March 28, 1961 W. A. BYCHINSKY 2,977,498

PREIGNITION DETECTION SYSTEM AND SPARK PLUG THEREFOR

Filed Jan. 14, 1959

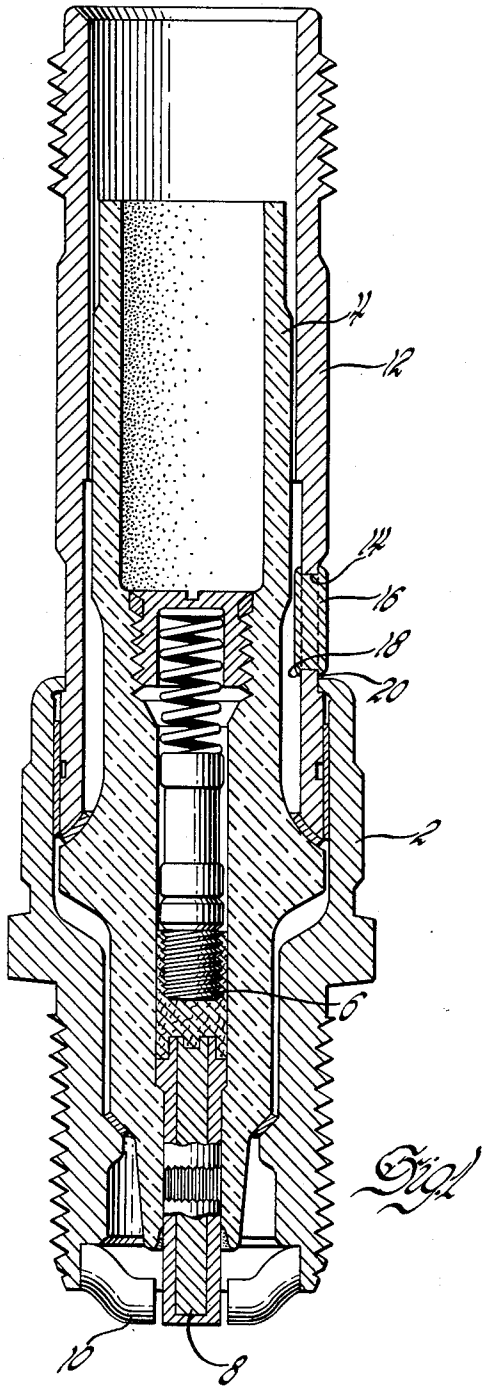


Fig. 1

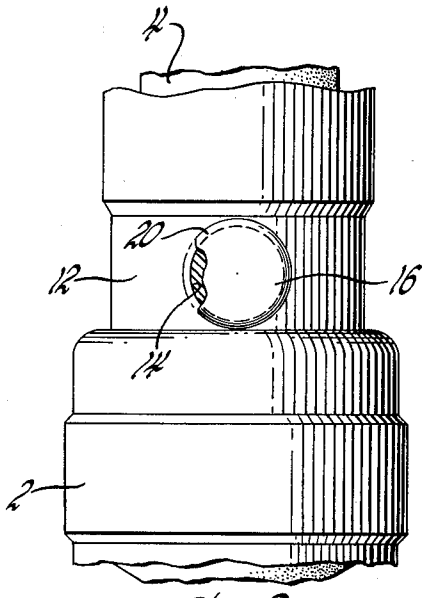


Fig. 2

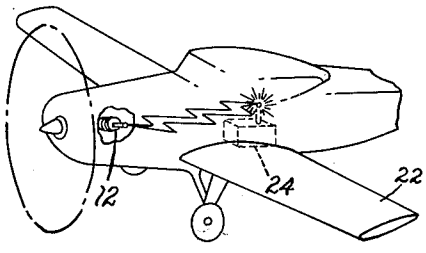


Fig. 3

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PREIGNITION DETECTION SYSTEM AND SPARK PLUG THEREFOR

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3 Claims. (Cl. 313—134)

This invention relates to a spark plug for reciprocating type aircraft engines and, more particularly, to a spark plug having means for detecting preignition or other engine malfunctions which cause excessive heat.

Preignition in piston type aircraft engines can give rise to serious and dangerous engine damage unless detected early so that corrective measures can immediately be taken. For example, the excessive heat which always accompanies continued preignition can cause extremely rapid parts wear and structural failures such as cracked pistons or cylinder heads thus leading to a hazardous flying condition. It is an object of the present invention to provide a simple, low cost means for detecting preignition before serious engine damage occurs. More specifically, it is an object of the present invention to provide a spark plug having temperature responsive means to cause an opening in the high tension shielding of the spark plug to thereby cause a radio signal on the occurrence of continued preignition.

These and other objects and advantages of the invention will appear more clearly from the following detailed description made with reference to the accompanying drawings in which:

Figure 1 shows a side view in section of a spark plug constructed in accordance with the invention;

Figure 2 shows a partial side view of the spark plug shown in Figure 1; and

Figure 3 is a schematic view of an aircraft, with parts broken away, embodying the detection system of this invention.

