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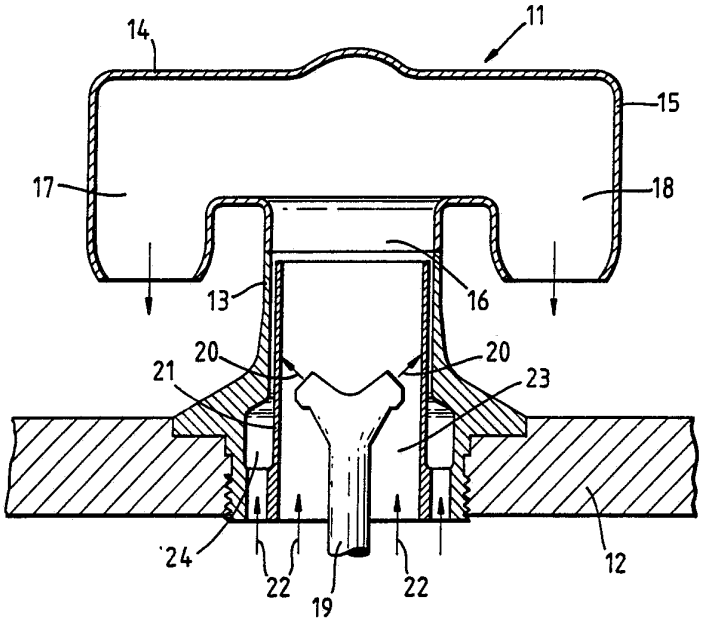
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(54) Title: FUEL VAPORISER



(57) Abstract

A fuel vaporiser (11) is formed by a tube (13) extending into a fuel burning region. A gas flow passage (16) is defined within the tube and a fuel injector (19) injects fuel into this passage. A shield (21) is placed to prevent this injected fuel (20) impinging directly onto the tube (13). This prevents the production of excessive thermal differentials in the tube (13), increasing the lifetime of the vaporiser (11).

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FUEL VAPORISER

This invention relates to a fuel vaporiser and particularly to a ceramic fuel vaporiser.

A typical fuel vaporiser is shown in figure 1. The vaporiser 1 projects into a fuel burning region through a burner wall 2. The vaporiser 1 is formed by a first tube 3 bifurcating into a second tube 4 and a third tube 5.

In operation air, denoted by the arrows 6, passes through the vaporiser 1 and a fuel injector 7 sprays two jets 8 of fuel against the inner face of the first tube 3. The fuel is then carried through the vaporiser 1 by the flow of air 6. As the fuel passes through the vaporiser 1 it absorbs heat from the walls of the vaporiser 1, simultaneously vaporising the fuel and cooling the vaporiser 1. A mixture of air and vaporised fuel, denoted by the arrows 9, is emitted from the ends of the second and third tubes 4 and 5 into the fuel burning region where it is burnt.

The use of the fuel to cool the vaporiser 1 allows it to withstand temperatures in the fuel burning region which would otherwise destroy it or greatly shorten its useful life.

The use of ceramics to replace metals in hot environments in gas turbine engines because of their higher temperature tolerances is quite common. It has been found that vapourisers of the type described above can be prone to sudden failure in use and that when they are formed from ceramics they tend to fail in use very rapidly, necessitating frequent replacement. This is of

course undesirable because of the cost of the replacement vapourisers and the cost of disassembling the reassembling the engine to fit them.

This invention was intended to produce a more durable fuel vaporiser and at least partially overcome these problems.

This invention provides a fuel vaporiser comprising a tube defining a gas flow passage, a fuel injector arranged to inject fuel into the gas flow passage and a shield spaced apart from the tube and arranged to prevent the injected fuel impinging directly on the tube.

It has now been realised that the reason for the failure of vapourisers is that the regions of the tube 3 on which the jets 8 of fuel directly impinge experience a very large amount of cooling and as a result are at a much lower temperature than the rest of the tube 3. This results in differential thermal expansion within the material of the tube 3 which generates internal stresses which cause fatigue. In ceramics this is an especial problem because these internal stresses tend to shatter the brittle ceramics.

