Nov. 10, 1931. E. B. NOWOSIELSKI 1,831,132

SPARK PLUG

Filed May 1, 1930

FIG. 1.

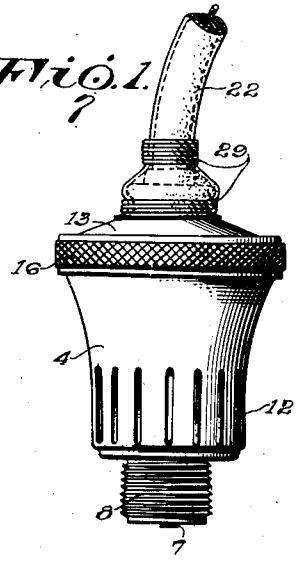
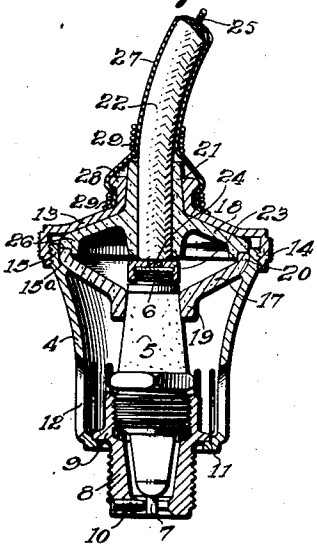


FIG. 2.



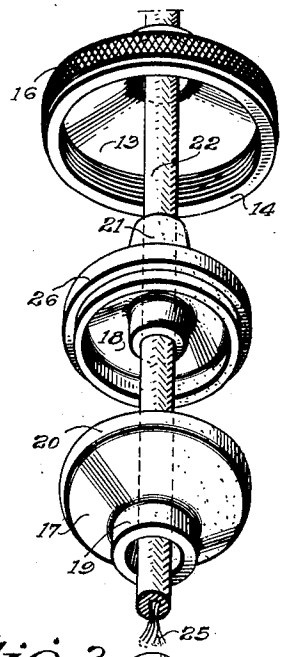
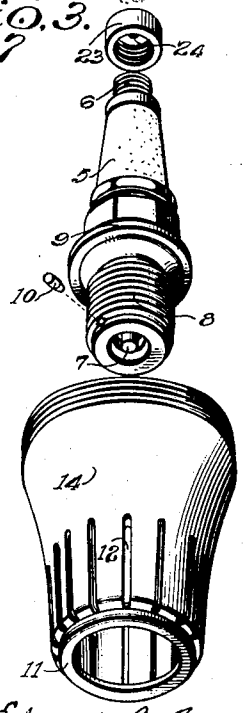


FIG. 3.



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UNITED STATES PATENT OFFICE

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SPARK PLUG

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The present invention relates to ignition apparatus for internal combustion engines, and more particularly to spark plugs.

One of the objects of the present invention is to provide novel means for mechanically and electrically shielding spark plugs in order to avoid injury thereto by accidental blows or the weather elements, and to prevent electrical interference with sensitive electrical equipment in the vicinity, such as radio receiving apparatus.

Another object is to provide a novel spark plug shield which is light in weight, simple in construction and inexpensive of manufacture.

A further object is to provide a metallic shield for a spark plug which may be readily and easily assembled or disassembled, and which is adapted for use with any of the usual types of spark plugs.

Still another object is to provide a spark plug shield in which the proper clearance between its metallic parts and the high tension terminal of the spark plug is maintained by the provision of novel insulating supporting means which also provides a support for the ignition cable which is connected to the high tension terminal.

A still further object is to provide a novel shield for spark plugs which is both mechanically rugged and electrically efficient for shielding purposes, and yet requires only a minimum of shielding and insulating material.

These and other objects will appear more fully in the detailed description of the invention which follows, and although only one embodiment thereof has been shown and illustrated in the accompanying drawings, it is to be expressly understood that these drawings are for the purpose of illustration only and are not to be construed as a limitation of the scope of the invention, reference being had for this purpose to the appended claims.

