G. A. BELL.
SPARK PLUG.
APPLICATION FILED MAY 26, 1917.

1,352,775. Patented Sept. 14, 1920.

Fig. 1.

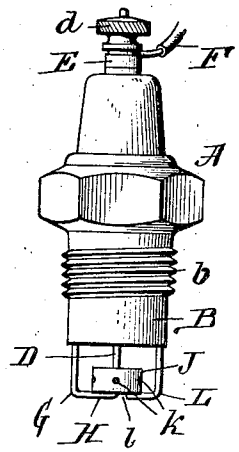


Fig. 2.

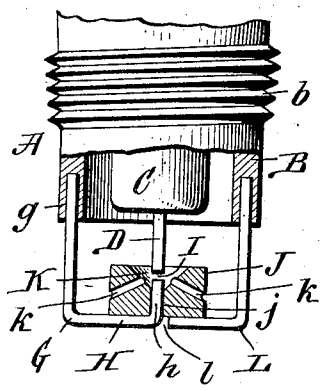


Fig. 3.

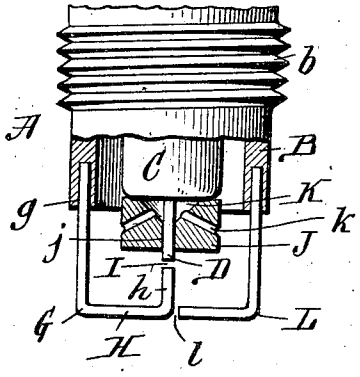


Fig. 4.

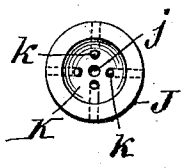
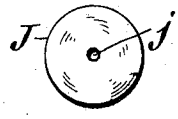


Fig. 5.



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UNITED STATES PATENT OFFICE.

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SPARK-PLUG.

1,352,775. Specification of Letters Patent. Patented Sept. 14, 1920.

Application filed May 26, 1917. Serial No. 171,140.

To all whom it may concern:

Be it known that I, GEORGE A. BELL, a citizen of the United States, residing at Silver Creek, in the county of Chautauqua and State of New York, have invented certain new and useful Improvements in Spark-Plugs, of which the following is a specification.

My invention relates to spark plugs, and more particularly to what may be termed a self-cleaning spark plug.

One of the objects of my invention is the production of a self-cleaning spark plug wherein provision is made for automatically cleaning the electrodes of the spark plug and retaining the space between them unobstructed under all working conditions.

Another object of my invention is the provision of a self-cleaning spark plug wherein the electrodes are disposed in alinement and wherein an automatic cleaning device is arranged to move lengthwise on said electrodes, said cleaning device being constructed and arranged to assure reciprocable movement thereof with each cycle of the engine piston coöperating with the spark plug.

Another object is the provision of a self-cleaning device movable lengthwise along alined electrodes and adapted to be limited in its outward movement by the porcelain or other insulating core of the spark plug, said cleaning device being provided with means to assure an inward movement of the same with or immediately following each explosion of the gases within the cylinder to which the spark plug is attached.

A further object is the provision of a spark plug having novel means for automatically cleaning the electrodes thereof and which means are simple, inexpensive and durable, said means being further constructed of a material which will assure a spark plug of considerable magnitude and increased intensity whereby increase in power is derived from the engine to which the spark plug is attached.

With these and other objects in view, the invention consists in a spark plug having a pair of electrodes and a movable cleaning device constructed of conducting material which will assure a spark of greater magnitude and intensity.

The invention also consists in a spark plug having alined electrodes and a reciprocable cleaning device movable along said electrodes and constructed to assure an inward movement thereof with or immediately following each explosion within the cylinder to which the spark is attached.

The invention further consists in a spark plug having a pair of alined electrodes and a metallic element surrounding said electrodes and movable lengthwise thereon, said element having an explosion chamber therein whereby the exploding gases are caused to force the element inwardly along the electrodes with or immediately following each explosion of the gases within the cylinder to which the plug is attached.

It further consists in the novel features of construction and in the arrangement and combination of parts to be hereinafter described and more particularly pointed out in the subjoined claims.