The use of a shield to prevent the injected fuel impinging directly onto the tube reduces the temperature differences within the material of the tube and as a result reduces the internal stresses produced by differential thermal expansion. The shield is spaced apart from the tube to insulate it from the tube.

It is preferred to have the shield situated within the passage because this ensures that the shield is not exposed to the full temperature within the fuel burning region. As a result the temperature of the shield will be considerably less than the temperature of the tube so

failure of the shield due to differential thermal expansion where the shield has fuel directly impinging on it will not be a problem.

The invention will now be further described by way of example only with reference to the accompanying diagrammatic figures in which;

Figure 2 shows a fuel vaporiser employing the invention.

Referring to figure 2 a fuel vaporiser 11 for use in a gas turbine engine is shown. This projects through a wall 12 bounding a fuel burning region and is formed by a first cylindrical ceramic tube 13 and second and third cylindrical ceramic tubes 14 and 15 respectively. The three tubes 13, 14 and 15 are arranged so that a first internal passage 16 defined by the first tube 13 bifurcates into second and third internal passages 17 and 18 defined by the second and third tubes 14 and 15 respectively. The cross sectional area of each of the second and third passages 17 and 18 being half that of the first passage 16. All three of the tubes 13, 14 and 15 are formed from the same ceramic material.

A fuel injector 19 injects two jets 20 of fuel into the vaporiser 11 and these impinge on a tubular shield 21 inside and coaxial with the first tube 13. The tubular shield 21 is formed from the same ceramic material as the tubes 13, 14 and 15.

In use, air denoted by arrows 22, passes along a fourth passage 23 defined within the tubular shield 21 and a fifth annular passage 24 defined between the first tube 13 and the shield 21. The shield 21 is connected to the first tube 13 by a plurality of vanes 25 which extend

across the fifth passage 24, these vanes 25 support the shield 21 and hold it in place.

The fuel jets 20 impinge on the shield 21 and this causes the fuel to scatter around the whole of its circumference. The airflow along the fourth passage 23 then carries the fuel out of the end of the fourth passage 23 into the first passage 16, where it mixes with the air from the fifth passage 24.

The fuel picks up heat energy from the walls of the vaporiser 11 and from the shield 21 and as a result vaporises, simultaneously the vaporiser 11 and shield 21 are cooled.

The temperature of the shield 21 will be less than the temperature of the rest of the vaporiser 11 because the air passing along the fifth passage 24 insulates the shield 21 from the first tube 13, which is exposed to the heat within the fuel burning region.

The function of the shield 21 is to prevent direct impingement of the jets 20 of fuel onto the outer tube 13 and so reduce the differential temperatures present in the outer tube 13. As a result the shield 21 does not have to extend all the way through the wall 12, but could be shorter, provided it blocks the jets 20 of fuel.

The shield 21 is shown supported by vanes 25 connecting it to the outer tube 13, this is not essential, the shield 21 could be supported by a dedicated support structure, avoiding all contact with the outer tube 13 or the shield 21 could be connected to the outer tube 13 in some other way.

Although the vaporiser 11 shown is a bifurcated vaporiser a vaporiser having only one outlet or three or more outlets would be equally practical.

The vaporiser described has the vaporiser tubes 13, 14 and 15 and the shield 21 formed of the same ceramic material. These parts could be formed of other materials and/or dissimilar materials, in particular the shield 21 could be formed from a different material to the other parts because it is exposed to a different environment. The shield 21 could for example be metal while the tubes 13, 14 and 15 were all formed from a single ceramic material.

The vaporiser described has air passing along the passages 23 and 24, this could of course be replaced by any other combustion sustaining gas or mixture of gasses.

CLAIMS

1 A fuel vaporiser comprising a tube defining a gas flow passage, a fuel injector arranged to inject fuel into the gas flow passage and a shield spaced apart from the tube and arranged to prevent the injected fuel impinging directly on the tube.

