Jan. 7, 1936. I. E. CLOSE 2,026,822

SPARK PLUG

Filed May 5, 1934

Fig. 1.

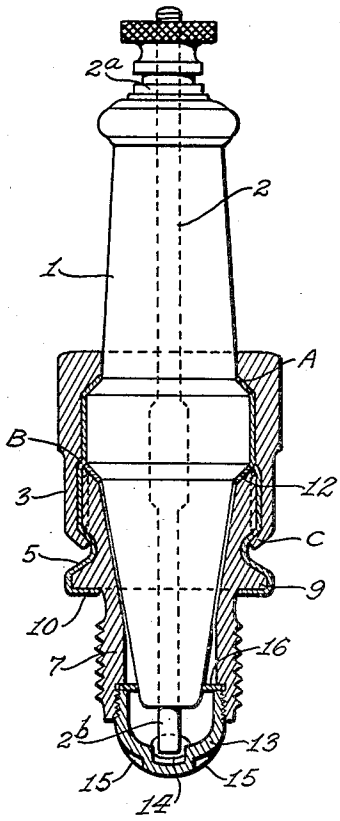


Fig. 2.

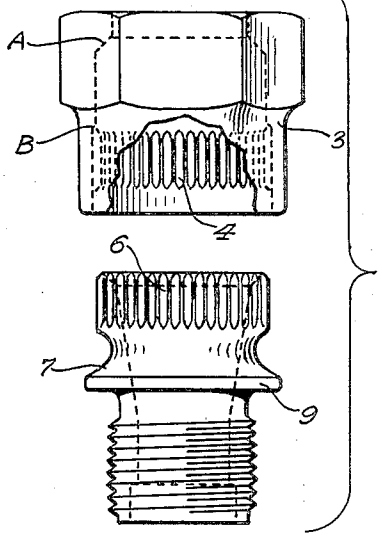


Fig. 3.

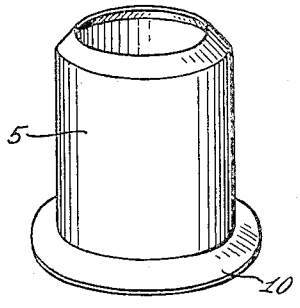
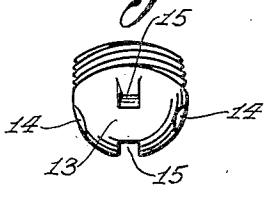


Fig. 4.



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SPARK PLUG

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7 Claims. (Cl. 123—169)

My invention relates to spark plugs of the type commonly used for the ignition of gases in the cylinders of internal combustion engines.

Spark plugs of the type in question are provided with an insulator through which the electrode passes. This electrode is connected at its upper or outer end to the source of electrical supply and has provision at its lower or inner end for the dissipation of the energy in the form of an electric spark. Since the lower end of the insulator carrying the discharge point of the electrode necessarily must be located on the inside of the cylinder, the insulator is subjected to heat created by the firing of the gases in the cylinder and also to the heat generated by the electric spark. This heat causes serious deterioration and shortening of life of the insulator and spark points, and it is not unusual for such insulators to crack under the intense heat and their usefulness be destroyed.

One of the objects of my invention is to provide a spark plug of such design that its lower end will be shielded against the destructive effects of the heat in the cylinder, and another object is to provide a device of this type in which heat unavoidably transferred to the insulator will be more adequately dissipated than has been possible heretofore.

Referring to the accompanying drawing in which one embodiment of my invention is shown, Fig. 1 represents a partial sectional view of the complete plug; Fig. 2 shows perspective views of the upper and lower shells; Fig. 3 is a perspective view of the heat conducting element; and Fig. 4 is a perspective view of the cap.

The central porcelain insulator 1, as is customary, is provided with an electrode 2 extending from the upper end or head 2^a of the plug to which the ignition wire is connected, through the insulator to the spark point 2^b at the lower or inner end thereof. This insulator, as is usual in spark plugs of this type, may be shaped generally as shown, with an enlarged portion toward the middle thereof so arranged that the insulator will be securely held in position by the shell, as hereinafter described.

