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[54] **SERIES GAP SPARK PLUG**

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[52] **U.S. Cl.** **313/120,** 313/124, 313/136, 313/138

[51] **Int. Cl.**.....**H01t 13/02**

[58] **Field of Search**.....313/120, 124

[56] **References Cited**

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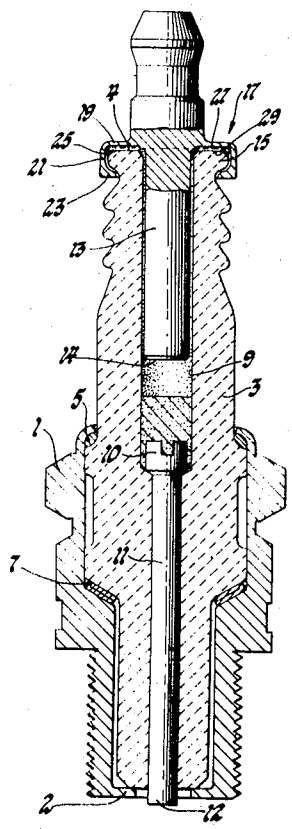
[57] **ABSTRACT**

A series gap spark plug having an auxiliary spark gap within the insulator centerbore between the end of the terminal screw and the end of the center electrode, the plug being formed to permit pressure relief from and temperature control of the auxiliary spark gap by providing a loose fit of the terminal screw within the centerbore, the terminal screw having a cap-like member secured over the top rib on the outer surface of the insulator, the space between the insulator centerbore wall and the terminal screw being vented to atmosphere.

