electrode consistent with the length or amount of heat, to which the electrode is subjected.

A still further purpose is to provide an improved spark plug having a main or positive electrode being constructed of an alloy which differs fundamentally from older and harder alloys having sufficient hardness together with the distorted construction that results with high thermal and electrical conductivity, thereby causing a much hotter and more efficient spark at the end or termination of the electrode.

Furthermore it is a purpose to provide an intermediate or neutral electrode paralleling the positive electrode from the bottom of the expansion chamber, and being capable of movement due to expansion and contraction in the porcelain core, both if which electrodes extend beyond the core, the ground electrode being secured or imbedded in the spark plug shell or casing adjacent to the neutral electrode, and so spaced that a range of sparks are obtained and will synchronize with the compression of one or more internal combustion engine cylinders.

Also with the arrangement of the electrodes and the proper synchronizing with the engine compression together with the high thermal electrical conductivity of the electrodes, a new and more practical construction and method of a spark plug may be provided for internal combustion engines, and such as will co-operate properly with every firing stroke.

Moreover this improved spark plug includes an expansion chamber for insuring expansion and contraction of, particularly, the positive electrode, there being an intermediate cylindrical head, or an over-lying arm on the neutral electrode adapted for regulating or governing the spark between the terminals of the negative and positive electrodes, the gaps between the terminals of all of the electrodes, acting to intensify the sparking action, when the electrodes are set accordingly.

It is to be understood that the particulars herein given are in no way limitative, and that while still keeping within the scope of the invention, any desired modification of details and proportions may be made in the construction of the appliance according to circumstances.

The invention comprises further features and combination of parts to be hereinafter set forth, shown in the drawing and claimed.

Figure 1 is a view in section of the improved spark plug constructed in accordance with the invention.

Figure 2 is a view in side elevation of a spark plug wherein the electrodes are modified to those shown in Figure 1.

Figure 3 is a cross-sectional view on line 3—3 of Figure 2.

Figure 4 is a sectional view on line 4—4 of Figure 2.

Referring to the drawing 1 identifies the casing or shell of the spark plug comprising a lower or bottom section 2 and an upper section 3 thread-

ingly united at 4, the two sections housing and supporting a porcelain core or electrode holder 5. This porcelain core or holder has an expansion chamber 6, the core or holder containing an intermediate or neutral electrode 7, which is cemented or otherwise permanently fastened in the core or holder and thus preventing fracture of the porcelain core or holder, which carries the main or positive electrode. The neutral electrode in Figure 2 has an over-hanging portion or arm 8 with a lateral extension 9 which plays or operates between the negative and positive electrodes 10 and 11 governing the spark between the gaps of the electrodes 7, 10 and 11. Obviously the core or holder adjacent the end of the threaded terminal of the core or holder is constructed for the reception of the upper or top end of the positive electrode, the electrode having movement caused by the expansion and contraction of the electrode, according to the size or amount of heat that may be subjected to the electrode.

The section 2 of the casing or shell has its reduced end exteriorly threaded at 12 for threaded engagement with the wall of the combustion chamber of the engine, for mounting the spark plug in its proper operating position.

The holder or porcelain core has a tapered shoulder 13 which co-operates with a similar tapered shoulder 14 of the interior of the section 2 of the shell or casing, there being a copper ring 15 between the two shoulders acting to prevent escape of gases from the combustion chamber of the motor. By adjusting the section 3 of the shell or casing tight and toward a shoulder 16 of the porcelain core or holder, it is possible to retain the copper rings 15 and 15*a* in position to insure the prevention of escaping gases from the combustion chamber of the engine.

The core or holder 5 passes through the section 3 of the shell or casing and has a cap, or head 17, a reduced portion 18 of which is threaded through the porcelain holder at 19. The exteriorly threaded portion 18 has at one end an interiorly threaded part connected at 20 to an enlarged extension 21 of the positive electrode 11, there being a coil or spiral connecting the positive electrode and the enlarged extension 21. By this coil or spiral the positive electrode is permitted to expand and contract. In this manner the cap or head 17 is connected to and carried by the porcelain core or holder.

The cap or head 17 has a reduced screw 22, on which a nut or member 23 is threaded, for clamping a wire or lead 24 to the cap or head from any suitable source of current supply. In connecting the threaded reduced portion 18 of the cap or head into the threaded part of the core a sufficient amount of cement is applied to the threads to make a secure union or connection. Where the coil or spiral 21*a* connects to the extension 21 a shoulder 21*b* is provided, against which the end of the reduced portion 18 engages, said shoulder acting to prevent the loss of cement from between the threads thereby insuring a secured joint. The under service of the cap or head 17 where it engages with the end of the core or holder is slightly under-cut at 17*a* to receive a certain amount of the cement to additionally insure a secured joint.

