H. C. GARBER.

SPARK PLUG.

APPLICATION FILED MAR. 25, 1918.

1,327,382.

Patented Jan. 6, 1920.

Fig. 1.

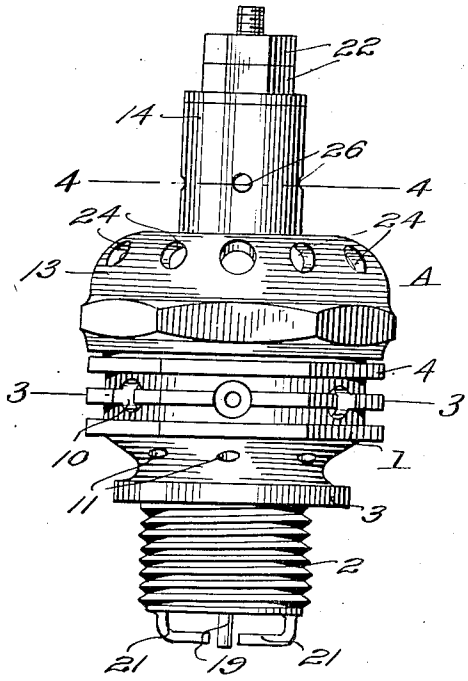


Fig. 2.

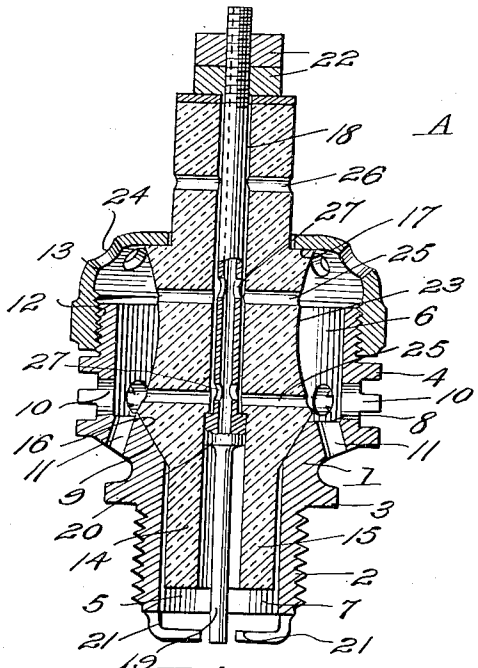


Fig. 3.

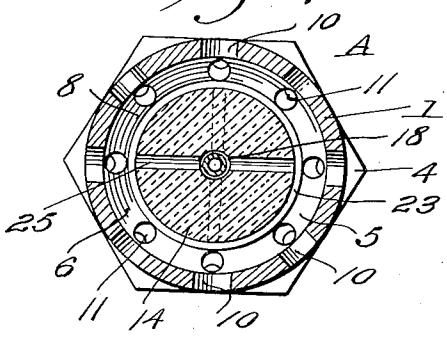
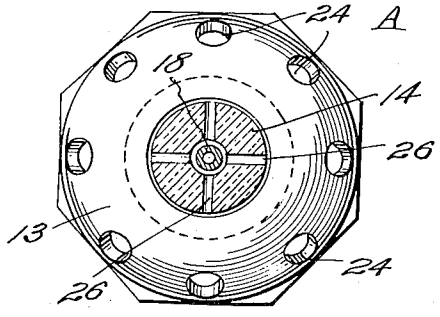


Fig. 4.



Witness

W. L. McDowell

Inventor

Harvey C. Garber,

By C. C. Shepherd

Attorney

UNITED STATES PATENT OFFICE.

HARVEY C. GARBER, OF COLUMBUS, OHIO.

SPARK-PLUG.

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To all whom it may concern:

Be it known that I, HARVEY C. GARBER, a citizen of the United States, residing at Columbus, in the county of Franklin and State of Ohio, have invented certain new and useful Improvements in Spark-Plugs, of which the following is a specification.

This invention relates to spark plugs, and has particular reference to the type employed for ignition purposes in connection with internal combustion engines.

The object of the invention is to produce a spark plug, embodying the improved features of construction for effecting circulation of a cooling fluid around and between the various members of the plug, so as to reduce the temperature of the latter when it is in operation and to thereby prevent certain of its internal members from breaking or cracking when subjected to the prevailing high temperature incident to engine operation.

