Jan. 26, 1932. C. E. LEONARD 1,842,833

AVIATION PLUG

Filed Nov. 21, 1928

Fig. 1.

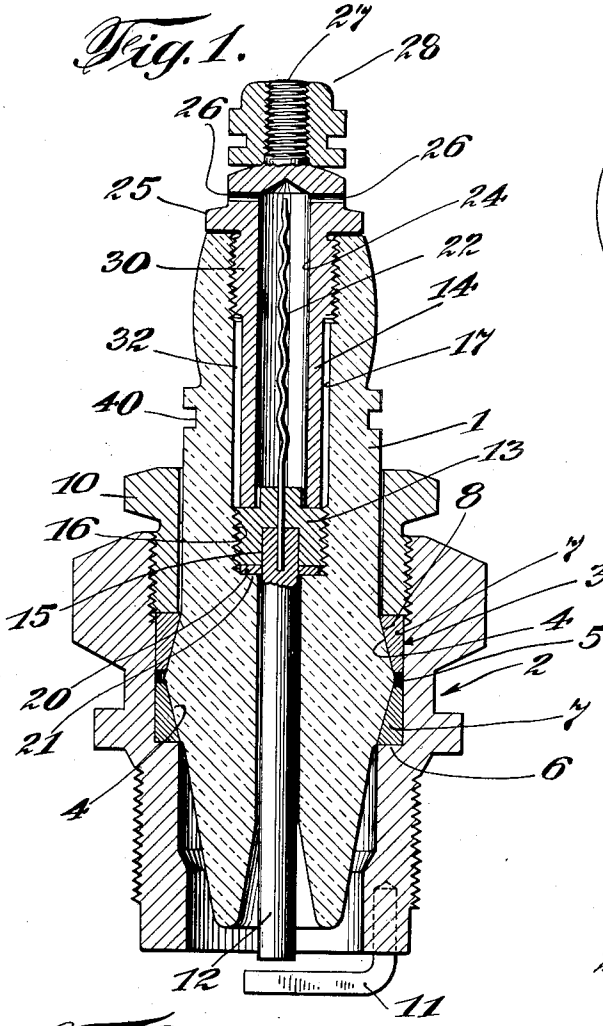


Fig. 3.

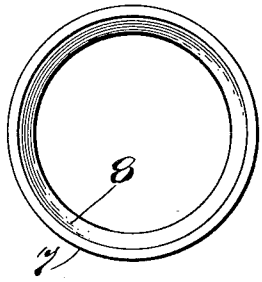
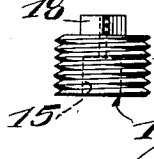


Fig. 4.



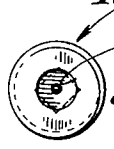


Fig. 5.

Fig. 6.

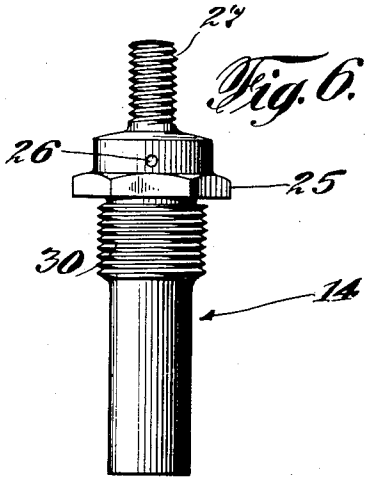
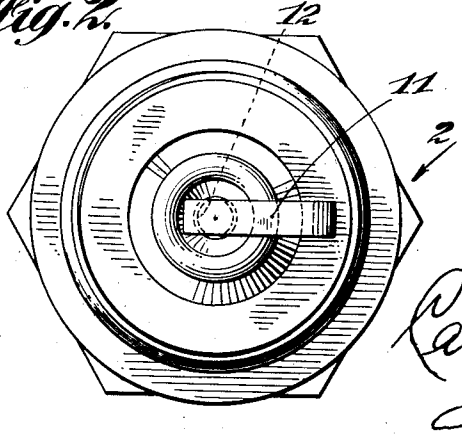


Fig. 2.



Caleb E. Leonard INVENTOR

BY Frank A. Lent ATTORNEY

Patented Jan. 26, 1932

1,842,833

UNITED STATES PATENT OFFICE

CALEB E. LEONARD, OF MIAMI, FLORIDA, ASSIGNOR TO LEONARD SPARK PLUG COMPANY, OF ST. PETERSBURG, FLORIDA, A CORPORATION OF FLORIDA

AVIATION PLUG

Application filed November 21, 1928. Serial No. 320,815.

My invention relates to ignition plugs for internal combustion engines, and its general object is to provide a structure which is exceptionally durable and efficient under the severe conditions imposed by service in a high pressure cylinder, as well as under less severe conditions.

More particular objects are: to effectively radiate the heat from the central electrode; to provide an improved gas tight connection of the insulator in the shell, which prevents gas leakage under high as well as ordinary pressures; and to provide a new and improved main electrode assembly.