In the drawings:

Fig. 1 is a side elevation of one embodiment of the invention;

Fig. 2 is a side elevation partly in section of the embodiment shown in Fig. 1; and

Fig. 3 is an exploded perspective of the assembly of Fig. 1 on a longitudinal axis showing the relation of the various parts.

Referring now to the drawings, wherein like reference characters indicate like parts throughout the several views, the embodiment of the present invention shown therein comprises a spark plug shield of extreme simplicity having a pair of metallic shielding members which surround the spark plug and are maintained in a fixed spaced relation thereto by means of a novel insulating supporting member or members.

In the form shown, a bell-shaped metallic shielding member 4 constitutes the lower part of the shield, and surrounds and extends substantially the length of a spark plug 5 which is to be shielded. This spark plug may be of any of the usual types and is provided with a high tension terminal 6 to which is connected the positive electrode 7, a body portion 8 which is adapted for threaded engagement with an orifice in the cylinder wall of an internal combustion engine and is provided with an outwardly extending annular flange 9 normally flush with the external surface of said cylinder wall, and an adjustable negative or grounded electrode 10 which has a driving fit within an opening in the lower portion of body 8 adjacent the end of the positive electrode 7. Shielding member 4 is provided with an inturned annular lip or flange 11 at its lower end which is adapted to fit under flange 9 of the spark plug and to be securely held between said flange and the outer surface of the engine cylinder wall when the spark plug is threaded therein. Shielding member 4 may also be provided with a plurality of longitudinal slots 12 (or, if desired, grooved holes may be used) circumferentially spaced around its lower portion which are adapted to ventilate and cool the lower or hottest portion of spark plug 5, and also to allow the drainage of any moisture which might form on the shield.

An upper shielding member or cap 13 is provided to close the upper or flared end of shielding member 4, and is provided with an internally threaded flange 14 which is adapted for engagement with an externally threaded flange 15 of member 4. The exte-

rior surface of flange 14 is knurled as indicated at 16 in order to facilitate the assembly and disassembly of shielding members 4 and 13.

The voltage impressed upon the high tension terminal 6 of spark plug 5 is usually very high, and when such a spark plug is provided with a metallic shield, it is necessary that adequate insulation be interposed between the high tension terminal and the adjacent portions of the metallic shield in order to prevent flash overs between these points of positive and negative potential and thus avoid impairing the charge igniting efficiency of the spark plug. This insulation may be provided by forming a body of suitable material such as porcelain or mica which will closely encircle the spark plug and completely fill the space between said plug and the interior of the metallic shield or by providing a comparatively large air distance between the high tension terminal and the nearest point of the shield. Both of these methods are objectionable, the first because it requires expensive manufacturing methods and produces a shield which is difficult of assembly, and the second because of the fact that when air is the only insulating medium provided between the points of opposite potentials, the shield must necessarily be located at a substantial distance from the positive high tension terminal and is therefore made bulky and heavy. Another objection to this latter method is that the insulating quality, or dielectric strength, of air decreases with an increase in altitude, such as would be experienced where such spark plugs are installed in an aircraft engine, and this decrease in insulation resistance increases the possibility of flash overs.