Another object of the invention is to provide a spark plug wherein its members are formed with communicating air passage ways and openings, which are positioned to permit of air circulation through and around said plug and to thereby maintain its working temperature within such bounds as to eliminate injury of its internal structure.

With these and other objects in view, as will appear as the description proceeds, the invention accordingly consists in the novel features of construction, combination of elements and arrangement of parts, hereinafter fully described and having the scope thereof defined by the appended claims.

In the accompanying drawing forming a part of the specification:

Figure 1 is a side elevation of the spark plug comprising the present invention.

Fig. 2 is a vertical sectional view taken through the plug.

Fig. 3 is a transverse, horizontal sectional view taken along the line 3—3 of Fig. 1.

Fig. 4 is a similar view taken along the line 4—4 of Fig. 1.

Similar characters of reference denote corresponding parts throughout the several views of the drawing.

Referring more particularly to the details of the invention, the spark plug A in its preferred embodiment is constructed to include an outer metallic shell member 1, which is provided at its lower end with a threaded portion 2 for permitting said member to be connected with a plug socket (not shown) of an engine. An annular shoulder 3 is integrally formed with the member 1 above its threaded portion 2, for the purpose of limiting the threading movement of said member within a plug socket. The upper end of the member, that is the end opposite the portion 2, as the word upper is merely employed for sake of clearness, is diametrically enlarged and provided with integral, preferably hexagonal shape, heat radiating fins or webs 4 which, in addition to other features, permit of the reception of a suitable wrench or other tool to effect the convenient rotation of the plug when removing or threading the same out or into engagement with a plug socket.

Interiorly the plug is formed with a bushing receiving chamber 5, which chamber includes an enlarged upper portion 6 and a reduced lower extremity 7, and formed between the parts 6 and 7 is a shoulder 8, which terminates in a tapering bushing seat 9, said seat in appearance closely resembling the puppet valve seat of an explosive engine. Radially disposed horizontal openings 10 are formed in the wall of the enlarged portion 6 of the chamber 5, and permit of a convenient circulation of air or other fluid from the exterior of said plug into the enlarged portion 6, for purpose to be hereinafter set forth. The circulation of air is further enhanced by the provision of concentrically arranged vertically disposed openings 11, which are formed in the shoulder 8, and permit air to pass vertically through the chamber 5 as well as in the transverse direction afforded by the openings 10. The upper end of the member 1 is formed with threads 12, which are utilized to connect with said member a nut or cap 13.

Positioned within the chamber 5 is an electrode bushing 14, formed from a suitable insulated material, such as porcelain or mica. This bushing is provided with a reduced lower end 15, which is adapted to occupy the reduced lower extremity of the member 1. The end 15 terminates at its upper end in an outwardly flared, inclined annular face 16, which is adapted to engage and to rest upon the tapering seat 9 formed in the member 1. Contiguous to the upper end of the bushing there is provided an annular shoulder 17, upon which the interior surface of the cap 13 is adapted to engage. It will be obvious that by threading the cap 13

down upon the member 1, that the bushing 14 will be forced into firm frictional engagement with the seat 9, so as to secure the parts in rigid relation, and to prevent the passage of gases into the upper part of the plug. This prevents the plug from becoming heated to an excessive temperature around its central and upper portions. If desired, a gasket or washer may be placed between the cap 13 and the shoulder 17 or between the seat 9 and the face 16, this, however, being a common construction employed in spark plugs it was therefore not illustrated. The central or axial portion of the bushing 14 is formed with a vertically extending bore 18, which is adapted to receive the main electrode 19 of the plug. This electrode is provided adjacent to its lower end with an enlarged shoulder 20, which is adapted to engage with a coöperating shoulder formed by enlarging the lower end of the bore 18. The lower end of said electrode is extended in the usual manner, so as to terminate the spaced relation from shell carried electrodes 21, providing the usual spark gap therebetween. It will be obvious that the present invention is not limited to the arrangement of the electrodes for forming the spark gap, but may be arranged in any preferred manner to effect this feature. The upper end of the electrode is threaded to receive binding nuts 22, which are adapted to firmly retain the electrode in its operative position within said bushing and to effect the association of a suitable electrical conductor therewith.