2 A vaporiser as claimed in claim 1 in which the shield is within the passage.

3 A vaporiser as claimed in claim 1 in which a second gas flow passage is defined between the shield and the tube.

4 A vaporiser as claimed in claim 3 in which the shield is an open ended tube.

5 A vaporiser as claimed in any preceding claim in which the tube is formed from a ceramic material.

6 A vaporiser as claimed in any preceding claim in which the shield is formed from a ceramic material.

7 A vaporiser substantially as shown in or as described with reference to the accompanying figure 2.

Fig.1.

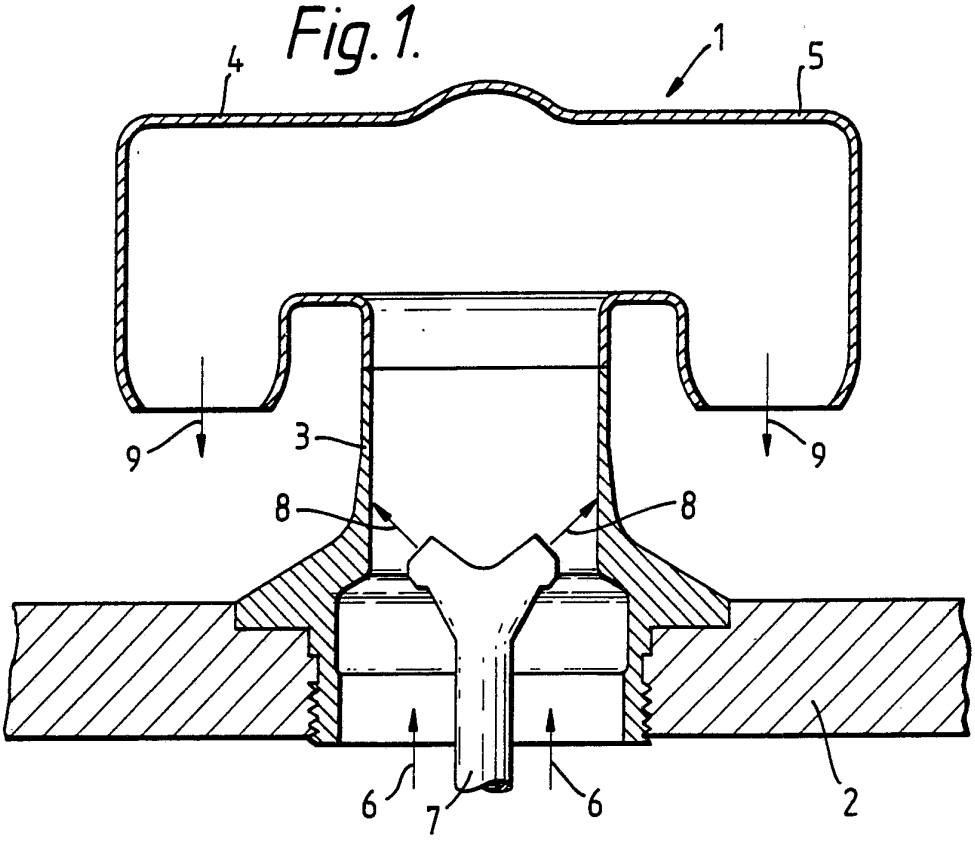
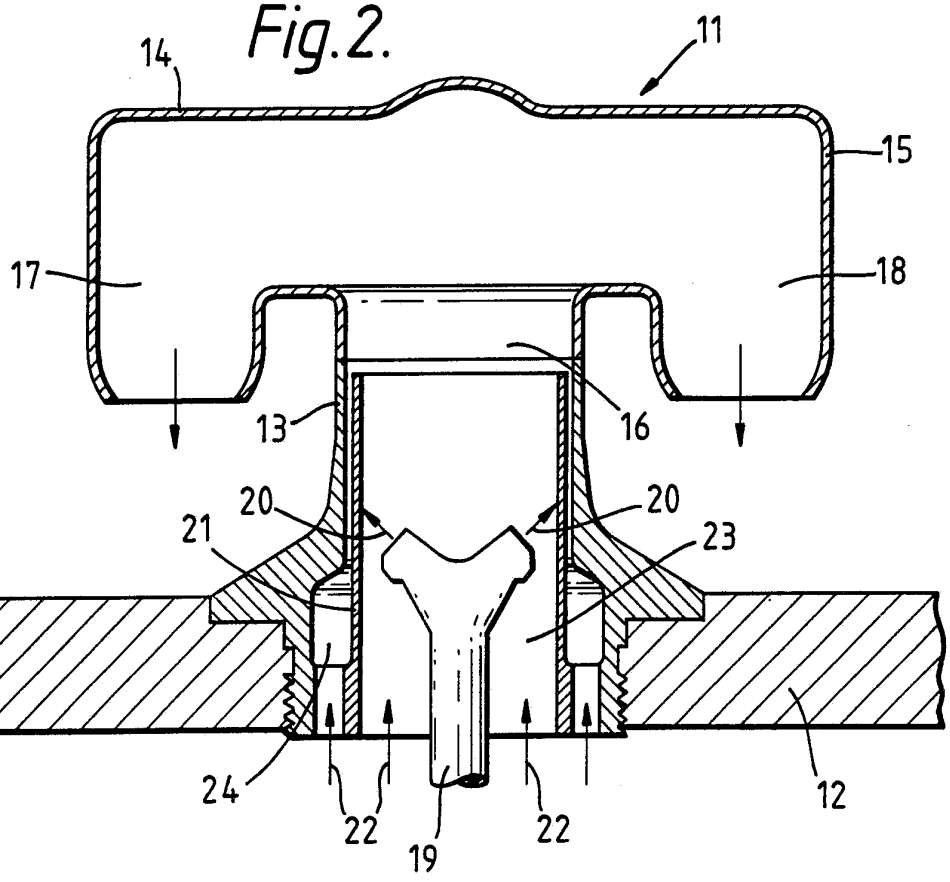