There is disclosed, however, in the present invention a novel form of insulation to be placed between the high tension terminal and the metallic shield which not only performes its electrical function in an efficient manner, but also acts as a support for the metallic shield and forms an insulated entrance for the high tension ignition cable which is connected to terminal 6. In the form shown, the combined insulating and supporting means referred to comprise a lower insulating member 17 of any suitable material, such as porcelain, bakelite, etc. and an upper member 18 of similar characteristics. Member 17 is frusto-conical in shape and is provided with a central boss 19 the inner surface of which is suitably bored to correspond with the outer surface of spark plug 5 and adapted to receive the same, and with a peripheral flange 20 which is adapted to fit snugly within flange 15 of shielding member 4 and supported by the shoulder 15*a* provided at the top of member 4 and thus maintain said member in its proper spaced relation from terminal 6. Upper insulating member 18, which could be made integral, if desired, with member 17, is similar in general form to member 17, but is provided with a longitudinally elongated portion or boss 21 which is coaxial with boss 19 and spark plug body 5, and forms an insulated entrance for an ignition cable 22, which is adapted for connection to terminal 6 by any suitable means such as an internally threaded cap 23 having a small central aperture 24 through which the bared end portion of conductor 25 of cable 22 extends, the strands of the conductor being flattened out within said cap so that when the latter is screwed down upon high tension terminal 6, a firm and rigid electrical connection is obtained. Upper insulating member 18 is also provided with a peripheral flange 26 which is adapted to rest upon flange 20 of lower member 17 and to be supported thereby. The conical surface of member 18 is also adapted to support upper shielding member 13 and to insulate it from high tension terminal 6.

In shielded ignition systems of the type with which the present invention is adapted for use, it is preferable that the high tension ignition cable be electrically shielded as well as the spark plugs, and suitable means must be provided for forming a proper and serviceable connection between the cable shield and the spark plug shield. As shown in Figs. 1 and 2, cable 22 is usually provided with a flexible sheathing of woven wire 27 which may be expanded around the rim of a central boss 28, formed integral with upper shielding member 13, and securely bonded to said shielding member by any suitable means such as by tightly winding several turns of wire 29 around the shield at the point where it is expanded over boss 28 and also at a point adjacent said boss just before said shield is expanded. The wrapped wire 29 is preferably soldered to the respective shields in order to form a good electrical and mechanical connection.

In assembling the structure of the present invention, spark plug 5 is first inserted within lower shielding member 4, flange 9 of the spark plug body engaging inwardly turned lip 11 of member 4, and then the plug is threaded through the cylinder wall of the engine in which it is to be used in the usual manner, employing a socket wrench fitting over the upper portion of body member 8. Insulating supporting member 17 is then placed over spark plug 5 and dropped within shielding member 4 until flange 20 fits snugly within flange 15 and boss 19 rest on the surface of spark plug 5. The end of ignition cable 22 is then bared and the portion of sheathing 27 adjacent the bared end 22 expanded so as to allow upper shielding member 13 and insulating member 18 to be threaded onto cable 22. The bared end of conductor 25 is then inserted through orifice 24 and flattened out within the top of cap 23

which is then screwed down upon high tension terminal 6 until a firm electrical contact is formed. Insulating member 18 is then slid down on cable 22 until it rests upon member 17 as shown in Fig. 2 and upper shielding member 13 is secured to lower shielding member 4. The expanded portion of sheathing 27 is then pulled over the lip of boss 28 and is secured in bonded relation thereto by wire wrappings 29.

There is thus provided by the present invention a novel spark plug shield which is particularly well adapted for use in ignition systems of aircraft engine installations where it is necessary that the high tension portions of the ignition system be thoroughly shielded electrically in order to avoid interference with sensitive electrical apparatus such as radio receiving equipment. Spark plugs which are used in such installations are also subject to hard usage under severe operating conditions and therefore require rugged mechanical as well as electrical shielding. The shield disclosed herein is simple in structure and the parts are so formed as to be inexpensive of manufacture and easy to assemble. The use of insulating supporting members such as those described not only efficiently insulates the high tension terminal of the spark plug from the metallic shield, but also provides a rugged support for the shielding members, both of which functions are performed by a structure embodying a minimum of weight and material. One of the insulating members also provides a well insulated and supporting entrance for the ignition cable, thus allowing a vertical connection of said cable to the high tension terminal of the spark plug without subjecting the former to sharp bends or twists which break down the insulation. It will be understood that insulating members 17 and 18 may be made integral, if desired. The novel shield disclosed in the present invention is also provided with venting and draining means so that the interior of the shield may be maintained cool and dry. The structure is adapted for use with any of the usual types of spark plugs and may be easily and quickly installed on any existing ignition system.

