April 15, 1958 R. C. TEASEL 2,831,138

ELECTRICAL CONNECTION FOR HIGH ENERGY IGNITERS, AND METHOD FOR PRODUCING SAME

Filed Feb. 3, 1955

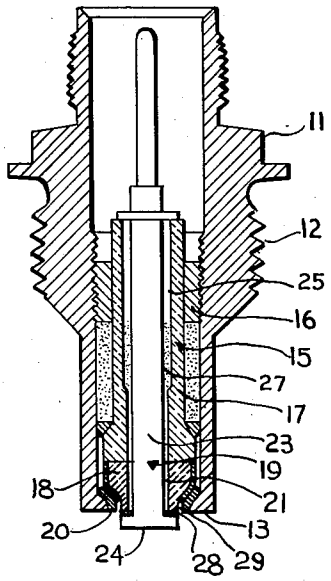


FIG. 1.

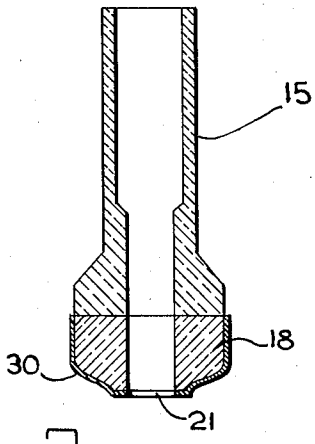


FIG. 2.

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United States Patent Office 2,831,138 Patented Apr. 15, 1958

2,831,138

ELECTRICAL CONNECTION FOR HIGH ENERGY IGNITERS, AND METHOD FOR PRODUCING SAME

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Application February 3, 1955, Serial No. 485,842

5 Claims. (Cl. 313—130)

This invention relates to an electrical connection for high energy igniters, and to a method for producing same.

A recent development in the field of spark plugs and jet engine igniters contemplates a high energy spark discharge over the surface of the nose of a spark plug or igniter. Although many advantages are achieved from using this type of discharge to fire reciprocating engines and jet engines, there are also difficulties. When a high voltage is applied to cause the spark, serious problems are encountered in insulating the ignition system. When only a low voltage is applied the discharge must be along some semi-conducting surface, but substantial difficulties have been encountered in the production of igniters of this type. One major problem that has been encountered is the relatively rapid increase in "minimum sparking voltage" which occurs during use of the igniter. The term "minimum sparking voltage" is used herein to refer to the lowest voltage applied across the terminals of an igniter that is capable of causing a spark discharge across the semi-conductive surface. When a high energy, low voltage, igniter is in service in a reciprocating engine or in a jet engine, the useful life thereof is ended when the minimum sparking voltage exceeds the voltage available in the ignition system, usually between 1000 and 2000 volts. Therefore, the relatively rapid increase in minimum sparking voltage of high energy igniters can be, and frequently is, the limiting factor on useful life thereof.

The instant invention is based upon the discovery of an electrical connection in a high energy igniter, and of a method for producing such electrical connection, which substantially prolongs the service life thereof prior to the increase of minimum sparking voltage to any predetermined maximum. Such electrical connection is between a center electrode of an igniter and a semi-conducting sparking surface, and also between a ground electrode and such surface.

It is, therefore, an object of the invention to provide an improved electrical connection in a high energy igniter.

It is a further object of the invention to provide a method for producing improved electrical connections in high energy igniters.

Other objects and advantages will be apparent from the description which follows, reference being had to the accompanying drawings, in which—

Fig. 1 is a view in section of a high energy igniter incorporating an improved electrical contact according to the invention; and

Fig. 2 is an enlarged cross-sectional view of a portion of the igniter of Fig. 1 showing a step in the production of the improved electrical connection according to the invention.

According to the invention an improved high energy igniter is provided. Such igniter comprises a ceramic insulator having a center bore, an electrically semi-conducting body constituting at least the surface of the nose portion of the insulator, a center electrode seated in the

insulator bore, and extending adjacent the conducting surface, a metal shell in which the insulator is seated, a ground electrode spaced from the center electrode and adjacent the conducting surface, a metalized coating interposed between the center electrode and the conducting surface, in electrical contact with each, and adhered to at least one, and a metalized coating interposed between the ground electrode and the conducting surface, in electrical contact with each, and adhered to at least one.

Referring now to the drawings, and particularly to Fig. 1, one specific high energy igniter embodying an electrical connection according to the invention comprises a shell **11** threaded as at **12** for engagement with the wall of the combustion chamber of a jet or reciprocating engine, and provided, in the construction shown, with an inwardly extending lower flange **13**. An insulator **15** is seated and fixed in the shell by a compressed body of holding powder tamped over a metal sleeve or gasket, and over which is disposed a metallic sleeve **16** threaded into the shell **11**. The insulator **15** is composed of an electrically insulating upper portion **17** and an electrically semi-conducting nose portion **18**, and supports a center electrode **19**. In assembly, the insulator **15** is disposed so that the nose portion **18** thereof is seated against a ground electrode **20**, which is in turn forced against the flange **13** of the shell. An air gap **21** of a few thousandths of an inch separates the electrode **19** from the lower portion of the insulating body **17** and from the nose portion **18**.