As stated in the preceding objects, the purpose of this invention is to provide a spark plug wherein its members will be cooled by circulation of a cooling fluid around and through its several members, in such an effective and positive manner to maintain the temperature of the plug within safe bounds calculated to prevent said plug from becoming overheated. To this end the bushing 14 is provided, between the shoulder 17 and the seating face 16 with an annularly concaved portion 23, which, as will be noted upon examining Fig. 2, spaces the exterior wall of the bushing from the wall of the upper portion 6 of the chamber 5, thus providing a circular air circulating space. The cap 13 is provided with a plurality of perforations 24, to permit of the escape of air, or other cooling fluid, from the portion 6. Thus it will be seen that air is permitted to enter the interior of the member 1 by way of the openings 10 and 11, so as to readily circulate around that portion of the bushing situated adjacent to a large portion 6 of the chamber 5, and to thereby maintain said bushing in a relatively cool condition.

To further enhance and perfect the cooling of the plug, the bushing 14 is provided with transverse horizontally extending openings 25, which openings extend from the air circulating space to the vertical bore 18 of said bushing. In view of the fact that this bore 18 is substantially greater in diameter than the electrode 19, it will be appreciated that air entering said bore will be permitted to circulate around the electrode, thus cooling the interior of said bushing and also said electrode. Air introduced into the bore 18 is permitted or forced to circulate upwardly, whence it is discharged from the bushing by way of ports 26, situated above the cap 13. To further effect the cooling of the plug, the upper portion of the electrode 9 is substantially tubular, as is shown in Fig. 2 and is provided with horizontal openings 27, connecting the interior of the electrode with the bore 18, whereby air entering said bore is permitted to circulate into the hollow interior of the electrode and to pass upwardly therein until ejected at the open end 27 thereof.

By the arrangement of openings, air passage ways, and ports shown in the accompanying drawing and herein described it will be manifest that air is permitted to pass in circuitous directions around and through various elements of the plug so that the prevailing, operative temperatures of the latter will be kept consistently low. Thus air is permitted to merely circulate about the air space formed between the bushing and the wall of the portion 6, to pass through the openings 10 and through the bushing openings 25 and into the bore 18 to be again discharged through similar openings 25 into the opposite portion of the part 6, or may be discharged through the ports 26, or may be forced through the tubular electrode 21. In other words the air is forced in zigzag paths around and through the plug elements, thus keeping the bushing of insulating material at a relatively low temperature so as to prevent its cracking or breaking by dissipating its heat. The construction of spark plug herein described is particularly advantageous when employed in connection with revolving aeroplane engines, although it will be understood that the invention is applicable for all forms of explosive engines.

While I have herein shown a single embodiment of my invention for the purpose of clear disclosure it is evident that changes may be made therein within the scope of the appended claims.

I claim:

1. In a spark plug, a hollow metallic shell member having a bushing receiving chamber formed therein, and provided with a transverse fluid circulating opening, an electrode bushing of insulating material positioned within said chamber and formed with a substantially transverse fluid circulating opening in communication with said former

opening, and an electrode positioned within a bore formed in said bushing, said latter bore being of substantially greater diameter than the electrode to permit a cooling fluid passing through said openings to circulate about said electrode.

2. In a spark plug, the combination with a hollow metallic shell member, of an electrode bushing positioned within said member and formed with a substantially annular concaved wall situated in spaced relation from the corresponding interior wall of said member to produce an air circulating space, said bushing and shell member being provided with openings in communication with said air space, and a substantially hollow electrode positioned within said bushing and formed with openings in communication with said member and bushing openings, whereby a circulation of air from the exterior of said plug around said bushing and through said electrode is effected.

3. In a spark plug, the combination with a hollow metallic shell member, of an electrode bushing positioned within said member and formed with a substantially annular concaved wall situated in spaced relation from the corresponding interior wall of said member to produce an air circulating space, said bushing and shell member being provided with openings in communication with said air space, and a substantially hollow electrode positioned within said bushing and formed with openings in communication with said member and bushing openings, whereby a circulation of air from the exterior of said plug around said bushing and through said electrode is effected, and a perforated cap adapted to retain said bushing in a fixed position within said member and to permit of a free circulation of air within and through said air space.

In testimony whereof I affix my signature.

HARVEY C. GARBER.