April 6, 1926. 1,579,625

G. E. BANGHART

SPARK PLUG

Filed Sept. 5, 1923

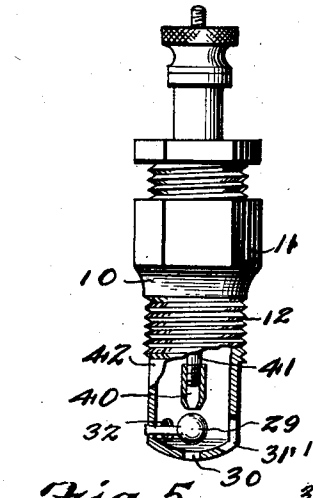


Fig. 5.

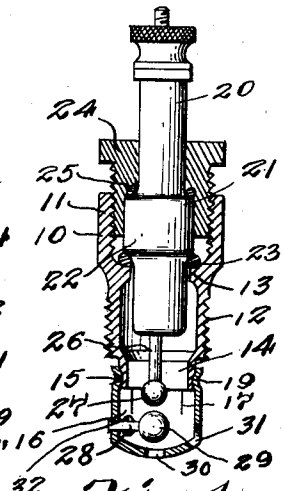


Fig. 1.

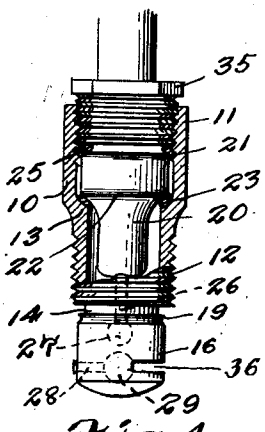


Fig. 4.

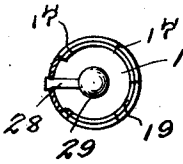
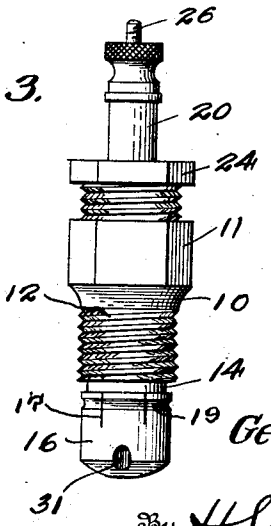


Fig. 2.

Fig. 3.



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UNITED STATES PATENT OFFICE.

GEORGE E. BANGHART, OF BALLSTON, VIRGINIA.

SPARK PLUG.

Application filed September 5, 1923. Serial No. 661,039.

To all whom it may concern:

Be it known that I, GEORGE E. BANGHART, a citizen of the United States, residing at Ballston, in the county of Arlington and State of Virginia, have invented certain new and useful Improvements in Spark Plugs, of which the following is a specification.

The invention has for an object to effect improvements in spark plugs, to the ends of securing more efficient function in ignition, longer life in the plug, minimum use of stock in production of the parts, and other improvements.

For the more efficient functioning of the plug it is an attainment of the invention that the path of the spark is localized and tends after initiation, to move in the same path in which it is initiated, whereas in plugs having one or more ordinary electrodes the spark changes from one position to another rapidly, encountering successively new cool dieletric matter which limits its head and intensity of activity. It is also an attainment in this direction that the electrodes keep themselves clear by physical functions. Further efficiency is attained by provided means by which,—contrary to a previous practice of heating that part of a main charge adjacent the igniting device—heat accumulating electrodes are utilized to heat a small part of the charge within an enclosure which in itself will impart to the enclosed mixture a certain amount of heat absorbed from ignition of charges. It is an important object to provide a plug in which an electrode may be utilized also as a heat transmitting element and whereby the use of high compression and excessively large size in the said element will not be required, by preventing absorption of heat from the heat transmitting element by movement of large bodies of the charge which are not adjacent the electrodes when the time of ignition eventuates. Another purpose is to cause a highly powerful explosion of the initially ignited part of the charge and its rapid propagation by direction of the initially ignited part within limited paths to distant parts of the explosion chamber. It is also an aim to attain what is believed to be an improved ionization effect about the electrodes when the device is in use.

Incidentally, the plug functions to prevent access to the terminals of oil, or carbon from the main body of the charge. Naturally, the attainment of these ends also has its effect in the operation of a motor equipped with the plug, in economy of fuel; permitting use of low grade fuel; maximum development of power; smooth pull when power of the motor is utilized; quick get-away; low idling speed.