In carrying out one of the principal objects above stated, namely, the cooling of the central electrode, I provide an outer or upper electrode structure which is tubular and has openings to atmosphere, together with a heat conducting and radiating element within such tubular electrode which is in heat conductive connection with the main electrode and which rapidly conveys heat therefrom to the chamber of the tubular electrode, this heat being dissipated to atmosphere through the openings.

The stated features reduce strains upon the insulator such as are ordinarily occasioned by undue heating and expansion of the central electrode, and increase the durability and efficiency of the plug in various other ways.

The characteristics and advantages of the invention are further sufficiently explained in connection with the following detail description of the accompanying drawings, which show one representative embodiment. After considering this example, skilled persons will understand that many variations may be made without departing from the principles disclosed; and I contemplate the employment of any structures that are within the scope of the appended claims.

In the drawings:

Fig. 1 is a longitudinal section of a plug embodying the invention in one form.

Fig. 2 is a bottom plan.

Fig. 3 is a plan view of a gasket.

Fig. 4 is a side elevation of an electrode connecting member.

Fig. 5 is a bottom plan thereof.

Fig. 6 is a side elevation of the upper or chambered electrode member.

The insulator 1 may be of any material suitable for this service, but is specifically, as shown, of porcelain or analogous material. The portion of the insulator within the shell 2 and also within the cylindrical gasket receiving or sealing chamber 3 thereof is formed with conical surfaces 4, the bases of which abut at 5. The sealing chamber 3 has at its bottom a horizontal shoulder 6. Gaskets 7, usually of compressible material such as copper, are located in the sealing chamber in relatively reversed positions, as shown in Fig. 1. Each gasket has an inner conical face 8 cooperating with one of the conical formations 4 of the insulator, a cylindrical outer surface to engage the shell wall, and a flat upper or lower surface. The gaskets are compressed in engagement with the conical formations of the insulator, to form an absolutely gas tight seal, by a nut-headed bushing 10 screwed into the upper end of the shell.

Details of the shell, other than as stated, may be as usual. The outer or grounded electrode 11 may have a press or wedge fit in a socket in the lower end of the shell.

The central electrode structure comprises the main or lower portion 12, an intermediate or connecting member 13 and an upper, tubular member 14. The main or lower electrode 12 has a press fit in a socket 15 in the connecting member. This member has an external screw thread 16 engaging a thread in the lower portion of a bore 17 in the upper part of the insulator. The upper end 18 of the connector is of polygonal form, to cooperate with a suitable tool by which it and connecting parts are screwed down to a proper seat in the insulator. Preferably a compressible gasket 20 is located between the lower end of the connector and a shoulder 21 at the lower end of insulator bore 17, to form a gas-seal at this point. A radiating rod or wire 22 of relatively small diameter passes through an axial hole in the connector and is inserted with a press fit in a hole in the upper end of the main electrode 12. Thus

the main electrode, the connector 13 and the radiating rod 22 form practically a structural unit.

The radiating wire passes practically throughout the length of the bore, or radiating chamber 24, of the upper electrode 14. Near its upper end this member has a nut formation 25, the lower face of which approximately engages the upper end of the insulator. One or more holes 26 are bored above the nut formation to provide communication between chamber 24 and atmosphere. The upper end of the upper electrode is formed as a screw threaded stem 27, which is provided with a thumb nut 28 for the connection of the conductor terminal in any known or suitable way. Below the nut formation 25 the upper electrode has a screw thread 30 engaging in a thread in the upper portion of the insulator, so that by means of the nut 25 the upper electrode may be screwed down with its lower end in tight engagement with the upper face of the connector 13. Preferably, the main lower or sleeve portion of the upper electrode member is spaced from the wall of the insulator bore as at 32.

In some cases the upper or chambered electrode member 30 may be of copper, brass or other highly conductive metal; or other suitable metal may be used.

In operation, heat is conducted from the main or lower electrode 12 by the connector 13 and the upper electrode member 30 and dissipated to atmosphere by the upper exposed portions of the upper member; but more especially, heat is conducted from the lower electrode by the radiating rod or wire 22 and rapidly dissipated from it to air within the chamber 24 and thus to external atmosphere through the openings 26. By the described means or arrangement, the main electrode is kept at a desirable low temperature and undue strains on the insulator are avoided. Also, there is practically no mechanical strain on the lower part of the insulator except that imposed by the compression of the sealing gaskets 7. This compressive strain may be relatively small due to the formation of the gaskets and the cooperating surfaces of the insulator. The insulator, with connected parts, may be removed as a unit in an obvious way; also the lower electrode 12 with the connector 13 and the radiating wire 22 may be assembled as a unit, and removed and replaced, when the upper or chambered electrode 14 is removed.

In some cases the radiating wire 22 may be straight; otherwise, as shown, it is preferably made in crimped or waved formation to increase its effective radiation length.

In preferred cases an annular channel 40 is formed in the insulator, somewhat above bushing 10, to increase the effective surface length of the insulator and reduce or prevent the possibility of spark-jumping from the shell or other grounded part to the central electrode structure.

