

Jan. 16, 1962

J. J. LAWSEK

3,017,540

GLOW PLUG IGNITER

Filed Oct. 29, 1957

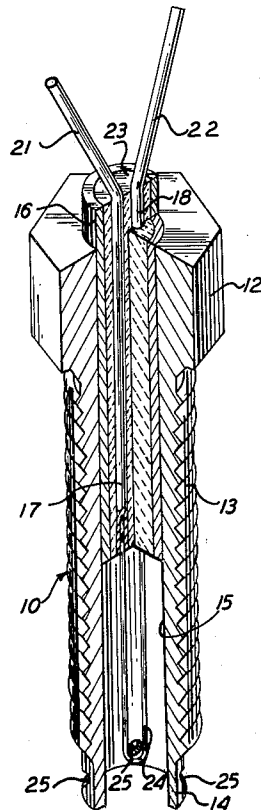


FIG. 1

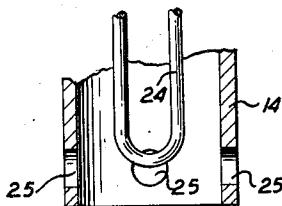


FIG. 2

J. J. LAWSEK
INVENTOR.
E. C. McRae
BY J. R. Faulkner
J. H. Oster
K. L. Zischling
ATTORNEYS

1

3,017,540

GLOW PLUG IGNITER

John J. Lawser, Dearborn, Mich., assignor to Ford Motor Company, Dearborn, Mich., a corporation of Delaware

Filed Oct. 29, 1957, Ser. No. 693,059

2 Claims. (Cl. 317-98)

This invention relates to a glow plug igniter and more particularly to a glow plug igniter which is especially adapted for use in the combustion chambers of gas turbine engines.

Although not so limited, the glow plug igniter of this invention is suitable for use in the heating means of the Elastic Fluid Power Plant disclosed in copending application Serial Number 650,446, filed April 3, 1957, in the names of Willis M. Clark, Jr., and Benjamin T. Howes, and assigned to the assignee of the present invention. Glow plugs used in this type of power plant must ignite a mixture of fuel and air which flows past the glow plug at quite high rates from the impetus of the compressor turbine. This high rate of flow past the igniter has always been a problem as the raw mixture of fuel and air tends to cool the igniter below ignition temperatures.

Under normal starting conditions, the resistance wire of a glow plug igniter must reach very high temperatures, on the order of 1500 to 3000 degrees F., for a period of ten seconds or more in order to ignite the fuel-air mixture. After combustion has been initiated and the glow plug has been deenergized, the end of the glow plug element will be exposed to high temperatures, for example, from 1400 to 1800 degrees F., for long periods of time while the engine is operating.

The present invention provides a glow plug igniter which is admirably suited for use in a gas turbine engine working under the above operating conditions. Briefly, the invention comprises a glow plug igniter with a body which is adapted to be affixed to the combustion chamber of a gas turbine engine. Mounted within the glow plug body is a metallic sleeve which extends from one end of the body to a point intermediate the ends of said body. Mounted within this sleeve are two electrical conductors which are electrically insulated from each other and from the sleeve by means of a refractory insulating material. A hairpin shaped electrical resistance element is positioned within the body and is electrically connected at one end to one of said conductors, and at the other end to the other conductor. Preferably, the body extends axially beyond the end of said resistance element to shield said element and thereby prevent undue chilling by the raw fuel-air mixture which flows by said glow plug element prior to ignition thereof. The body member may also have a plurality of apertures positioned therein adjacent the end of the resistance element to provide desired turbulence of the fuel-air mixture about the electrical resistance element.

An object of the present invention is the provision of a glow plug igniter for use in the combustion chamber of a gas turbine engine.

A further object of the invention is the provision of a glow plug igniter for use in the combustion chamber of a gas turbine engine in which the electrical resistance element is protected against undue chilling from the flow of an unignited combustible fuel mixture past said glow plug.

