



Europäisches Patentamt
European Patent Office
Office européen des brevets



(11) **EP 1 662 203 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
31.05.2006 Bulletin 2006/22

(51) Int Cl.:
F23R 3/60 (2006.01)

(21) Application number: **05256724.5**

(22) Date of filing: **31.10.2005**

(84) Designated Contracting States:
**AT BE BG CH CY CZ DE DK EE ES FI FR GB GR
HU IE IS IT LI LT LU LV MC NL PL PT RO SE SI
SK TR**
Designated Extension States:
AL BA HR MK YU

(72) Inventor: **Cooper, Stephen Mark**
Breedon on the Hill
Derbyshire, DE73 1AL (GB)

(74) Representative: **Gunn, Michael Alan**
Rolls-Royce plc
P.O. Box 31
Derby DE24 8BJ (GB)

(30) Priority: **30.11.2004 GB 0426214**

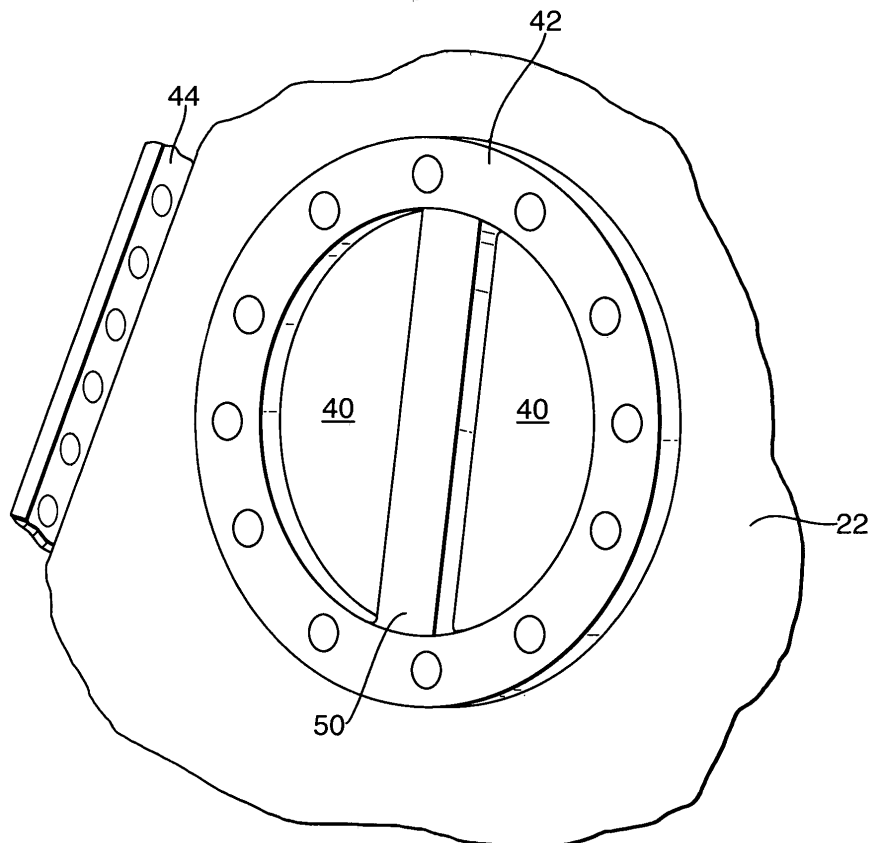
(71) Applicant: **ROLLS-ROYCE PLC**
London, SW1E 6AT (GB)

(54) **Combustor**

(57) A casing for a combustor of a gas turbine engine has a plurality of apertures, each aperture being reinforced with a band of material dividing the aperture.

The casing and reinforcing member are forged simultaneously with the reinforcing member aligned with the direction of maximum stress field.

Fig.3.



EP 1 662 203 A1

Description

[0001] This invention relates to a casing. More particularly this invention relates to a casing for a combustion chamber of a gas turbine engine.

[0002] A ducted fan gas turbine engine generally comprises, in axial flow series, an air intake, a propulsive fan, an intermediate pressure compressor, a high pressure compressor, combustion equipment, a high pressure turbine, an intermediate pressure turbine, a low pressure turbine and an exhaust nozzle.

[0003] The structure and operation of all these components is generally well known and consequently, with the exception of the combustion equipment, will not be described in great detail in this specification.

[0004] Combustors and combustor casings can have a large number of apertures. The apertures allow access for components such as fuel manifolds, probes and ignitors which, partly due to the high temperatures within the combustion chamber, must necessarily be positioned externally of the combustion chamber outer casing.

[0005] The apertures must be reinforced against stresses. Traditionally this is achieved by reinforcing the rim of the aperture with some of the material from which the casing is formed.

[0006] The casing and rim reinforcement are typically formed by casting or forging. In a forging process a volume of material is heated shaped by two or more dies. The material undergoes plastic deformation and conforms to the shape of the die. The volume of the material does not alter significantly in the forging process.

[0007] Where provision for apertures are formed as part of the forging process a volume of material equal to the size of the aperture must be formed. In some areas this volume of material may be used to form the reinforcing rims of the apertures, in other areas the volume of material is dispersed around the casing and must subsequently be removed.

[0008] Where the aperture requires reinforcement greater than the casing thickness an additional volume of material must be added in the forging process.

[0009] Gas turbines have weight and cost considerations that must be addressed. Where a turbine provides thrust for a transport device such as a ship or plane reducing the weight of the engine can have a beneficial effect on the efficiency of the transport device and can lead to a reduction in the fuel consumption.