Referring now to the drawings, the spark plug shown comprises a cylindrical steel shell **2** having concentrically secured therewithin a generally tubular ceramic insulator **4** with a center electrode assembly **6** therein. The lower end **8** of the center electrode assembly constitutes the center electrode firing tip and is positioned in spark gap relationship with the ground electrode **10** secured to the base of the metal shell. A steel or other high temperature resistant metal shielding barrel **12** is secured to the shell by crimping and brazing, and surrounds the upper end of the tubular insulator which is shaped for reception of ignition cable (not shown). As thus far described, the spark plug shown is the same as that covered by United States Patent 2,874,323, issued February 17, 1959 to Wilfred A. Bychinsky and Alfred Candelise, which is assigned to the assignee of the present invention.

It is conventional in all aircraft spark plugs and ignition systems to completely enclose the high tension conductors within metal tubing in order to shield against ignition interference with radio reception. This is the function which is served by the metal barrel **12** of the spark plug shown. In accordance with the present invention the steel or other high temperature resistant metal shielding barrel **12** is formed with an opening **14**, and this opening is filled with an insert **16** of low temperature fusible metal, the term "metal" here being intended to comprehend both single metals and alloys of metals. The metal insert **16** is such that it remains

solid and therefore fills the opening in the shielding barrel at normal operating temperatures but melts at the abnormally high temperatures which accompany continued preignition. This generally requires a metal or metal alloy for the insert having a melting point of from about 400° F. to 800° F.; however, the precise metal or metal alloy used will, of course, depend upon the operating temperature characteristics of the engine in which the spark plug is to be used, and upon the heat transfer characteristics of the particular spark plug. For example, the heat transfer properties of the spark plug shown are such that when it is used in one particular aircraft engine, the temperature of the shielding barrel **12** at the location of the fusible insert will always be under 650° F. while the engine is operating normally, but will well exceed 650° F. when continued preignition occurs. For this application the fusible insert can be made of an alloy consisting of 95% lead and 5% silver, which alloy has a melting point of 685° F. The insert **16** can be secured within the opening in any suitable manner, for example, by a pair of opposed peripheral flanges **18** and **20** as shown.

For optimum preignition detection performance from the spark plugs, it is preferable to equip the aircraft **22** (see Figure 3) with a special radio receiver **24** to pick up and indicate to the aircraft operator the ignition interference resulting from the melting of any of the inserts. In a multi-engine aircraft the radio can be equipped with a separate antenna in each engine nacelle to selectively pick up any ignition interference from that engine. Operation is as follows: While all cylinders of all engines are operating normally, the fusible inserts of all the spark plugs remain intact and, thus, the ignition shielding is complete and no radio interference occurs. However, if preignition occurs in, for example, one of the cylinders of the No. 4 engine, the excessive heat generated in that cylinder will cause the fusible insert in the spark plug of that cylinder to melt thereby causing an opening in the ignition shielding. Immediately, the antenna in the No. 4 engine nacelle detects the characteristic ignition noise which will be heard through the radio in the aircraft cockpit. By selectively switching off the various antennae, the aircraft operator can determine which engine is malfunctioning and immediately take appropriate corrective measures before the trouble gives rise to a dangerous flying condition.

If desired, the fusible alloy can be located elsewhere in the spark plug and operatively connected to a slidable steel or other metal door over the opening in the shielding barrel such that when the fusible alloy melts, it allows the door to slide open and thus give rise to radio interference. Hence, while the invention has been described specifically with reference to a preferred embodiment thereof, it is understood that changes and modifications may be made, all within the full and intended scope of the claims which follow.

I claim:

1. In an aircraft spark plug having an insulator-center electrode assembly secured within a metal shell, a high temperature resistant metal shielding barrel surrounding the upper end of said assembly to shield against ignition interference with radio reception, said barrel having an opening therein filled with an insert of a low temperature fusible metal which will melt out of said opening from excessive heat in the spark plug to allow ignition interference with radio reception and thereby indicate the occurrence of a malfunction causing the excessive heat.

2. An aircraft spark plug comprising an insulator-center electrode assembly secured within a metal shell, a metal shielding barrel secured to said shell and surrounding the upper end of said insulator-center elec-

trode assembly to shield against ignition interference with radio reception, and a mass of low temperature melting metal in said plug which, upon melting, provides an opening in said shielding barrel to allow ignition interference with radio reception and thereby indicate the occurrence of a malfunction causing excessive heat in the spark plug.

3. An aircraft spark plug comprising an insulator-center electrode assembly secured within a metal shell and a metal shielding barrel secured to said shell and surrounding the upper end of said insulator-center electrode assembly to shield against ignition interference with radio reception, a portion of said shielding barrel being

of a material which melts at between 400° F. and 800° F such that said portion melts and creats an opening in said shielding barrel by way of excessive heat in the spark plug to allow ignition interference with radio reception and thereby indicate the occurrence of a malfunction causing the excessive heat.

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