4 Claims, 3 Drawing Figures



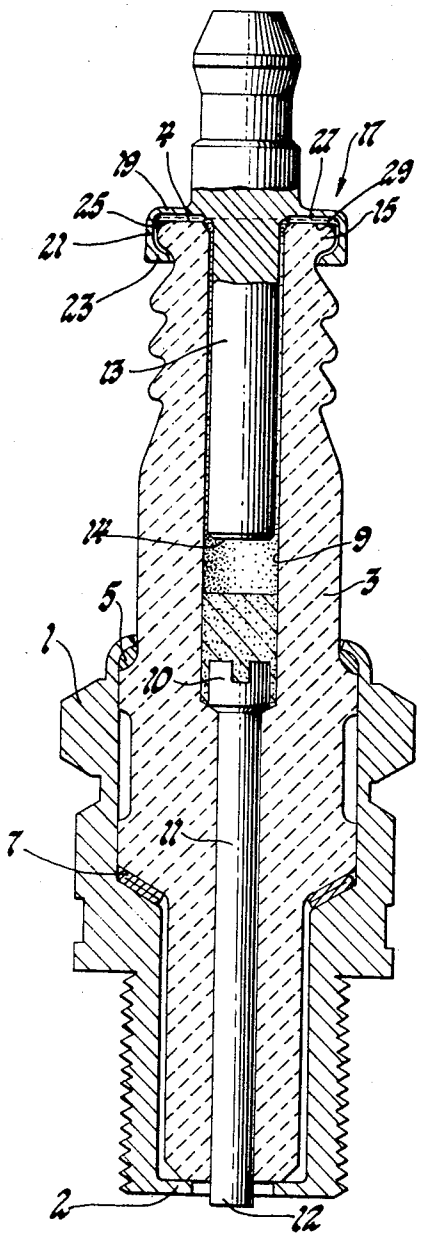


Fig. 1

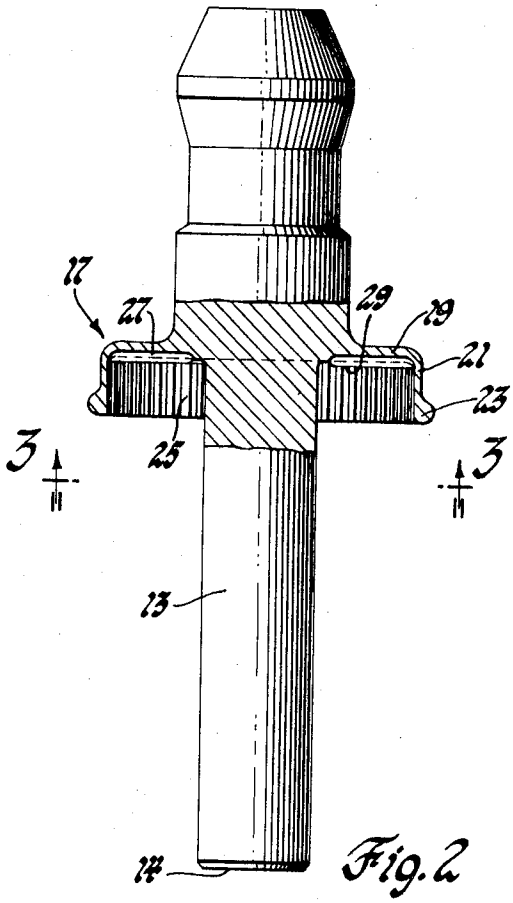


Fig. 2

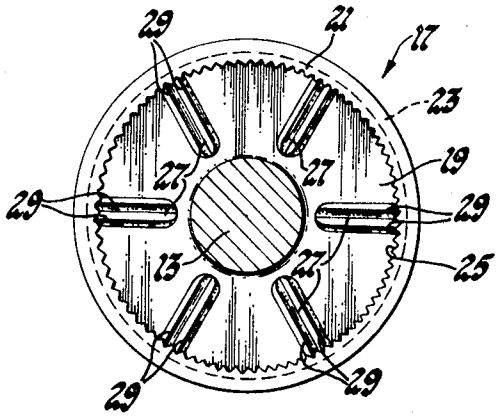


Fig. 3

SERIES GAP SPARK PLUG

Particular types of spark plugs such as those used for marine applications are designed with an auxiliary spark gap within the insulator centerbore and have a tendency therefore to generate high pressures and temperatures in this series gap. In order to avoid suppression of sparking and rapid wear of the electrodes forming this series gap, the terminal screw is provided with a centerbore to form a venting path to the atmosphere. Also, in order to retain the terminal screw within the centerbore, a portion of the outer surface of the terminal screw is threaded for mating with a correspondingly threaded portion of the inner wall surface of the centerbore. Further, while the centerbore in the terminal screw may be formed by drilling an axial passageway through bar stock, this is a difficult and expensive technique, and tubular stock is therefore normally used. It is obvious that the special materials and fabrication operations result in a relatively expensive spark plug.

It is therefore an object of our invention to provide a spark plug having an internal auxiliary spark gap providing a novel design for venting the internal spark gap to atmosphere. It is a further object of our invention to provide a series gap type spark plug having a relatively simple and inexpensively formed design enabling venting of the internally formed spark gap.

As is clearly shown on the attached drawing and as is more fully described in the following specification, the objects of our invention are achieved by providing a loose fit of the terminal screw within the centerbore, the terminal screw having a cap-like member secured over the top rib on the outer surface of the insulator, the space between the insulator centerbore wall and the terminal screw being vented to atmosphere.

In the attached drawing:

FIG. **1** is a cross-sectional view of a series gap spark plug formed in accordance with our invention;

FIG. **2** shows an enlarged view of the terminal screw of our invention, partially in section to show the venting construction formed in the cap;

FIG. **3** is a view taken on line **3—3** of the terminal screw as shown in FIG. **2.**

As is shown in FIG. **1,** the spark plug of our invention comprises a metal body member of shell **1** having positioned therein in gas-tight relationship a spark plug insulator or member **3,** the gas-tight relationship being achieved in the conventional manner by use of a pair of sealing gaskets **5** and **7.** A centerbore **9** is provided axially within the insulator body and is so dimensioned as to have positioned therein both the center electrode **11** and the terminal screw **13.** Center electrode **11** is positioned within the centerbore with its firing end **12** adjacent the ground electrode **2** formed by the firing end of the shell **1.** The upper end **10** of the center electrode is sealed in gas-tight relationship within the centerbore by means of a conducting glass seal well known in the art, such as the metal-glass seal material disclosed in the patent to David E. Achey, U.S. Pat. No. 3,538,021, "Resistor Composition", granted Nov. 3, 1970. As is clearly shown in FIG. **1,** a plurality of ribs are formed on the outer surface of the insulator **3** on its upper end portion, the rib **15** formed on the top of the insulator being adapted to retain the terminal screw within the centerbore in the manner hereinafter described.

As is clearly shown in FIG. **1,** the lower portion of the terminal screw **13** is positioned in loose fitting relationship within the upper portion of the centerbore **9** to form a space between the inner wall surface of the insulator and the outer surface of the terminal screw. The inner end **14** of the terminal screw is spaced apart from the upper end **10** of the center electrode to form an auxiliary spark gap therebetween. As will be more readily apparent from the description which follows, the space between the centerbore wall and the terminal screw serves as a gas venting path from the auxiliary spark gap.