Surrounding the insulator is a shell, preferably of metal, and in the embodiment shown this shell consists of two parts, one being hereinafter referred to as the upper shell part 3 and the other as the lower shell part 7. A heat element 5 is interposed between the insulator and the shell, as more fully described below. The outer surface of the upper shell part 3, or a portion thereof, may be formed hexagonal, so as to accommodate wrenches used in the assembly of the plug and in positioning the plug in place. In the embodiment shown, the upper shell part 3, toward its lower end, is provided with vertically disposed serrations or grooves 4 on its inner cylindrical surface. These grooves are adapted and arranged to engage, through the intermediate heat element 5, corresponding grooves 6 on the upper end of the lower shell part 7. The grooves, 4 and 6, as indicated above, are so arranged that when the upper and lower shell parts are forced together with the heat element 5 interposed between them, the grooves of the two shell parts will mesh and interlock in such a manner as to form a tight connection between the two shells.

Toward its upper end the upper shell part 3 is formed with an inner conically shaped surface as at A adapted to conform to and grip the surface of the insulator. An offset is provided in the inner cylindrical surface of the upper shell part, as at B, this offset being positioned so as to be adjacent the bottom of the enlarged portion of the insulator when the plug is assembled, as indicated in Fig. 1.

The lower shell part 7 is provided towards its lower end with threads suitable for attaching the plug to the engine block in the usual manner. Also, the lower shell part 7 is provided with a circular shoulder 9 located substantially as shown with respect to the lower end of the upper shell part 3, this shoulder being adapted to force the heat element 5 outwardly and upwardly against the upper shell part as the two shell parts are forced together. If desired, the lower end of the upper shell part can be rolled or peined as at C to secure more intricate contact between the two shell parts and the interposed heat element.

It is to be noted that in the embodiment shown the upper and lower shell parts are provided with the grooves 4 and 6 respectively, as described, for the purpose of securely attaching these parts to each other to form a composite shell. I wish to point out, however, that in certain types of plugs, particularly those of small size, the use of grooves, as described, may not be necessary or expedient. In an embodiment in which the shells are not provided with grooves, the dimensions of the corresponding adjacent surfaces of the two shell parts and the thickness of the metal composing the heat element would be such that as the two shell parts were forced together to form a composite shell, with the heat element interposed between them, a secure and binding fit would result.

The heat element 5 is composed of a malleable material of high heat conductivity, for example,

sheet metal, such as copper, of suitable thickness and flexibility so that when the heat element is inserted between the upper and lower shell parts and between the upper shell part and the insulator, as shown in Fig. 1, the pressure exerted by the upper shell part will force the heat element into close contact with the adjacent portion of the lower shell part and also into close contact with the adjacent portion of the insulator. More particularly, the pressure between the upper and lower shell parts, and the action of the gasket 12 as described below, will force the heat element into the offset at B in the upper part. Thus, as will be evident, the heat element is forced into close contact with the upper and lower shell parts and also with the insulator, and furthermore, the heat element, by this means, is held securely in position. If desired, the lower end of the heat element may be arranged so as to form a flange 10 around the shoulder 9. This flange provides a sealing gasket between the spark plug and the engine block and provides direct contact between the heat element and the relatively cool water-jacketed engine block so as to more effectually dissipate the heat from the insulator.

Arranged so that it may be disposed between the insulator 1 and the top of the lower shell 7 is a ring 12, preferably composed of malleable material, for example, copper. This ring has its principal surface inclined to the center line of the plug, this inclination corresponding to the angle of that portion of the surface of the insulator lying between the central extended portion and the lower portion. A similar ring is commonly used in the assembly of spark plugs, its principal function being to act as a sealing gasket and also as a cushion between the insulator and the metal shell. In the plug embodying my invention, however, the ring 12 has an added function, namely, to more securely hold the heat element 5 in position. This result is brought about as follows: As the upper and lower shell parts are forced together, as above described, the ring 12 will be compressed between the insulator 1 and the lower shell part 7, and being composed of malleable material it will be forced outwardly and upwardly against the heat element 5, forcing the latter into the offset at B in the upper shell part.

In the embodiment shown a cap 13 is attached to the lower or inner end of the lower shell part 7, as shown in Fig. 4. This cap may be provided with threads adjacent its upper end arranged to engage corresponding threads in the bore of the lower shell part, or attachment may be secured by any other suitable means. The purpose of the cap is to provide a heat protecting shield for the lower end of the insulator 1 and the spark point 2^b attached thereto, but in order that the gases to be ignited may come in contact with the spark, openings 14 are provided in the cap and in addition channels 15 are provided for the same purpose and for the additional purpose of accommodating a wrench used in the attachment of the cap. This cap also forms the ground side of the electrical circuit, that is, the electric spark passes from the spark point 2^b to the cap, and it will be noted that with this arrangement the path of the spark is not limited to a single path, as is the case with plugs where the ground is in the form of a single point attached to the plug. This has the advantage of spreading the spark and also reducing the deterioration on the ground side of the spark gap.