A further object is the provision of the glow plug igniter for use in a gas turbine engine in which a structure to produce turbulence of unignited combustible fuel mixture about the electrical resistance element is provided.

Still another object of the invention is the provision of a glow plug igniter for use in a gas turbine engine in

2

which the electrical connections are made remote from the end of the glow plug which is adapted to extend into the combustion chamber of the engine.

Other objects and attendant advantages of the present invention will become more apparent as the specification is considered in connection with the accompanying drawings in which:

FIGURE 1 shows a perspective view partially in section of a preferred embodiment of the invention; and,

FIGURE 2 is an enlarged partial longitudinal sectional view of a portion of the invention shown in FIGURE 1.

Referring now to the drawings in which like reference numerals designate like parts throughout the views thereof, there is shown in FIGURES 1 and 2 a preferred embodiment of the invention in which the numeral 10 designates the body of the glow plug igniter of the present invention. The body portion 10 may be divided into a hexagonal shaped portion 12, a threaded portion 13 and a portion of reduced diameter 14. The body portion 10 has an internal bore 15 positioned therein which is adapted to receive a metallic sleeve 16 preferably made of a high temperature metal such as stainless steel AISI Type 304 or 310, or "Inconel Major" which is an alloy whose major constituents are nickel 75%, chromium 15% and iron 8%. The sleeve can be conveniently secured to the body by hydrogen brazing. This sleeve may extend from the end of the hexagonal body portion to a point intermediate the ends of the body, and carries a pair of conductors designated by the numerals 17 and 18, said conductors having bent out portions 21 and 22 which facilitate the making of electrical connections thereto.

A refractory insulating material 23, for example, magnesium oxide, is positioned within the sleeve 16 and around the conductors 17 and 18 to electrically insulate the conductors from each other. The refractory insulating material also insulates the conductors from the sleeve 16 and the glow plug igniter body.

An electrical resistance element 24, preferably of a hairpin shape, is positioned within the bore 15 and is electrically and mechanically connected at one end to the conductor 17, and at the other end to the conductor 18 by any suitable method; for example, high temperature brazing or butt-welding so that the support for the resistance element is furnished by the conductors. The resistance element is preferably made of molybdenum disilicide which has high electrical resistivity, high oxidation resistance and high bending and tensile strengths at elevated temperatures.

The electrical conductors 17 and 18 are also preferably made of molybdenum disilicide so that a good mechanical and electrical connection can be made between the electrical conductors and the electrical resistance element by the high temperature brazing or butt-welding processes. Other materials may be used, however, the electrical conductors and the electrical resistance elements should be made of materials having coefficients of thermal expansion which are nearly equal so that stresses are not set up in the connection between the conductors and resistance element when they are heated and cooled. The conductors should preferably be made two to three times the diameter of the heating elements so that the majority of the heating occurs in the resistance element when electrical current is passed through the electrical conductors and the element, and so that relatively large areas are available at the face of the electrical conductors to facilitate connecting the resistance element thereto.

As best shown in FIGURE 2, the end of the body portion of reduced diameter 14 extends beyond the end of the curved portion of the electrical resistance element 24 and a plurality of apertures 25 are provided in the body portion 14 adjacent the curved portion of the electrical resistance element to provide desired turbulence of the

fuel-air mixture in the immediate vicinity of the electrical resistance element. This turbulence aids materially in the ignition of the fuel-air mixture.

The provision of the body member of the glow plug extending beyond the end of the electrical resistance element prevents the resistance element from becoming unduly chilled as the unignited fuel-air mixture moves past the element. It will also be noted from an inspection of the drawings that the electrical connections between the electrical resistance element 24 and the electrical conductors 17 and 18 is in such a position that excessive heat from the combustion chamber will not adversely affect and weaken such connection as it is located a considerable distance from the end of the glow plug igniter body.