In accordance with our invention, a cap-like member **17** is provided on the upper end of the terminal screw **13.** As is shown in FIG. **1,** the preferred embodiment of our invention contemplates that the member **17** be formed as an integral part of the terminal screw, this being readily accomplished by simple machining of bar stock. As is clearly shown in FIGS. **1** and **2,** the cap-like member **17** comprises a disk portion **19** extending radially outward from the terminal screw and having an annular wall portion **21** extending axially from the outer circumferential edge thereof over the rib **15** and being secured thereto to retain the terminal screw within the centerbore.

As is shown in FIG. **2,** the end of the annular wall portion **21** is formed with a bead **23,** the bead **23** being on the outer surface of the annular wall portion prior to assembly upon the insulator rib **15** and being on the inner surface of the annular wall portion after assembly to secure the cap upon the upper rib **15.** In our preferred embodiment the beam **23** is clinched upon the rib by closing-in the cap with a sizing die in order to produce an interference fit with the top rib.

As is more clearly shown in FIGS. **2** and **3,** a plurality of generally axial grooves or knurls **25** are provided on the inner wall surface of the annular wall portion **21,** the grooves or knurls serving as a part of the internal spark gap venting path. It is readily apparent that the grooves may be other than axial so long as they extend from one end to the other of the wall portion **21.** As shown in FIG. **3,** in our preferred embodiment, a plurality of radial grooves **27** are provided on the inner wall surface of the disk portion **19** in order to form a plurality of metal stand-offs **29** which space the inner surface of the disk portion **19** from the end surface **4** of the insulator. It can thus be seen that the venting path from the auxiliary spark gap within the centerbore **9** comprises the space between the terminal screw and the centerbore wall, the axial grooves **25** and the space between the inner surface of the disk portion **19** and the end surface **4** of the insulator. It will be obvious to those skilled in the art that the inner surface of disk portion **19** may be spaced from the end surface **4** of the insulator **3** by means other than the stand-offs **29,** as for example by a plurality of radial ridges or points provided on the end surface **4** of the insulator. As described, the venting path enables the auxiliary spark gap to breathe to atmosphere thus serving as a pressure relief from and as a temperature control for the gap.

It is apparent from the foregoing description that we have provided a series gap type spark plug of relatively simple design suited to relatively inexpensive fabrication. While we have described our invention with reference to the preferred embodiment as shown on the drawing, the scope of our invention is intended to cover those obvious design variances which will readily occur to those skilled in the art, this in accordance with the claims which follow.

What is claimed is:

1. A series gap spark plug comprising a metal body member adapted to be positioned on an engine with its firing end projecting into the cylinder and forming the ground electrode, an insulator member having a rib formed on the top thereof and positioned within said metal body in gas-tight relationship therewith and having a centerbore axially therethrough, a center electrode positioned within said centerbore with the firing end thereof adjacent said ground electrode, the other end of said center electrode being positioned within said centerbore intermediate its ends and in gas-tight relationship with said insulator, a terminal screw positioned in loose fitting relationship within the upper portion of said centerbore to form a space therebetween, the inner end of said terminal screw being spaced apart from the upper end of said center electrode to form an auxiliary spark gap, a cap-like member provided on the upper end of said terminal screw with its disk portion positioned on the upper end surface of said insulator, the annular wall portion of said cap-like member extending over said rib and being secured thereto to retain said terminal screw within said centerbore, and means providing a gas venting path along the inner surface of said cap-like member between said space and the atmosphere to serve as a pressure relief from and temperature control for said auxiliary spark gap.

2. A spark plug as set forth in claim 1 wherein said cap-like member is formed as an integral part of said terminal screw and said disk portion is in contact with but a portion of the upper end surface of said insulator.

3. A spark plug as set forth in claim 2 wherein said means comprises a plurality of generally axial grooves on the inner surface of said annular wall portion and a plurality of stand-offs provided between said upper end surface and the inner surface of said disk portion.

4. A spark plug as set forth in claim 2 wherein said means comprises a plurality of grooves extending on the inner surface of said annular wall portion from the upper to the lower end thereof and a plurality of stand-offs formed on the inner surface of said disk portion.

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