J. E. LEHR.

SPARK PLUG.

APPLICATION FILED MAY 31, 1919.

1,370,655.

Patented Mar. 8, 1921.

2 SHEETS—SHEET 1.

Fig. 1.

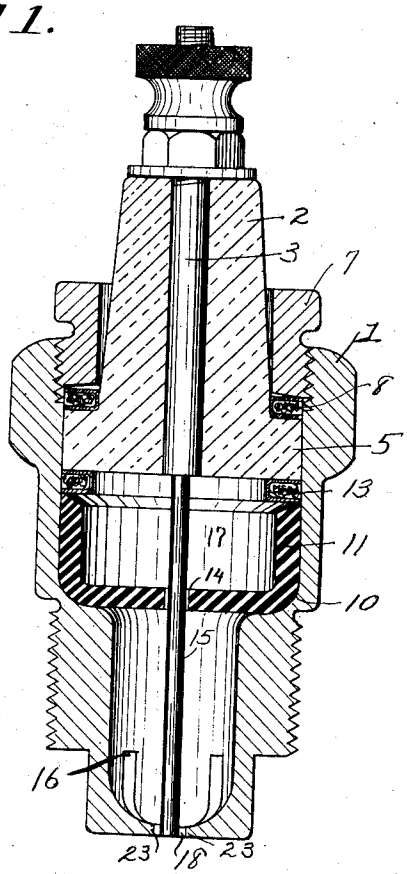
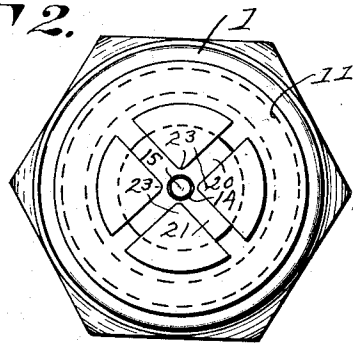


Fig. 2.



Witness

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2 SHEETS—SHEET 2.

Fig. 3.

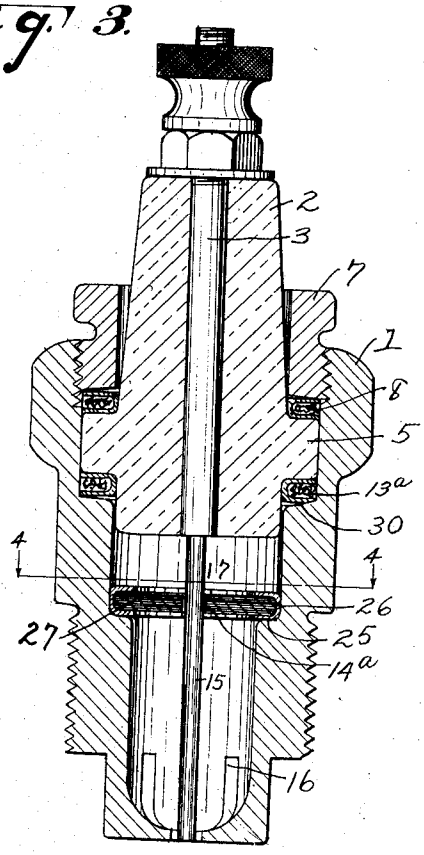
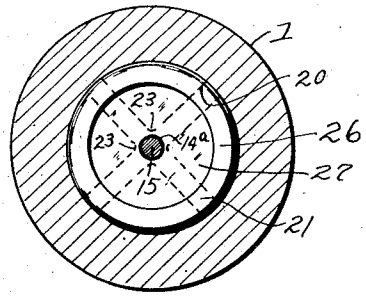


Fig. 4.



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UNITED STATES PATENT OFFICE.

JOSEPH ELMER LEHR, OF MILWAUKEE, WISCONSIN.

SPARK-PLUG.

1,370,655. Specification of Letters Patent. Patented Mar. 8, 1921.

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To all whom it may concern:

Be it known that I, JOSEPH ELMER LEHR, a citizen of the United States, residing at Milwaukee, county of Milwaukee, and State of Wisconsin, have invented new and useful Improvements in Spark-Plugs, of which the following is a specification.

My invention relates to improvements in spark plugs.

The object of my invention is to provide a form of construction in which the porcelain, or other embedding material, will be protected from the heat and shock of the so-called explosions within the engine cylinder, and in which the contact points will be kept clean by circulating currents, and a guard provided for the central electrode, which will prevent it from deflecting or warping into contact with the opposing terminals of the plug, without developing arcing tendencies, the guard being formed of non-conducting material.

In the drawings:—

Figure 1 is a vertical sectional view of a spark plug embodying my invention in one form.

Fig. 2 is a view of my improved spark plug as seen from the lower end.

Fig. 3 is a view similar to Fig. 1, illustrating a modified form of construction.

Fig. 4 is a sectional view, drawn on line 4—4 of Fig. 3.

Like parts are identified by the same reference characters throughout the several views.

The casing 1, insulating head 2, formed of porcelain or other embedding material, and the central electrode 3, conform generally to established practice, the porcelain having an annular anchor flange 5 fitted within the casing, and held therein by a clamping nut 7 with interposed packing at 8.

But it will be observed that the casing 1 is provided with an interior annular concavely rounded shoulder at 10, upon which a cup-shaped member 11 is seated; and between the upper margin of this cup-shaped member 11 and the flange 5 of the embedding member, or porcelain body, I have mounted an additional cushioning or packing ring 13, which is supported by the upper margin of the cup-shaped member 11, and upon which the porcelain body may be clamped down by means of the clamping ring 7.