It will be obvious that the invention is not limited to the specific form described and illustrated in the drawings, but is capable of a variety of mechanical embodiments. For example, it is to be expressly understood that, if desired, insulating supporting members 17 and 18 may be made integral, or that other suitable means may be employed for bonding the cable sheathing 27 to the spark plug shield. Various other changes, which will now appear to those skilled in the art, may be made in the form, details of construction, and arrangement of the parts without departing from the spirit of the invention, and reference is therefore to be had to the appended claims for a definition of the limits of the invention.

What is claimed is:

1. A shield for a spark plug comprising a lower shielding member, an upper shielding member detachably connected to said lower member, and an insulating member interposed between said shielding members and the spark plug for supporting said members and maintaining them in spaced relation to the spark plug.

2. In apparatus of the class described, a bell-shaped shielding member, a shielding cap for the flared end of said bell-shaped member, means for detachably securing said cap to said member thus providing a complete shield, a spark plug within the shield thus formed, and an insulating web interposed between said spark plug and said shield for maintaining the shield in a fixed spaced relation to said spark plug.

3. In a spark plug of the type having a high tension terminal and an insulated cable connected thereto, a metallic shield comprising a lower shielding member, an upper shielding member, means for detachably connecting said members, a lower insulating supporting member interposed between the spark plug body and the lower shielding member, and an upper insulating member resting on said lower member and supporting the upper shielding member, said upper insulating member having an elongated central portion surrounding said insulated cable.

4. In a shield for a spark plug having a high tension terminal and an insulated cable connected thereto, a metallic shielding member surrounding and extending substantially the length of the spark plug, a metallic shielding cap adapted to be removably secured to said shielding member, said cap having a central boss through which the insulated cable extends, and an insulating supporting member interposed between the spark plug and said shielding member and cap for maintaining said metallic members at a fixed distance from said high tension terminal.

5. In a spark plug of the type having a flange formed adjacent its lower end and a high tension terminal adjacent its upper end, a metallic shielding member surrounding and extending substantially the length of the spark plug, a lip formed on said shielding member and adapted to engage said flange, a plurality of longitudinal slots in said shielding member adjacent its lower end, an insulating supporting member interposed between the spark plug and said shielding member for maintaining said parts in a fixed spaced relation, a shielded cable attached to the high tension terminal of the spark plug, a metallic shielding cap adapted to be removably secured to the metallic shielding member, a second insulating supporting member within said cap, said member having a cen-

tral bore surrounding and supporting said shielded cable, and means for electrically bonding the shield of said cable to said shielding cap.

6. In a shield for a spark plug having a high tension terminal and an insulated cable connected thereto, a lower metallic member, an upper metallic member adapted to be removably secured to the lower member, and a hollow insulating supporting member interposed between said metallic members and the spark plug for maintaining a fixed spaced relation therebetween, said insulating supporting member enclosing the high tension terminal of the spark plug and having a central bore through which the insulated cable extends.

7. In a spark plug of the type having a high tension terminal, a shield for said plug comprising a metallic shell enclosing said spark plug, and a hollow insulating member removably housed within said shell, said insulating member enclosing the high tension terminal of the spark plug and supporting and maintaining the metallic shell in spaced relation to said high tension terminal.

8. In a spark plug of the type having a high tension terminal and a shielded cable attached thereto, a shield for said plug comprising a metallic shell enclosing said plug, a hollow insulating member removably housed within said shell, said insulating member enclosing said high tension terminal and supporting said shell in spaced relation thereto, and a second insulating supporting member having a central bore through which said cable extends.

In testimony whereof I have signed this specification.

EDWARD B. NOWOSIELSKI.