H. F. PROVANDIE.

SPARK PLUG.

APPLICATION FILED MAY 18, 1909.

968,687.

Patented Aug. 30, 1910.

Fig. 1.

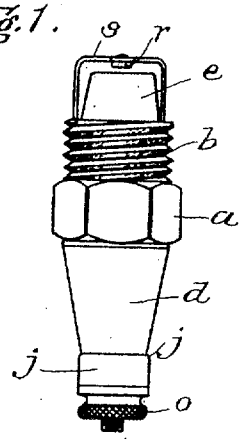


Fig. 2.

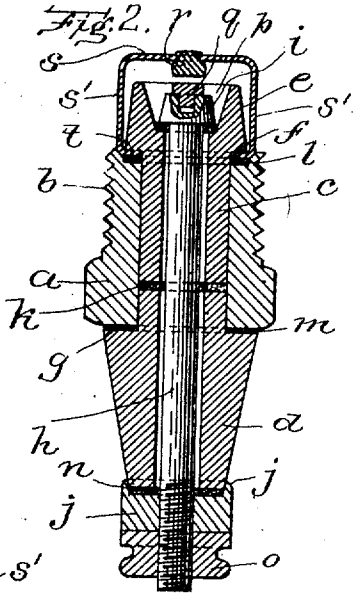


Fig. 3.

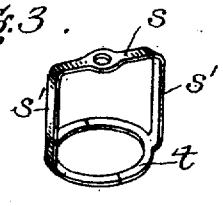


Fig. 5.

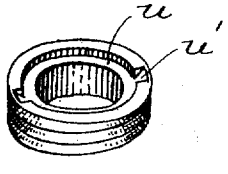
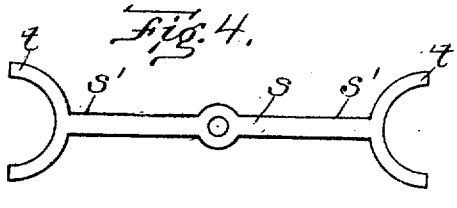


Fig. 4.



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UNITED STATES PATENT OFFICE.

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SPARK-PLUG.

968,687. Specification of Letters Patent. Patented Aug. 30, 1910.

Application filed May 18, 1909. Serial No. 496,735.

To all whom it may concern:

Be it known that I, HERBERT F. PROVANDIE, of Boston, in the county of Suffolk and State of Massachusetts, have invented certain new and useful Improvements in Spark-Plugs, of which the following is a specification.

This invention relates to spark plugs, the principal use of which is to ignite the explosive mixture in the cylinder or combustion chamber of an internal-combustion engine, and has for its object to increase the length of effective use of such plugs, by diminishing the tendency of soot to collect and short circuit the sparking electrodes, to simplify the construction of the plug, and in other ways to improve the construction of the plug and reduce the cost thereof.

In carrying my invention into effect, I have devised a plug of which the important characteristics are described in the following specification and illustrated in the accompanying drawings, wherein the preferred embodiment of my invention is shown.

Figure 1 is an elevation of a spark plug embodying the principles of my invention. Fig. 2 is a central sectional view of the same on an enlarged scale. Fig. 3 is a perspective view of the bridge for one of the electrodes. Fig. 4 is a plan view of the blank in which such bridge is formed. Fig. 5 is a perspective view of the end of the shell of the spark plug.

The same reference characters indicate the same parts in all the figures.

The device consists of an outer shell *a* which is preferably of metal and a conductor of electricity, said shell being threaded through a part of its length at *b* so that it may be screwed into the wall or head of an engine cylinder, and formed at its outer end similarly to the head of a bolt, to enable it to be gripped by a wrench for screwing it into position and unscrewing it. The shell is centrally bored and receives insulators *c* and *d* which are formed as sleeves or tubes of non-conducting material, preferably porcelain, which are set into the shell from opposite ends, and the combined length of which is greater than the length of the shell, so that the insulators project beyond the opposite ends of the shell. The projecting end of the sleeve or insulator *c* is formed with a head *e* of greater diameter than the bore of the shell, which somewhat overlaps the adjacent end of the shell, there being a shoulder *f* where the head joins the body or shank of the sleeve. The other insulator *d* also has a shoulder *g* overlapping the adjacent end of the shell, and these sleeves are drawn together and clamped against the shell by a conductor or electrode bar *h* which has a head *i* upon one end bearing against the insulator *c*, and a nut *j* screwed upon the other end bearing against the insulator *d*. Interposed between the two insulators is a gasket or packing *k* of somewhat elastic insulating material, such as asbestos fiber, while between the shoulders of the insulators and the respective ends of the shell are gaskets *l* and *m*, respectively. Another gasket *n* is inserted between the nut *j* and the insulator *d*. These gaskets are provided for the purpose of permitting expansion and contraction of the parts, due to unequal heating and cooling, without danger of breaking the fragile insulators. On the nut *j* is formed a flange or rib *j'* projecting axially from its edge nearest the insulator *d*, which surrounds the gasket *n* and fits closely against the insulator. Coöperating with the nut *j* is a thumb nut *o* which is used for clamping the wire or other conductor thereto to make electrical connection from a source of electrical energy with the conductor or electrode bar *h*.