In the drawings,—

Figure 1 is a side view of a spark plug embodying what I now consider the preferred form of my invention.

Fig. 2 is a sectional elevation of the lower or inner portion of the spark plug on an enlarged scale, the cleaning device being at its innermost point of movement.

Fig. 3 is a similar view with the cleaning device at its outermost point of movement.

Fig. 4 is a plan view of the cleaning device.

Fig. 5 is an inverted view of the same.

In the preferred embodiment of my invention shown in the drawings, but which may be greatly modified without departing from the spirit of my invention, A represents the spark plug considered as a whole. This spark plug is of the type having an outer or ground casing B constructed of suitable current conducting material, as is common, and having an external thread *b* which permits of the plug being threaded into a cylinder of an engine. Suitably secured within this outer or ground casing B is a porcelain or other insulating core C through which the power electrode D is passed. The inner end of this plug is shown as terminating short of the inner end of the outer or ground casing with the power electrode D extending inwardly therefrom a short distance. The outer end of said electrode D is provided with a binding nut *d* between which and a washer E surrounding said electrode, a circuit wire F is clamped.

G designates the ground electrode which

is fastened into the outer or ground casing B, as at *g*, it being directed inwardly from its point of attachment to said casing and thence radially, as at H, to a point coincident with the axis of the power electrode D, thence outwardly in alinement with said power electrode, as at *h*, forming a substantially U-shaped electrode with its spark terminal terminating a short distance from the inner end of said power electrode to provide the usual sparking space or gap I between the two electrodes.

It is of course to be understood that the spark plug may be variously formed and that the herein illustration thereof is merely representative of the general type of spark plugs to which this invention is particularly adapted. The arrangement of the electrodes shown is, however, highly desirable since it enables the use of my improved electrode cleaning device in its simplest form. The principle of my invention, however, could readily be applied in spark plugs having electrodes otherwise arranged.

It is also to be understood that the current is carried through the outer or ground casing of the spark plug in the usual manner, the current being passed through the engine casing into which the spark plug is threaded, a ground wire being fastened to the engine casing for this purpose, as is common.

In the preferred form of my invention I employ a comparatively small cast-iron cleaner member J, which is preferably cylindrical and of a depth or height somewhat less than the length of that portion of the power electrode extending from the porcelain or other insulating core C, as clearly shown in Fig. 3, wherein the cleaner is in its outermost position in contact with the inner end of said core C. The depth or height of this cleaner is preferably somewhat greater than the length of the short leg *h* or terminal of the U-shaped ground electrode, as clearly shown in Fig. 2. This cleaner has an axial opening *j*, counterbored at its outer end, as at K, the counterbore serving as a chamber for the reception of compressed gases when the cleaner is in its outermost position against the inner end of the core C, said core serving as one of the walls of the chamber, as clearly shown in Fig. 3.

Extending laterally from said counterbore or chamber to the outer periphery of the cleaner are one or more passages or ducts *k* which serve as inlet passages for the chamber formed by the counterbore and core C. This cleaner, as stated, is preferably formed of cast-iron and when in its innermost position, shown in Fig. 2, has both electrodes D and G terminating within said counterbore; consequently when in this position and the current is passed through the spark plug the flaring walls of the counterbore serve as a sparking surface as well as the extreme terminal of the ground electrode, thus assuring a spark of greater magnitude and intensity than under the usual conditions of use in a spark plug of this type. This condition of operation will be encountered when starting a multi-cylinder engine on a battery; the cleaners of the spark plugs of one or more cylinders being forced outwardly under the compression created by the outward movement of the piston or pistons, while at other spark-plugs, sparks will be created while the cleaners are at their innermost points of movement.