When installed for operation in a gas turbine engine, the end 21 of the electrical conductor 17 is connected to one terminal of the electrical power source of the engine; for example, a battery, while the end 22 of the other electrical conductor 18 is connected to the other terminal of said power source through any conventional switching mechanism (not shown). The igniter may be energized at the same time that the compressor turbine of the gas turbine engine is set into operation. The igniter remains energized until it has accomplished its purpose of igniting a combustible fuel-air mixture which flows in the combustion chamber of the engine past the igniter. After ignition of this combustible mixture, the igniter is deenergized.

Thus, the present invention provides a simple, rugged and reliable glow plug igniter for a combustion chamber of a gas turbine engine.

I claim as my invention:

1. In a glow plug igniter for use in a combustion chamber of a gas turbine engine, a body having an internal bore positioned therein, said body having an hexagonal portion at one end thereof, a threaded portion intermediate the ends, and a portion of reduced diameter at the end opposite said hexagonal portion, a sleeve positioned in said internal bore and extending from said hexagonal portion of said body to a position intermediate the ends of said body, said sleeve having a pair of conductors positioned therein, and a refractory insulating material positioned therein to electrically insulate said conductors from said sleeve and from each other, a hairpin shaped electrical resistance element positioned within said internal bore terminating short of the end of said body portion of reduced diameter, one end of said resistance wire being electrically connected to one of said conductors, the other end of said resistance wire being electrically connected to the other conductor, said hairpin shaped resistance element having a terminal portion positioned adjacent that end of the body which is adapted to be positioned in combustion chamber of the gas turbine engine, said body being imperforate from a position adjacent the electrical connection between said first and said second electrical conductors and said resistance element to a position adjacent the curved terminal portion of said resistance element, said body portion of reduced diameter having a plurality of apertures positioned therein immediately adjacent the curved terminal portion of said hairpin shaped

electrical resistance element, each of said electrical conductors extending beyond said sleeve at the end of the hexagonal portion of said body and being bent outwardly from said sleeve to facilitate electrical connection thereto.

2. In a glow plug igniter for use in a combustion chamber of a gas turbine engine, a body having an internal bore positioned therein, said body having an hexagonal portion at one end thereof, a threaded portion intermediate the ends, and a portion of reduced diameter at the end opposite said hexagonal portion, a sleeve positioned in said internal bore and extending from said hexagonal portion of said body to a position intermediate the ends of said body, said sleeve having a pair of conductors positioned therein, and a refractory insulating material positioned therein to electrically insulate said conductors from said sleeve and from each other, a hairpin shaped electrical resistance element positioned within said internal bore terminating short of the end of said body portion of reduced diameter, one end of said resistance wire being electrically connected to one of said conductors, the other end of said resistance wire being electrically connected to the other conductor, said hairpin shaped resistance element having a terminal portion positioned adjacent that end of the body which is adapted to be positioned in the combustion chamber of the gas turbine engine, the electrical connection between said conductors and said hairpin resistance element being positioned an appreciable distance from the end of said body portion of reduced diameter and located within said sleeve, said body being imperforate from a position adjacent the electrical connection between said first and said second electrical conductors and said resistance element to a position adjacent the curved terminal portion of said resistance element, said body portion of reduced diameter having a plurality of apertures positioned therein immediately adjacent the curved terminal portion of said hairpin shaped electrical resistance element, each of said electrical conductors extending beyond said sleeve at the end of the hexagonal portion of said body and being bent outwardly from said sleeve to facilitate electrical connection thereto.

References Cited in the file of this patent

UNITED STATES PATENTS

1,826,788	Huber	Oct. 13, 1931
1,914,284	Palmer	June 13, 1933
1,956,586	Palmer	May 1, 1934
2,149,868	Rabazzana	Mar. 7, 1939
2,239,175	Unser	Apr. 22, 1941
2,553,975	Little	May 22, 1951
2,582,890	Stamm	Jan. 15, 1952
2,756,811	Little	July 11, 1956
2,776,394	Cuny	Jan. 1, 1957
2,795,220	Atwood	June 11, 1957
2,941,363	Cuny et al.	June 21, 1960

FOREIGN PATENTS

1,069,881	France	July 13, 1954
-----------	--------	---------------