The cup-shaped member 11 is preferably formed of vitrified aluminum clay, from which iron or other conducting material is absent. Such clay, when vitrified or fused, possesses high di-electric strength, and its co-efficient of expansion and contraction under varying temperatures is not radically different from that of the metal composing the casing 1. Its tensile strength is not great, but it is capable of considerable resistance to crushing strains, and when made of substantial thickness, it will not fracture under the pressures exerted by the gases in the cylinder, which, of course, extend into and fill the spark plug cavity in which this cup-shaped member 11 is seated.

The central portion of the bottom of the member 11 is provided with an aperture 14, through which the central electrode 15 loosely passes, preferably without contact with the member 14, whereby the gases are allowed to pass from the portion 16 of the spark plug cavity into the portion 17, thereby allowing for circulatory currents and equalization of pressures.

Electrode 15 extends to the lower end of the casing, with its extremity in a central aperture 18 formed in the end wall of the casing. This wall, and the inner end of the casing, is preferably cross channeled, or slitted, as clearly shown at 20 and 21 in Fig. 2, thereby forming a set of inwardly projecting V-shaped members 23 at the bottom of the casing, which constitute opposing terminals, the inner angles of which are spaced from the extremity of the electrode 15, whereby the igniting arc may be formed across the gap between the electrode 15 and the terminals 23.

It will be observed in Fig. 1, that the channels or slots 20 and 21 extend upwardly in the casing a substantial distance, and provide openings of sufficient size to allow the gases to freely enter the cavity 16. But in order to reach the cavity 17, these gases are required to pass through the narrow annular passage between the central electrode 15 and the wall of the aperture 14 in the cup-shaped member 11. Therefore, in the operation of an engine to which this spark plug is applied, there will ordinarily be a difference in pressure in the cavity 17 from that existing in the cavity 16, and a strong current of air or gas will therefore be passing almost continuously through the open-

ing 14. This current will, of course, flow downwardly when the pressure in the engine cylinder is at minimum, and will flow upwardly during the compression stroke, and during the initial portion of the combustion interval.

Owing to the fact that the bottom wall of the cup-shaped member 11 is of substantial thickness, the aperture 14 constitutes a nozzle adapted to deliver a blast of air or gas downwardly along the electrode 15 during the low pressure intervals in the engine cylinder, thereby blowing off soot, and effectually cleaning the electrodes after each combustion period.

I have also found that the aluminum clay member 11 is a good heat conductor, and that it carries the heat from the interior of the cavities outwardly to the walls of the casing, and allows it to dissipate to the exterior with such rapidity that the porcelain is very effectively protected, not only from excess pressures or impacts, but also from excessive heat. The interposed packing at 13 is a non-conductor of heat, and therefore the member 11 transfers its heat to the casing 1, without facilitating any transfer of heat to the porcelain, and without causing any unequal heating of the porcelain member, such as has heretofore frequently caused a fracture of the porcelain embedding members of spark plugs.

Owing to the fact that the member 11 is composed of non-conducting material, it may be brought into close proximity to the electrode 15, without any danger of short circuiting from the electrode through this member 11 to the casing, and of course without danger of arcing. In fact, the member 11 may be brought into such proximity to the electrode 15 as to hold it from bending out of shape, if, for any reason due to heat or pressure, this member might otherwise be forced laterally into contact with one of the terminals 23.

In Fig. 3, the structure of the spark plug is exactly the same as in Fig. 1, and the same reference letters are applied thereto, with the exception that the cup-shaped members 11 is omitted and a shoulder 25 provided, which receives a ring 26, U-shaped in cross section, with upper and lower flanges projecting inwardly, and receiving a partition member 27 composed of superposed layers of mica, the outer margins of which are embraced, preferably under pressure, between the upper and lower flanges of the ring 26. This mica partition is centrally apertured at 14^a, and the electrode stem 15 extends through the aperture in the same manner as above described with reference to Fig. 1.

In this modified construction shown in Fig. 3, the results obtained are substantially the same as in Fig. 1, except that the mica does not convey the heat as readily to the walls of the casing, and it also does not provide an upwardly extending flange to receive a packing upon which the porcelain member may be clamped. Therefore, the casing in the modified form of construction is provided with an additional interior shoulder 30, which receives a packing ring 13^a, upon which the seating flange 5 of the porcelain member is clamped.

Under some conditions the structure shown in Fig. 1 may be preferred, but under other conditions the structure shown in Fig. 3 would be preferred, and particularly where it is difficult to secure a clay of the desired quality, or to secure it in properly vitrified form. In such cases, or in cases where it is desired to reduce the cost of construction to a minimum, a partition formed of mica, and seated in a retaining ring will be found very satisfactory.

I claim:

1. A spark plug, comprising the combination with a casing having an interior annular shoulder, and provided with electrodes at its lower end, a cup-shaped centrally apertured partition member, composed of di-electric material, loosely seated on said shoulder, with its annular wall extending upwardly, a central electrode extending through the partition aperture, out of contact with the walls thereof, and with its upper end embedded in a supporting body of embedding di-electric material, and means for clamping said embedding material to the upper margin of the partition member to be supported thereon.

2. A spark plug, comprising the combination with a casing having an interior annular shoulder, and provided with electrodes at its lower end, a cup-shaped centrally apertured partition member, composed of di-electric material, loosely seated on said shoulder, with its annular wall extending upwardly, a central electrode extending through the partition aperture, out of contact with the walls thereof, and with its upper end embedded in a supporting body of embedding di-electric material, and means for clamping said embedding material to the upper margin of the partition member to be supported thereon, with suitable packing interposed.

In testimony whereof I affix my signature in the presence of two witnesses.

JOSEPH ELMER LEHR.

Witnesses:
O. C. WEBER,
A. J. MCKERIHAN.