By providing a spark plug including a plurality of electrodes, a negative, positive and intermediate or neutral electrodes, so arranged as to have their sparking terminals affording a multiple of sparking gaps, the terminals aligned or out of alignment, it is possible to intensify or modify the spark between the electrode terminals, or lessen the intensity. In Figure 1, the preferred form of electrodes are provided, the positive electrode being mounted in and carried by the core or holder 5, the negative electrode 10, is carried by the section 2 of the shell or casing, while the neutral or intermediate electrode is also carried by the core or holder. This neutral electrode 7 has a cylindrical head 7*a*, located between the terminals of the positive and negative electrodes. This head 7*a* is slightly enlarged, and by adjusting the negative electrode toward and from the head 7*a* and to one side or the other relative to the head 7*a* by bending the negative electrode it is possible to regulate or govern the sparking action, namely to intensify it, or to lessen the intensity. If the negative electrode is bent to one side or the other, the extremity of the negative electrode will move toward and from the head of 7*a* of the neutral electrode thereby either lessening the intensity or increasing it and hence producing a more positive sparking action, such an action, such as will eliminate the ping.

In Figure 2 the electrodes are modified, the negative one still being carried by section 2 of the shell, the positive electrode being mounted in and carried by the core or holder, while the neutral electrode has its arm operable between the negative and positive electrodes, such construction still affording all the features and advantages as are carried out by the preferred construction in Figure 1. By keeping the terminals aligned, the intensity of the spark is at its maximum, and by adjusting the terminal of the neutral or intermediate electrode toward one side or the other and from between the negative and positive electrode terminals, it is possible to lessen the intensity of the spark. In this particular type of spark plug an expansion chamber is provided, there being a coil integrally connecting an end of a screw exposed at the upper wall of the chamber, and this coil produces a substantial heat range or body in said chamber, and the sparks created at the spark gap or gaps produce a substantial amount of heat along the positive electrode and in the expansion chamber, the area of the coil likewise increasing the heat range or heat body, and therefore a plug having a multiple of gaps, one gap set at 25 thousandths and one at 20 thousandths, giving a total of 45 thousandths range in the gaps, thus producing twice or double the heat range, of a single gap, set at either 25 or 20 thousandths (bearing in mind a gap with a total of 45 thousandths, meaning one gap of this size) would not function at all, same being too wide for any compression. This greater heat range combined with proper gaps of 20 to 25—M meets the cylinder compression from said 60 to 90 pounds. A single gap must be set for the compression best suited, having only the heat and gap range for the compression of each individual cylinder, according to the compression of the cylinder, it seldom is the case that after some wear that any two or more are alike. The advantage of the two gaps or range is to overcome such a condition, at the same time both the gaps and of course greater heat range means or synchronizes with the compression giving a more and powerful combustion, due to the fact of the proper gap and heat range.

As previously stated the positive electrode passes through said expansion chamber, said electrode in receiving heat from the two sparks at the electrode terminals create an unbroken

positive heat range along a positive electrode, also creating a substantial unbroken positive heat body in the expansion chamber. The coil integrally connecting the positive electrode and the screw in the upper wall of the chamber intensifies said unbroken heat body, and thereby causing a substantial spark at the sparking electrode terminals, all of which functions and structure acting to eliminate engine pings.

Engine "Pings" are caused by pre-ignition. In other words when spark plug electrodes burn away rapidly, it is evidenced by streaks of soot appearing on the upper portion of the insulator core, resulting by the spark not synchronizing with the compression stroke. The spark plug at bar with its electrodes properly set to give the two sparks in the proper heat range for firing, together with the sparks synchronizing with the compressor stroke will eliminate the "pings" in the engine.

The invention having been set forth what is claimed is:

1. A spark plug comprising a casing, a refractory core contained therein and having means for attaching an electrical conductor thereto, said core having a reduced end partially exposed on the interior of a firing chamber of a combustion motor, a plurality of electrodes, two of said electrodes mounted in the core, one being an intermediate or neutral electrode, the other being a positive electrode, another of said plurality of electrodes being negative and being permanently connected to an end edge of said casing, said core having an expansion chamber into which said positive electrode terminates into a coil subjected to heat from said chamber, said intermediate or neutral electrode having a sparking terminal co-operatively mounted for movement between the terminals of the positive and negative electrodes.