Fig.2.



INTERNATIONAL SEARCH REPORT

PCT/GB 91/01988

International Application No

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all)[6]

According to International Patent Classification (IPC) or to both National Classification and IPC

Int.Cl. 5 F23R3/32

II. FIELDS SEARCHED

Minimum Documentation Searched[7]

Classification System	Classification Symbols
Int.Cl. 5	F23R

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched[8]

III. DOCUMENTS CONSIDERED TO BE RELEVANT[9]

Category °	Citation of Document,[11] with indication, where appropriate, of the relevant passages[12]	Relevant to Claim No.[13]
X	US,A,2 956 404 (KASSNER) 18 October 1960 see column 1, line 33 - line 72 see column 4, line 4 - line 18; figure 4	1,2
X	GB,A,902 510 (BRISTOL SIDDELEY ENGINES) 1 August 1962 see page 2, line 39 - line 80	1-3
A	NL,C,85 569 (POWER JETS) 15 July 1957 see the whole document	1,2
A	US,A,2 830 439 (JOHNSON) 15 April 1958 see the whole document	1

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IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
11 FEBRUARY 1992	04.03.92
International Searching Authority	**Signature of Authorized Officer**
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III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)

Category °	Citation of Document, with indication, where appropriate, of the relevant passages	Relevant to Claim No.
A	FR,A,2 131 790 (SOCIETE NATIONALE D'ETUDE ET DE CONSTRUCTION DE MOTEURS D'AVIATION) 17 November 1972 see page 1, line 18 - page 2, line 30 see page 7, line 5 - page 8, line 36; figure 5 ---	1

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL PATENT APPLICATION NO. GB 9101988 SA 53162

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The members are as contained in the European Patent Office EDP file on 11/02/92
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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US-A-2956404		None	
GB-A-902510		None	
NL-C-85569		None	
US-A-2830439		None	
FR-A-2131790	17-11-72	None	