The head *i* of the bar *h* is set into a recess or chamber *p* in the projecting end or head of the insulator *c* and carries on its end a sparking point *q* of suitable metal, adapted to withstand the destructive effect of electric sparks. Coöperating with this sparking point or electrode is a complemental electrode or spark point *r* mounted upon a bridge piece *s* which crosses the end of the insulator and is in electrical connection with the shell *b*. Preferably this bridge is connected at its ends with a metal gasket *t* which is contained between the shoulder *f* and the adjacent end of the shell *b*. This combined bridge and gasket is one of the important features of my invention, and is preferably constructed as follows: The bridge piece is stamped from a sheet of metal in the form of a bar having forked or bifurcated ends, the arms of which forked ends are curved approxi-

mately semi-circularly. At two points between its ends the bar is bent at right angles to make parallel legs s' of a length slightly greater than that of the head e, and the end portions are then bent inward toward one another to meet and form the halves of a divided ring. The plane of the divided ring is thus parallel to the bar s, and when the ring is contained between the head e and the end of the shell the bar s crosses the end of the head and holds the electrode r at the proper distance from the electrode q to provide a spark gap. The metal ring or gasket t is contained between the shoulder f of the insulator c and the flexible gasket l, these gaskets being set into an annular recess u in the end of the shell, and the combined thicknesses of the gaskets being approximately equal to the depth of this recess. At opposite sides of the recess are pockets u' which receive the ends of the legs s' where they are curved to join the parts of the metal gasket. The combined metal gasket and bridge as thus constructed serves at once to hold the head of the insulator clear of the shell, and as a support for the electrode bridge, rendering unnecessary the attachment of the bridge directly to the shell, and thus obviating the necessity which has hitherto existed of drilling the shell to insert the end of an electrode or of soldering the electrode to the shell. Other modes of supporting the electrode or sparking point r in coöperative relation with the spark point q may be adopted, but this is the one which I have found preferable.

Another important feature of the invention results from the construction of the insulator c with the solid head e projecting bodily beyond the end of the shell into the engine cylinder, and having a recess to receive the electrode. The plugs commonly used hitherto have had an electrode carried by an insulator contained within a shell, but separated from the shell on all sides by an annular space and not projecting to any appreciable extent beyond the end of the shell. Such space provides less efficient protection against short circuiting between the shell and the electrode within the insulator than is afforded by the construction which I have devised, for in my invention before a short circuit may be established, the recess p must be filled with a deposit of soot, and the outer face of the head coated with soot throughout its entire length.

The construction of the plug as a whole is simpler and less expensive than those hitherto made, for with the exception of the sparking terminals and the flexible gaskets, the device consists of only seven parts, all of which are of simple construction and may be inexpensively made and put together. This is a saving over the common form of previously used plugs of at least one part and seven operations necessarily employed in the manufacture thereof.

I claim:—

1. A spark plug comprising a shell, a sleeve of insulating material within said shell, an electrode passing through said insulating sleeve and beyond the end of the shell, a head upon said sleeve extending beyond and over the end of the shell and having a recess or cavity containing the electrode end, a metal gasket between said head and the end of the shell, a bridge extending across the end of said head and connected at its ends with said gasket, and a complemental electrode attached to said bridge.

2. A spark plug comprising a shell, a sleeve of insulating material within said shell, an electrode passing through said insulating sleeve and beyond the end of the shell, said sleeve being formed with a shoulder bearing on the end of the shell and extending beyond the latter, a gasket interposed between said shoulder and the shell, and a bridge electrode united at its ends to said gasket and extending across the end of the sleeve.

3. A spark plug comprising a shell, a sleeve of insulating material within said shell, an electrode passing through said insulating sleeve and beyond the end of the shell, said sleeve being extended beyond the end of the shell and having a shoulder overlapping the latter, and an electrode bridge crossing the end of the sleeve and having its ends clamped between the shoulder thereof and the end of the shell.

4. A spark plug comprising a shell, a sleeve of insulating material within said shell, an electrode passing through said insulating sleeve and beyond the end of the shell, said sleeve being extended beyond the end of the shell and having a shoulder overlapping the latter, and an electrode bridge crossing the end of the sleeve and having its ends bifurcated to form the halves of a divided ring or gasket and clamped between the said shoulder and the end of the shell.

5. An electrode bridge for spark plugs consisting of a bar having forked ends formed approximately as semi-circles.

6. An electrode bridge for spark plugs consisting of a bar having forked ends formed approximately as semi-circles, the bar being bent so that such forked ends extend toward one another.

7. A spark plug comprising a metallic shell, two pieces of insulation meeting inside said shell and projecting from opposite ends thereof, each said piece having a shoulder overlying the adjacent end of the shell, and one of them having a recess in its projecting end, a bar passing longitudinally through said insulation, an electrode on the end of said bar contained entirely within said re-

cess, a clamp mounted on said bar bearing against the end of the other piece, and a complemental electrode in electrical connection with the shell.

8. A spark plug comprising a shell, sleeves of insulating material set into opposite ends of said shell and having shoulders overlying the ends of the shell, an electrode bar passing through said sleeves, a gasket contained between the shoulder of one of said sleeves and the shell, and an electrode bridge formed as an integral part of said gasket and extending across adjacent ends of the sleeve and electrode bar.

9. In a spark plug, a metal gasket, and an electrode bridge parallel with the plane of said gasket and integrally united thereto.

In testimony whereof I have affixed my signature, in presence of two witnesses.

HERBERT F. PROVANDIE.

Witnesses:
A. C. RATIGAN,
P. W. PEZZETTI.