The central electrode **19** may be of any suitable construction, and in the form shown is composed of a stem part **23** and an integral flange **24**. The stem part **23** is received in an enlarged central hole **25** of the insulator **15**, while the flange **24** bears against a flat surface of the nose portion **18** of the insulator **15**. The stem part **23** of the electrode **19** is sealed in the central hole **25** in any known manner as by a suitable sealing material **27**. A metalized coating **28**, which can be of any suitable metal, but is preferably of copper, silver, platinum or gold, is interposed between the flange **24** of the electrode **19** and the flat surface of the nose portion **18** of the insulator **15**. A similar metalized coating **29** is interposed between the ground electrode **20** and the nose portion **18** of the insulator **15**.

Referring to Fig. 2, the insulator **15** and semi-conducting nose portion **18** are shown enlarged with a metal coating **30** applied to the exposed portions of the body **18**. The coating **30** can be a uniform dispersion of colloidal silver in a relatively volatile hydrocarbon oil, preferably a drying oil. Such a dispersion is available commercially under the trade designation "DuPont silver 4887." The dispersion can be applied to the exposed portions of the semi-conducting body **18** by dipping, brushing, spraying, or in any desired manner. The viscosity of the dispersion, and with it the thickness of the coating **30**, can be varied by suitable regulation of the ratio of silver, oil and solvent, for example turpentine, in the case of most drying oils. Similar dispersions of platinum, gold and copper have also been used, but most satisfactory results have been achieved with the silver dispersion.

After the insulator-semi-conducting body assembly (which can be produced, for example, as described in a co-pending application entitled "Electrically Semi-Conducting Body," Serial No. 386,189, filed October 15, 1953, by Harry G. Schurecht) has been coated as described in the preceding paragraph, the electrode **19**, which can be silvered in the same manner, if desired, is inserted in a central bore of the insulator, and the holding powder **27** tamped in place. The resulting assembly is then heated to volatilize the oil in the silver or other dispersion, for example to a temperature from about 1200°

F. to about 1400° F. for approximately fifteen minutes.

The electrode-insulator assembly is then locked in the shell **11** as shown in Fig. 1.

After the igniter has been assembled as described the silver or other metal coating is removed, for example, by mechanical abrasion, from the exposed portions of the insulator, leaving the coating intermediate the ground electrode **20** and the conducting body **18**, and also intermediate the center electrode **19** and the semi-conducting body **18**.

It has been found as the result of extensive engine tests that igniters having a metalized coating positioned according to the invention have substantially increased useful life over identical igniters produced without such coating, the increase being of the order of 50 to 75 percent when the metalizing is with silver, as specifically described.

It will be apparent that various changes and modifications can be made from the specific details shown in the attached drawings and discussed in the specification without departing from the spirit of the invention. For example, various metals can be used in place of silver, gold, platinum and copper, previously mentioned specifically, so long as such metal does not oxidize or melt at temperatures encountered in service of an igniter, usually in the vicinity of 1500° F. to 1600° F. Preferably, the metalized coating comprises a metal from group 1(*b*) of the periodic system having an atomic number from 29 through 79, inclusive, i. e., comprises copper, silver or gold, and most desirably silver or gold. The hydrocarbon drying oil disclosed specifically acts only as a temporary binder to hold the finely divided silver particles in place prior to firing. Other temporary binders, for example a dextrine solution in water, could be used for this purpose.

While the invention has been described in connection with a body of substantial size of electrically semi-conducting material along the surface of which a spark discharge occurs, it is equally operable when a semi-conducting engobe coating having a thickness of, at the most, a few thousandths of an inch is used in place thereof. In such case it is usually preferred to leave at least a small gap between the portion of the coating that will ultimately contact the center electrode and the portion that will contact the ground electrode. The high energy spark that occurs across the engobe surface will then vaporize in a short time any metalized coating that is exposed. If desired, a solvent can be used to remove the exposed portion of the metalized coating, for example after assembly of the igniter. The final metalized coating in the igniter is present only on portions of the body which are in contact with the electrodes, the surface of the semi-conducting body along which a spark discharge occurs not being metalized.

What I claim is:

1. A high energy igniter comprising a ceramic insulator having a center bore, an electrically semi-conducting body constituting at least the surface of the nose portion of said insulator, a center electrode seated in said insulator bore, and extending adjacent said conducting surface, a metal shell in which said insulator is seated, a ground electrode spaced from said center electrode and adjacent said conducting surface, a metalized coating interposed between said center electrode and said conducting surface, in electrical contact with each, and adhered to at least one, and a metalized coating interposed between said ground electrode and said conducting surface, in electrical contact with each, and adhered to at least one.

2. A high energy igniter as claimed in claim 1 in which each of said metalized coatings is adhered to said conducting surface.

3. In a high energy igniter including a ceramic insulator having a center bore, an electrically semi-conducting body constituting at least the surface of the nose portion of the insulator, a center electrode seated in the insulator bore, and extending adjacent the conducting surface, a metal shell in which the insulator is seated, and a ground electrode spaced from the center electrode and adjacent the conducting surface, the improvement comprising a metalized coating interposed between the center electrode and the conducting surface, in electrical contact with each, and adhered to at least one, and a metalized coating interposed between the ground electrode and the conducting surface, in electrical contact with each, and adhered to at least one.

4. In a high energy igniter, the improvement as claimed in claim 3 in which each of said metalized coatings is adhered to the conducting surface.

5. In a high energy igniter, the improvement as claimed in claim 4 in which the metalized surface is composed of a metal from group 1(*b*) of the periodic system having an atomic number from 29 through 79, inclusive.

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