If desired, a sealing ring 16 may be interposed between the outer surface of the insulator and the inner surface of the lower shell part, this ring being generally positioned as indicated in Fig. 1. The principal function of this ring is to protect the upper part of the insulator from the heat gases adjacent the lower end of the plug.

It is evident that my invention provides a new and useful improvement in spark plugs in that the lower end of the insulator and the spark points are shielded from the excessive heat due to the ignited gases, and, furthermore, provides a means, through the heat element, of dissipating heat transmitted to the insulator, with the result that deterioration of the insulator and the spark points will be greatly lessened and the life thereof prolonged. In addition to these advantages the absence of deterioration heretofore common in spark plugs will permit a more efficient operation of the engine than has heretofore been possible.

I contemplate changes from the embodiment shown and the modifications thereof as described in the specification. The heat element, for example, might be extended upwardly to contact a greater portion of the surface of the insulator, with the shell arranged to correspond. Again, if desired, the two shell parts might be welded together to form a composite shell. I contemplate such and other changes as will not affect the spirit of my invention, which in essence, provides for a spark plug having a heat element in direct and close contact with the surface of the insulator and in direct or indirect contact with the engine block, whereby the amount of heat transmitted to the insulator will be limited and the heat actually transmitted thereto will be effectively dissipated.

What I claim as new and desire to secure by Letters Patent, is:—

1. In a spark plug adapted for use with an internal combustion engine and including as parts thereof an insulator and a shell enveloping a portion of said insulator and an element of heat conducting material interposed between said insulator and said shell so as to be in direct contact with the block of said engine, whereby heat transmitted to said insulator will be effectively dissipated to said block.

2. A spark plug adapted for use with an internal combustion engine, and comprising an insulator, a shell enveloping a portion of said insulator and an element composed of heat conducting material interposed between said insulator and said shell, said element having intimate contact with said insulator and with the block of said engine whereby heat transmitted to said insulator will be effectively dissipated to said block.

3. A spark plug adapted for use with an internal combustion engine and comprising an insulator and a two-part shell enveloping a portion of said insulator, and an element composed of heat conducting material interposed between said insulator and the parts of said shell so as to be in intimate contact with said insulator and the parts of said shell, means for securely fastening the parts of said shell to one another and said element also having intimate contact with the block of said engine whereby heat transmitting to said insulator will be effectively dissipated to said block.

4. A spark plug adapted for use with an internal combustion engine and comprising an insulator, a shell encircling said insulator, a cap attached to the bottom of said plug to shield the bottom of said insulator from heat and an ele-

ment composed of heat conducting material interposed between said insulator and said shell in intimate contact with said insulator and having heat transmitting contact with the block of said engine, whereby heat in said insulator will flow through said element to said block to effectively reduce the temperature of said insulator.

5. A spark plug adapted for use with an internal combustion engine and comprising an insulator having a spark point adjacent its lower end, a shell encircling said insulator, a perforated cap attached to the bottom of said plug to shield the lower end of said insulator and said spark point from heat, an element composed of heat conducting material interposed between said insulator and said shell in intimate contact with said insulator and having heat transmitting contact with the block of said engine whereby heat in said insulator will flow through said element to said block to effectively reduce the temperature of said insulator.

6. A spark plug adapted for use with an internal combustion engine and comprising an insulator having a spark point adjacent its lower end, an element of heat conducting material, a shell encircling said insulator and composed of two parts having grooves on their adjacent surfaces so adapted and disposed that when said parts are forced together with said element interposed between them they will be intimately fastened together and said element will be in intimate contact with said insulator, said element also having intimate contact with the block of said engine whereby heat in said insulator will flow through said element to said block to effectively reduce the temperature of said insulator.

7. In a spark plug adapted for use with an internal combustion engine, in combination, an insulator having a spark point adjacent its lower end, a shell encircling said insulator and composed of two parts, an element of heat conducting material interposed between said insulator and the parts of said shell, means for fastening the parts of said shell together with said element interposed between them, said element also having heat transmitting contact with the block of said engine, a perforated cap adjacent the lower end of said insulator and said spark point adapted and arranged to shield said insulator and said spark point from heat, and a gasket interposed between the surface of said insulator adjacent its lower end and said shell adapted and arranged to prevent the flow of heated gases upwardly along said insulator.

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