2. A spark plug comprising a casing, a refractory core contained therein and having means for attaching an electrical conductor thereto, said core having a reduced end partially exposed on the interior of a firing chamber of a combustion motor, a plurality of electrodes, two of said electrodes mounted in the core, one being an intermediate or neutral electrode, the other being a positive electrode, another of said plurality of electrodes being negative and being permanently connected to an end edge of said casing, said intermediate or neutral electrode having a sparking terminal co-operatively mounted for movement between the terminals of the positive and negative electrodes, said core having an expansion chamber through which the positive electrode passes, one of said electrodes being allowed free movement caused by expansion and contraction of said electrode according to the length or amount of heat subjected to said electrode from the expansion chamber.

3. A spark plug comprising a casing, a refractory core contained therein and having means for attaching an electrical conductor thereto, said core having a reduced end partially exposed on the interior of a firing chamber of a combustion motor, a plurality of electrodes, two of said electrodes mounted in the core, one being an intermediate or neutral electrode, the other being a positive electrode, another of said plurality of electrodes being negative and being permanently connected to an end edge of said casing, said intermediate or neutral electrode having a sparking terminal co-operatively mounted for movement between the terminals of the positive and negative electrodes, said core having an expansion chamber, one of said electrodes being allowed free movement caused by expansion and contraction of said electrode according to the size or the amount of heat from said chamber subjected to said electrode, one of said electrodes not being cemented or permanently fastened with said core, thus allowing free movement preventing fracture of the core.

4. In a spark plug, the combination with a casing, of an insulating core provided with a positive electrode and an intermediate or neutral electrode contained therein, said casing having a negative electrode on one of its end edges, the sparking terminals of all of said electrodes being aligned and spaced causing sparking gaps to be formed, said insulating core having an expansion chamber through which the positive electrode passes and allowing expansion and contraction of the positive electrode according to the size of the positive electrode or the amount of heat derived from said chamber and subjected to the positive electrode.

5. A spark plug comprising a casing, a refractory core contained therein and having means for attaching an electrical conductor thereto, said core having a reduced end partially exposed on the interior of a firing chamber of a combustion motor, a plurality of electrodes, two of said electrodes mounted in the core, one being an intermediate or neutral electrode, the other being a positive electrode, another of said plurality of electrodes being negative and being permanently connected to an end edge of said casing, said intermediate or neutral electrode being provided with a sparking head co-operatively mounted between the terminals of the positive and negative electrodes.

6. A spark plug comprising a casing, a refractory core contained therein and having means for attaching an electrical conductor thereto, said core having a reduced end partially exposed on the interior of a firing chamber of a combustion motor, a plurality of electrodes, two of said electrodes mounted in the core, one being an intermediate or neutral electrode, the other being a positive electrode, another of said plurality of electrodes being negative and being permanently connected to an end edge of said casing, said intermediate or neutral electrode being provided with a sparking cylindrical element, said negative electrode being adapted to be adjusted towards and from one side to the other of said cylindrical surface of the element for regulating the sparking action.

7. In a spark plug the combination with a casing, of an insulating core provided with a positive electrode and intermediate or neutral electrode contained therein, said casing having a negative electrode on one of its end edges, the sparking terminals of all of said electrodes being aligned and spaced causing sparking gaps to be formed, said insulating core having an expansion chamber through which the positive electrode passes and allowing expansion and contraction of the positive electrode according to the size of the positive electrode, said electrode terminals being set for different ranges or gaps for producing twice or double the heat range, thereby creating a substantial volume of heat in said chamber, the greater part of said heat range being derived from a positive electrode and creating a substantial spark at the sparking terminals of said electrodes, said electrodes being set to produce two sparks simultaneously on said positive heat range, thereby eliminating engine pings.

8. In a spark plug the combination with a casing, of an insulating core provided with a positive electrode and intermediate or neutral electrode contained therein, said casing having a negative electrode on one of its end edges, the sparking terminals of all of said electrodes being aligned and spaced causing sparking gaps to be formed, said insulating core having an expansion chamber through which the positive electrode passes and allowing expansion and contraction of the positive electrode according to the size of the positive electrode, said electrode terminals being set for different ranges or gaps for producing twice or double the heat range, thereby creating a substantial volume of heat in said chamber, the greater part of said heat range being derived from a positive electrode and creating a substantial spark at the sparking terminals of said electrodes, said electrodes being set to produce two sparks simultaneously on said positive heat range, thereby eliminating engine pings, a heat coil in said chamber integrally connecting the positive electrode and the upper wall of said chamber, the said coil creating a substantial heat range or body in said chamber, thereby insuring the elimination of engine pings.

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