In some cases the adjacent edges of gasket 7 may approximately or closely meet, when compressed, to increase the "tightness" of the gas seal at this point.

I claim:

1. In a spark plug, an insulator having a lower axial aperture to receive a main electrode and an enlarged upper axial aperture, an electrode structure comprising a main lower electrode and a connector operatively integral therewith and secured in the lower portion of said upper aperture of the insulator, a radiating wire conductively connected to the lower electrode and extending axially therefrom, and an upper tubular electrode member enclosing the wire and engaging the connector and having an upper ventilating opening.

2. In a spark plug, an insulator having a lower axial aperture to receive a main electrode and an enlarged upper axial aperture, and an electrode structure comprising a main lower electrode and a connector operatively integral therewith and secured in the lower portion of said upper aperture of the insulator, and an upper electrode member secured in the upper end of the insulator and having its lower end in contact with the connector, said upper electrode having a longitudinal chamber apertured to provide communication with atmosphere.

3. In a spark plug, an insulator having a lower axial aperture to receive a main electrode and an enlarged upper axial aperture, and an electrode structure comprising a main lower electrode and a connector operatively integral therewith and secured in the lower portion of said upper aperture of the insulator, an upper electrode member secured in the upper end of the insulator and having its lower end in contact with the connector, and a radiating rod conductively connected to the lower electrode and extending axially therefrom.

4. In a spark plug, an insulator having a lower axial aperture to receive a main electrode and an enlarged upper axial aperture, and an electrode structure comprising a main lower electrode and a connector operatively integral therewith and secured in the lower portion of said upper aperture of the insulator, an upper electrode member secured in the upper end of the insulator and having its lower end in contact with the connector, and a radiating rod conductively connected to the lower electrode and extending axially therefrom, said upper electrode having a longitudinal chamber apertured to provide communication with atmosphere, and said radiating rod being located within said chamber.

5. In a spark plug, an insulator having a lower axial aperture to receive a main electrode and an enlarged upper axial aperture,

and an electrode structure comprising a main lower electrode and a connector operatively integral therewith and secured in the lower portion of said upper aperture of the insulator, an upper electrode member secured in the upper end of the insulator and having its lower end in contact with the connector, and a radiating rod conductively connected to the lower electrode and extending axially therefrom, said upper electrode having a longitudinal chamber apertured to provide communication with atmosphere, and said radiating rod being located within said chamber, and extending practically throughout its length.

6. In a spark plug, an insulator having a lower axial aperture to receive a main electrode and an enlarged upper axial aperture, and an electrode structure comprising a main lower electrode and a connector operatively integral therewith and secured in the lower portion of said upper aperture of the insulator, an upper electrode member secured in the upper end of the insulator and having its lower end in contact with the connector, and a radiating rod conductively connected to the lower electrode and extending axially therefrom, the radiating rod being in wave formation to increase its effective radiating length.

7. In a spark plug, an electrode structure comprising a main lower electrode and a connector operatively integral therewith, and a heat radiating wire conductively connected to the lower electrode and extending axially therefrom, and an upper tubular electrode member in conductive contact with the connector and enclosing the radiating wire.

8. In a spark plug, an electrode structure comprising a main lower electrode and a connector operatively integral therewith, and a heat radiating wire conductively connected to the lower electrode and extending axially therefrom, the radiating rod or wire being in wave formation to increase its effective radiating length, and an upper tubular electrode member in conductive contact with the connector and enclosing the radiating wire.

9. In a spark plug, an electrode structure comprising a main lower portion, a tubular upper portion in conductive connection therewith, said upper portion having an opening near its upper end communicating with atmosphere, and a radiating wire conductively connected to the upper end of the main electrode portion and extending within said chamber, whereby heat is radiated to air within the chamber and therefrom to atmosphere through the opening.

10. In a spark plug, in combination with the shell and insulator, a central conductor passing through the insulator and including a lower electrode portion, an upper, tubular conducting portion having upwardly therein an opening to atmosphere, and a heat-conducting rod conductively connected with the electrode and extending upward within the tubular portion.

11. In a spark plug, in combination with the shell and insulator, a central conductor passing through the insulator and including a lower electrode portion, an upper, tubular conducting portion having upwardly therein an opening to atmosphere, a heat-conducting rod conductively connected with the electrode and extending upward within the tubular portion, and of substantially smaller diameter than the bore thereof.

12. In a spark plug, in combination with the shell and insulator, a central conductor passing through the insulator and including a lower electrode portion, an upper, tubular conducting portion having upwardly therein an opening to atmosphere, a heat-conducting rod conductively connected with the electrode and extending upward within the tubular portion, and terminating below the top of said tubular portion.

13. In a spark plug, in combination with the shell and insulator, a central conductor passing through the insulator and including a lower electrode portion, an upper, tubular heat conducting portion having a closed top and therebelow an opening to atmosphere, and a heat-conducting rod conductively connected with the electrode and extending upward within the tubular portion.

In testimony whereof I affix my signature.

CALEB E. LEONARD.