Nov. 3, 1925. 1,560,081

H. G. GRIER

SPARK PLUG

Filed March 9, 1916

Fig. 1.

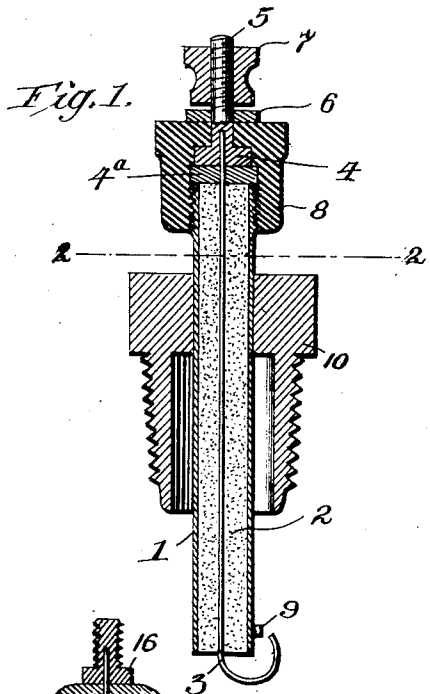
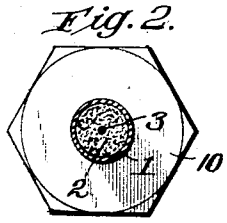


Fig. 2.



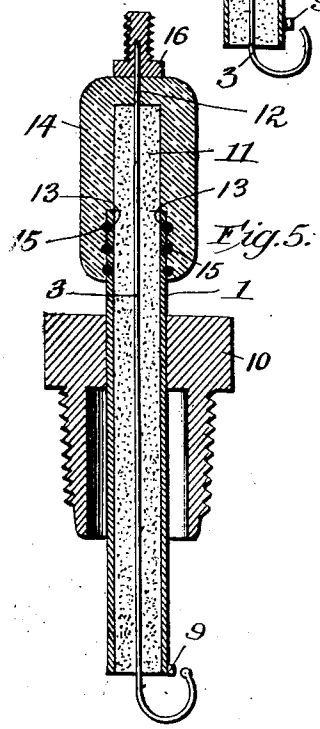


Fig. 5.

Fig. 3.

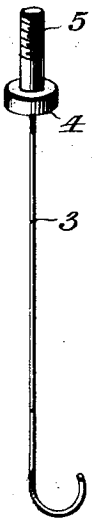
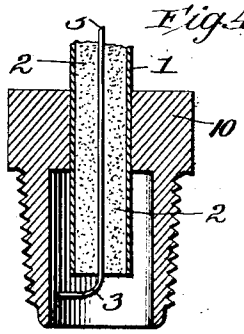


Fig. 4.



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UNITED STATES PATENT OFFICE.

HARRY GRAHAM GRIER, OF BROOKLYN, NEW YORK.

SPARK PLUG.

Application filed March 9, 1916. Serial No. 83,073.

To all whom it may concern:

Be it known that I, HARRY G. GRIER, a citizen of the United States, residing at 601 Park Place, borough of Brooklyn, in the county of Kings and State of New York, have invented a certain new and useful Improvement in Spark Plugs, of which the following is a specification.

My present invention pertains to an improved spark-plug.

Spark-plugs as now made commonly employ one or more insulating elements formed of porcelain or other refractory material, which materials frequently crack or break, both in assembling and handling, and also when subjected to the strains incident to their use in explosive or internal-combustion engines. The use of such porcelain elements also entails the employment of gaskets or packing of one or another form in their mounting.

The present invention has for its object the production of a spark-plug in which the use of such materials is done away with, and instead of the porcelain element there is employed a suitable dielectric which, during the process of the formation of the plug, will be so compacted or condensed that it will withstand all the strains to which the plug is subjected in use, without deterioration. Such dielectric material has a higher heat-conductivity in proportion to its electrical conductivity than the usual dielectrics now employed, a point of manifest advantage, in that it conducts the heat which it receives outwardly to the grounded element or bushing.

Furthermore, by reason of the manner in which the plug, which forms the basis of this invention, is assembled, the employment of gaskets is done away with, thereby not only lessening the number of parts employed, but also reducing the chance of loose joints and leakage.

An exemplification of the invention is illustrated in the annexed drawings, wherein:

Figure 1 is a longitudinal sectional view of the plug;

Fig. 2 a cross-section on the line 2—2, of Fig. 1;

Fig. 3 a perspective view of the positive or internal electrode;

Fig. 4 a view similar to Fig. 1, showing a slightly modified arrangement; and

Fig. 5 a similar view of a still further modification.

Referring to the construction shown in Figs. 1 to 3, 1 denotes a metallic tube, formed from a suitable metal susceptible of being drawn or reduced in diameter; 2 a condensed dielectric filling which in the final form of the plug is condensed or compacted in the process of formation to such a degree that it becomes so dense and hard that it will withstand the explosive force of the engine charge without disintegrating or blowing out, or in any manner cracking or breaking down; and 3, the central electrode, formed of wire and embedded in the insulating material 2. Any suitable material which at once is a dielectric and is of such a nature that it will withstand the heat produced within the engine cylinder may be employed such, for instance, as magnesium sulfate or magnesium oxid.