Longer life in the plug is secured in the provision of electrodes which will burn away in a minimum degree, reduced liability of breakage of porcelains either by extremes of heat, or by mal-adjustments due to removal and replacement in cleaning.

Additional objects, advantages and features of invention reside in the construction, arrangement and combination of parts as hereinafter described, and shown in the accompanying drawings, wherein,

Figure 1 is a vertical sectional view of the plug in one embodiment,

Fig. 2 is a top view of the hood removed,

Fig. 3 is an elevational view of the plug,

Fig. 4 is an elevational view partly in section, showing a familiar mounting of the porcelain.

Fig. 5 is a fragmentary view showing the hood integral, and also illustrating a modification of the upper electrode.

There is illustrated a plug comprising a case body 10 having an enlarged, interiorly threaded, exteriorly hexagonal upper or nut part 11, and an exteriorly threaded cylindrical nipple part 12 adapted to be screwed into the ordinary plug opening of an internal combustion engine cylinder. The case as shown in Figure 1 is formed with an interior annular shoulder 13 having a diameter considerably less than the interior of the upper part 11, as well as somewhat smaller than the interior of the part 12.

The lower end of the plug of Figure 1 is formed with a further reduced cylindrical extension 14, below the nipple proper formed with a circumscribing exterior groove 15. Upon this extension there is snugly fitted a hood 16 the sides of which are cylindrical and formed with slits 17 opening on the upper open edge of the hood whereby some resilient flexing action of the intervening parts is permitted. The upper edge portion is formed with a rib or indentations 19 adapted to snap snugly into the groove 15, and retain the hood against casual detachment. The part 14 is of sufficiently smaller diameter than the threads on the nipple to permit the hood to fit thereover and still clear the sides of the plug open-

ing of the engine cylinder readily. In fact, a shoulder is formed in practice, which enables the ready insertion of a screw driver between the edge of the hood and the nipple proper and the exercising of leverage to pry the hood off when necessary. The hood may be replaced by holding it in position with the upper end of the case rested on an anvil or the like, and delivering a blow with a hammer on the bottom of the hood. The bottom or closed end of the hood may be formed as desired, but in the present instance is in the form of a segment of a sphere formed integrally with the wall of the hood.

A porcelain core 20 is mounted in the upper case 11 which includes preferably upper and lower cylindrical stem and apron parts 21—22 within intervening cylindrical enlargement adapted to rest on a packing 23 on the shoulder 13 and receive at the upper side the thrust of a gland 24 of sleeve-like form extending beside the enlargement a distance, a packing 25 being interposed. The gland is provided with an upper nut part.

It is to be noted that the lower part of the porcelain or apron 22 stops a distance above the extension 14. In the porcelain there is mounted in any approved manner an axial electrode 26 having a ball terminal 27 thereon within, adjacent or below the extension 14.

In the hood there is mounted a horizontal stud-like electrode 28 extending from the wall of the hood a distance above the bottom this electrode is provided with a terminal ball 29 located on the axis of the plug. The last electrode is readily mounted by insertion through a drilled opening in the wall of the hood, and the electrode or hood peened. An axial aperture 30 is formed in the hood beneath the ball 29, and in Fig. 1 the hood is shown as having a diagonal opening 31 extending partly in the wall and partly in the bottom of the hood, while additional apertures 32 may be formed at other parts of the hood as found desirable to correspond with the size or shape of the cylinder in which the device is used. Ordinarily, I have formed two of the openings 32 in plugs adapted for use in the Ford motor. The electrodes are so spaced in the hood that there is a clearance between the hood and ball 29 which will permit adjustment of the ball 29 with respect to the ball 27, by movement on the axis of the latter. This may be accomplished by insertion of a tool through the aperture 31 for widening or through the aperture 30 for reduction of the gap. For this reason the aperture 31 is preferably located opposite the base of the electrode 28, so that the centering of the electrode in adjustment may be assured.