When starting an engine with a magneto, the spark is created only in that cylinder of the engine in which the gases are being compressed on the outward movement of the piston, and in such cases the compression thus created forces the cleaner outwardly into the position shown in Fig. 3, in which position the terminals of the electrodes D and G are fully exposed outside of or beneath the cleaner, the gas being forced into the counterbore K of the cleaner through the ducts or passages *k*, and when ignition of the gas takes place within the cylinder, the gas within said counterbore or within the chamber of the cleaner formed by said counterbore and the core C is also ignited and the cleaner forced inwardly. The explosion of the gas within the chamber of the cleaner takes place immediately after the explosion in the cylinder so that there is no counteracting force to retain the cleaner in its outermost position. It is of course apparent that the ducts or passages *k* may be dispensed with, since the gases would be crowded into the counterbore during the outward movement of the cleaner and trapped therein as the cleaner seats itself against the inner end of the core C; but I consider the use of such ducts or passages highly desirable since they assure a greater compression of the gases within the counterbore or chamber K.

It is of course understood that the bore *j* through the cleaner must be of a slightly larger diameter than the electrodes D and G so that the cleaner may act easily in its movement on said electrodes, and during the operation of an engine to which the spark plug is attached the cleaner is moved outwardly during each outward movement of the coöperating piston, and moves inwardly by gravity; and when there is good compression due to proper packing of the piston, by gravity assisted by suction; but to assure proper and continual movements of the cleaner, reliance is had on the explosion of the gases within the counterbore, on the particular cycle of the piston at which explosion of the gases within the cylinder takes place. Consequently during the oper-

ation of the engine the cleaner reciprocates back and forth along the electrodes at the speed of the coöperating piston, thus keeping the electrodes thoroughly cleaned and avoiding the accumulation of carbon or oils which greatly diminish the effectiveness of the spark plug and oftentimes render the same inoperative.

In order that the cleaner, which owing to its bobbing movements may be termed a "bobber," be retained properly upon the electrodes, and particularly upon the terminal of the ground electrode G without tipping thereon, I have provided a stop L which is in the form of a wire secured into the outer or ground casing B in a manner similar to the ground electrode G, the wire extending inwardly from the inner edge of said casing parallel with the alined electrodes D and G and being thence directed radially in line with the radial portion H of the ground electrode, the inner end terminating short of the ground electrode, as shown at 1. The bobber, so called, therefore rests upon the radial portion H of the ground electrode at one side of its main axis, and against the stop L at the other side thereof and is held with its bore in alinement with the power electrode D so that free action is assured at all times.

It is to be understood that this bobber or cleaning-device may be formed of material other than cast-iron, whether a conducting material or a non-conducting material, but I have found in practice that cast-iron possesses high current-conducting qualities and therefore insures a "fatter" spark than other irons, or alloys; and furthermore, it does not permit the accumulation of carbon thereon. It consequently remains clean and smooth and also keeps the electrodes in a clean condition so that a very effective spark is obtained under all working conditions and greater power and more mileage secured per gallon consumption of gasolene or other power agency used to operate the engine.

Since my invention as shown and described illustrates merely what I now consider the simplest form of adaptation, it is apparent that, without departing from the spirit of the invention or sacrificing any of the advantages thereof, it may be modified for use in connection with spark plugs of different construction than herein shown and described, and where in the claims I refer to electrodes I do not intend to confine myself to the use of wires or other slender elongated members serving as such, but wish to have it understood that by such term I include all surfaces spaced apart to provide a gap which the electric current is to jump for creating a spark.

Now therefore, what I claim is,—

1. A spark plug provided with a pair of alined electrodes, a cleaning device comprising a comparatively small body having a center bore and a counterbore at one end of said center bore, said center bore being adapted to receive said electrodes and permit lengthwise movement of said body on said electrodes, said body having a passage extending therethrough from the periphery thereof to said counterbore.

2. In a spark plug, a cleaning device adapted for movement in contact with the electrodes thereof and comprising a body portion having a center bore and a counterbore at one end of said center bore, said body also having a passage leading from the exterior thereof to said counterbore.

3. A spark plug comprising an outer or ground casing, an insulating core within said casing and a pair of electrodes, one of said electrodes projecting from said insulating core; combined with a cleaning device in the form of a solid body having a bore to receive one of said electrodes, said bore being flared at one end to serve as a chamber and said chamber opening toward said core.

In testimony whereof I affix my signature.

GEORGE A. BELL.