Initially the wall of the metallic tube 1 is much thicker and the tube is of a greater diameter than that of the finished element. The wire 3 is also of greater diameter. The wire which is, of course, longer than the tube, is placed centrally therein and surrounded by the insulating material, also positioned in the tube. The parts thus assembled are all drawn down at one operation, which has the effect of reducing the diameter of the tube, the thickness of its wall, the diameter of the wire, and simultaneously compacting and densifying the insulating material. The stock thus drawn is cut into shorter lengths suitable for assembling with other parts of the plug, the outer tube and insulating material being skinned or cut away as required.

The upper end of the wire preferably has secured to it a member consisting of a disk or button-shaped element 4 of a diameter equal to that of the tube, and an upwardly-extending, threaded stem 5, adapted to receive the usual terminal binding washer 6 and nut 7.

The upper end of the tube is preferably externally threaded and a lava or similar cap 8 is screwed thereon, the cap being of such internal conformation as to fit closely to the disk 4 and the adjacent portion of the stem 5, and to hold an insulating disk or washer 4^a between the disk 4 and the upper end of the tube 1, thus insulating the wire 3 and its connections from said tube.

The lower protruding portion of the electrode or conductor will be curved around so that its end will stand at the proper spark-

ing distance from the tube 1 or from a terminal element 9 secured thereon.

The usual bushing for securing the plug in position is employed, but in the present instance the bushing 10 is shrunk directly upon the tubular element 1 and, as a consequence, there is an absence of the gasket usually present between the bushing and the adjacent element, ordinarily the porcelain bushing.

In Fig. 4 a plug, produced in the same manner as that illustrated in the other figures is shown, but in this instance the lower end of the tube 1 terminates within the bushing and the end of the electrode 3 extends over toward the bushing 10, the spark gap being formed between the two.

In Fig. 5 I have shown a slightly different form of plug embodying the essence of my invention, wherein the outer metallic tube, indicated by 1, is skinned or removed from around the compressed insulating material, leaving a projecting portion 11, and such material is likewise skinned or removed from the upwardly-projecting portion 12 of the conducting wire, designated as a whole by 3. The upper outer portion of the tube 1 is provided with a plurality of encircling grooves 13, and a cap 14 (having an internal recess of such formation as to receive the upper end of the tube and the upper protruding portion 11 of the insulating material) is placed over the upper end of the tube and the section 11. Said cap will be provided with grooves, as 15, so spaced as to coincide with the grooves 13 when the parts are assembled, and a suitable heat-resisting cement such, for example, as plaster-of-Paris, will be placed between the parts when they are assembled. Such cement entering the opposite grooves 13 and 15, upon setting will bind the cap 14 securely to the lower portion of the plug. The cap 14 may be formed of any suitable material such, for instance, as porcelain, lava or glass, and is provided with an opening in its upper end through which the upwardly-extending portion 12 of the conductor 3 may pass. An exteriorly-threaded metallic terminal 16 will be secured upon the outer end of the projecting end 12. The bushing 10, as under the other constructions, may be sweated, welded or brazed to the exterior lower portion of the tubular member 1, or secured in any other desired manner, so long as a gas-tight joint between the parts is effected.

A plug produced in accordance with my invention is at once relatively cheap and likewise durable; there are no parts which will crack or break, either due to careless handling or by reason of stress or strain incident to placement; or strains or stresses due to pressure, contraction, or expansion, when the engine is in operation.

It is to be noted that the insulating material 2 is initially friable or pulverulent, as contradistinguished from those materials which in the process of formation are plastic and set, or which partake of a vitreous nature when completed. In other words, the insulating or dielectric material employed by me does not actually become a single solid piece like a porcelain bushing which, as is well known will crack and open up under heat, thereby producing a short-circuit and failure in the plug; but on the other hand my initially friable and finally compacted or densified dielectric will maintain its integrity under all working conditions.

No claim is made herein to the method or art of manufacturing spark-plugs as above set forth, the same being reserved for a divisional application pursuant to the requirement of the Patent Office.

Having thus described my invention, what I claim is:

1. A spark-plug, comprising a metallic tube; a conducting wire extending therethrough, the lower end of the wire forming one terminal of the spark-plug; a dielectric compacted or densified within the tube, surrounding the wire, insulating the same from the tube and forming the means for maintaining the wire in place; and a bushing secured to the outer face of the tube and effecting a gas-tight joint therewith.

2. A spark-plug, comprising a metallic tube; a conducting wire extending therethrough, the lower exposed end of the wire forming one terminal of the spark-gap; a magnesium compound compacted and densified within the tube and insulating the wire therefrom; and a bushing sweated upon the tube.

3. A spark-plug, comprising a metallic tube; a conducting wire extending therethrough, the lower exposed end whereof forms one terminal of the spark gap; a compacted dielectric material filling the tube extending and being exposed above said tube and insulating the wire from the tube, the upper end of the wire extending above such exposed portion of the dielectric material; a cap-piece of insulating material secured upon the upper end of the tube and surrounding the exposed portion of the dielectric, said cap having an opening in the upper end thereof through which the upper end of the wire may pass; and a metallic terminal secured upon the upper end of the wire.

In testimony whereof I have signed my name to this specification.

HARRY GRAHAM GRIER.