It is important that the balls 28 and 29 be of comparatively large size in proportion to the parts of the plug as ordinarily constructed, it being the purpose that either one or both shall function to accumulate a considerable degree of heat from explosions of charges, it is believed that if any difference is made in the size of the two, the lower should be the larger, and when direct current is used for ignition, the lower electrode should also be the positive terminal. It is believed also that the balls have an effect in so ionizing the air or field about the gap that the spark is made more efficient and less vacillating. The hood may be adjusted with one of the lateral apertures—preferably the large diagonal one 31—disposed toward the intake valve of the motor in which it is installed, so that the incoming charge will direct fresh gases into the hood. There will be no great movement of gases through the hood, however by this action, and the effect will be that heat given off by the balls will be concentrated on a comparatively small amount of the charge mixture bringing it to a nascent condition with respect to ignition so that it will readily become fired by the spark at the gap. The wall and bottom of the hood also aid in this effect, partly warming the mixture entering, so that the balls may raise the enclosed gas to a higher temperature than the balls or a hood acting alone. When the part of a charge within the hood becomes ignited under these conditions, it explodes violently, projecting itself through the openings of the hood and establishing immediately numerous areas of propagation of ignition in the main body of the charge, and resulting in a quicker explosion without requiring high initial compression.

In Fig. 4 the use of an ordinary retainer nut or gland 35 at the outer part of the porcelain is shown, as well as a modification of the formation of the shoulder 13, for the utilization of an electrode of greater diameter in the enlargement 22—a familiar structure in plugs.

In Fig. 5, in place of the ball 28, there is provided on the axial electrode a cup-like terminal 40, which is hollow and provided with a restricted opening immediately adjacent the ball 29 which is mounted as before described, the remainder of the plug being also made in accordance with the previous disclosure. In the formation of the terminal 40, the extremity of the electrode proper 41 is formed with a thread, and a short section of tube corresponding to the upper part of the terminal 40 is interiorly threaded and screwed on to the electrode, the lower end of the tube section being spun or otherwise restricted to form the reduced opening. This construction affords a ready means for adjusting the gap between the

electrodes, which is accomplished by removing the core and with a pair of pipe pliers turning the terminal 40 as required to vary the gap, then replacing the parts. In case the removable hood is employed, removal of the core from the case will not, of course, be required, but the hood is removed and the terminal 40 adjusted as indicated.

The function of this last described form of the device is to cause the opposed surfaces of the electrodes to be cleaned by the rush of exploding gas from the terminal 40, in addition to the heating effect before noted.

In adjusting the hood, the plug case is preferably first screwed home in the engine cylinder, and a mark then made on the case indicating the direction of the intake valve with respect to the plug; after which the hood is adjusted with the opening 31 adjacent the mark thus made.

The plug is adapted to be produced at a low cost without special difficulties in shop practice, and has been found to function with eminent satisfaction, through actual use.

As in Fig. 5, also, the hood element may be made integral with the case, as at 42.

It should be noted that the ball elements become very highly heated in the operation of the device as indicated, and this in addition to superheating the portion of the charge within the hood of the plug, also keeps the terminals free of soot or carbon.

Fig. 4 incidentally illustrates the use of a horizontal slot 36 formed in the wall of the hood in a plane at right angles to the axis of the plug and coincident with the stem 28. In conjunction with this slot, the apertures 32 may be used or omitted as desired, the width and length of the slot being varied as required to produce the effects desired.

It should be noted that in the hood of Fig. 5, where the hood is formed integrally with the case, the opening 31′ corresponding to the opening 31 is made sufficiently large to permit the ball 29 to be inserted therethrough. In this way in addition to the functional value in assembly of the parts during manufacture, the production of the plug is facilitated by the location of the opening 31′ as indicated, permitting the electrode 28 to be inserted through the opening in the hood instead of through the upper end of the case for securement in the wall of the hood.

What is claimed:—

In a plug of the character described, a case hooded at the inner end, an insulating core therein, an axial electrode mounted in the core exposed within the hood, a separate electrode mounted within and on the side of the hood including a stem set in the wall of the hood and a heat accumulating and retaining enlargement on the stem spaced within the hood and cooperative relation to the first electrode, said hood being laterally apertured for the reception of gases and projection of ignited gases as described, including an aperture opposite the stem of the second named electrode of a size to permit insertion of said electrode and admit a tool for adjustment of the gap.

In testimony whereof I have affixed my signature.

GEORGE E. BANGHART.