[0010] It is an object of the present invention to seek to provide an improved reinforced aperture.

[0011] According to the present invention there is provided a combustion casing for use in a gas turbine, the casing having an aperture extending therethrough, characterised in that the aperture has a reinforcing member extending across and dividing the aperture.

[0012] Preferably the aperture has a rim extending around the periphery of the aperture and preferably the rim is raised from a substantially planar area of the casing.

[0013] Preferably the reinforcing member is integral with the rim.

[0014] Preferably the rim and the reinforcing member are formed simultaneously by casting, sintering or forging.

[0015] Preferably the rim is integral with the casing.

[0016] Preferably the rim and the casing are formed simultaneously by casting, sintering or forging.

[0017] The rim may be subject to a stress field and preferably the reinforcing member is orientated so as to align with the direction of maximum stress field. The reinforcing member may be a single or plural bar that may be straight, curved or serpentine.

[0018] The term "casing" in this specification includes hoods, cowling, sheets, combustors, combustor casings and other components having similar functionality to the above.

[0019] The present invention will now be described, by way of example only, with reference to the accompanying drawings in which:

Figure 1 depicts an annular combustion chamber

Figure 2 is a conventional aperture in the combustion chamber casing

Figure 3 is an aperture according to the present invention.

Figure 4 depicts a gas turbine engine having a combustor with a casing in accordance with the present invention.

[0020] Figure 1 depicts annular combustion equipment for a gas turbine engine. The combustion equipment consists of an annular combustion inner casing 20, and a coaxial annular combustion outer casing 22. The combustion chamber 24 is coaxial with and positioned between the inner casing 20 and the outer casing 22.

[0021] The combustion chamber 24 is defined by an outer combustor wall 26 and an inner combustor wall 28, the internal volume being adapted to allow multiple combustion zones.

[0022] A series of regularly spaced fuel injectors 30 extend through a bulkhead 32 that forms one wall of the combustion chamber. The fuel injectors mix air with fuel and eject it into the combustion chamber as a finely dispersed mixture.

[0023] Fuel is supplied to the injectors via a conduit that extends through apertures in the combustion outer casing 22. Also extending through apertures in the combustion chamber outer casing are igniters that ignite the finely dispersed air and fuel mixture injected into the combustion chamber by the fuel injectors.

[0024] Figure 2 depicts an aperture 40 in the combustion outer casing that has been formed by a forging process. The aperture has a rim 42 that is raised from the local surface of the combustion outer casing 22. A flange 44 is provided on the combustion outer casing for connection with a high pressure compressor housing.

[0025] The material of the combustion outer casing is

a high temperature nickel alloy or steel. The rim reinforces the casing against stresses that are created by the presence of the apertures and movement induced by pressure fluctuations in the combustor.

[0026] To adequately overcome hoop stresses the volume of material within the rim is typically equal to that lost in the formation of the aperture.

[0027] Figure 3 depicts a reinforcing member for an aperture according to the present invention. The reinforcing member 50 extends across the aperture and is formed during the forging process. The member is aligned to align with the direction of maximum stress field. The stress fields may be determined either empirically or by routine calculation.

[0028] A reinforcing member of this type uses significantly less volume of material than that of the prior art to achieve an equal or better reinforcement. The overall volume of material for the casing is reduced. Where a large number of apertures are provided, as in the combustor outer casing, it can result in lower forging and machining costs and a significant cost saving in the amount of material required as well as a reduction in the weight of the component.

[0029] Where reinforcement is achieved through the provision of a reinforcement member of the present invention it is possible to increase the size of the aperture without loss of functionality due to detrimental effects caused by stresses on the component. The cost and weight savings offered by the present invention are thereby further enhanced.

[0030] Figure 4 is a schematic of a gas turbine engine incorporating a combustor with a casing of the invention. The gas turbine engine has a fan 102, an intermediate compressor 104, a high pressure compressor 106, an annular combustor 108, a high pressure turbine 110, an intermediate pressure turbine 112 and a low pressure turbine 114.

[0031] It will be appreciated that other embodiments may be apparent to the skilled reader without departing from the inventive concept of the present invention.

[0032] Each feature described herein may be incorporated into the claims either independently or in combination with any other feature.

Claims

1. A combustion casing (26) for use in a gas turbine, the casing having an aperture (40) extending therethrough, **characterised in that** the aperture has a reinforcing member (50) extending across and dividing the aperture.
2. A casing according to Claim 1, wherein the casing is annular.
3. A casing according to Claim 1, wherein the aperture has a rim (42) extending around its periphery.

4. A casing according to Claim 2, wherein the rim is raised from a substantially planar area of the casing.
5. A casing according to Claim 2 or Claim 3, wherein the reinforcing member (50) is integral with the rim.
6. A casing according to any one of Claim 2 to Claim 4, wherein the rim and the reinforcing member are formed simultaneously by casting, sintering or forging.
7. A casing according to any one of Claim 2 to Claim 5, wherein the rim is integral with the casing.
8. A casing according to any one of Claim 2 to Claim 6, wherein the rim and the casing are formed simultaneously by casting, sintering or forging.
9. A casing according to any one of Claim 2 to Claim 7, wherein the rim is subject to a stress field, the reinforcing member being orientated so as to align with the direction of maximum stress field.
10. A gas turbine engine incorporating a combustor casing as claimed in any one of the preceding claims.

Fig.1.

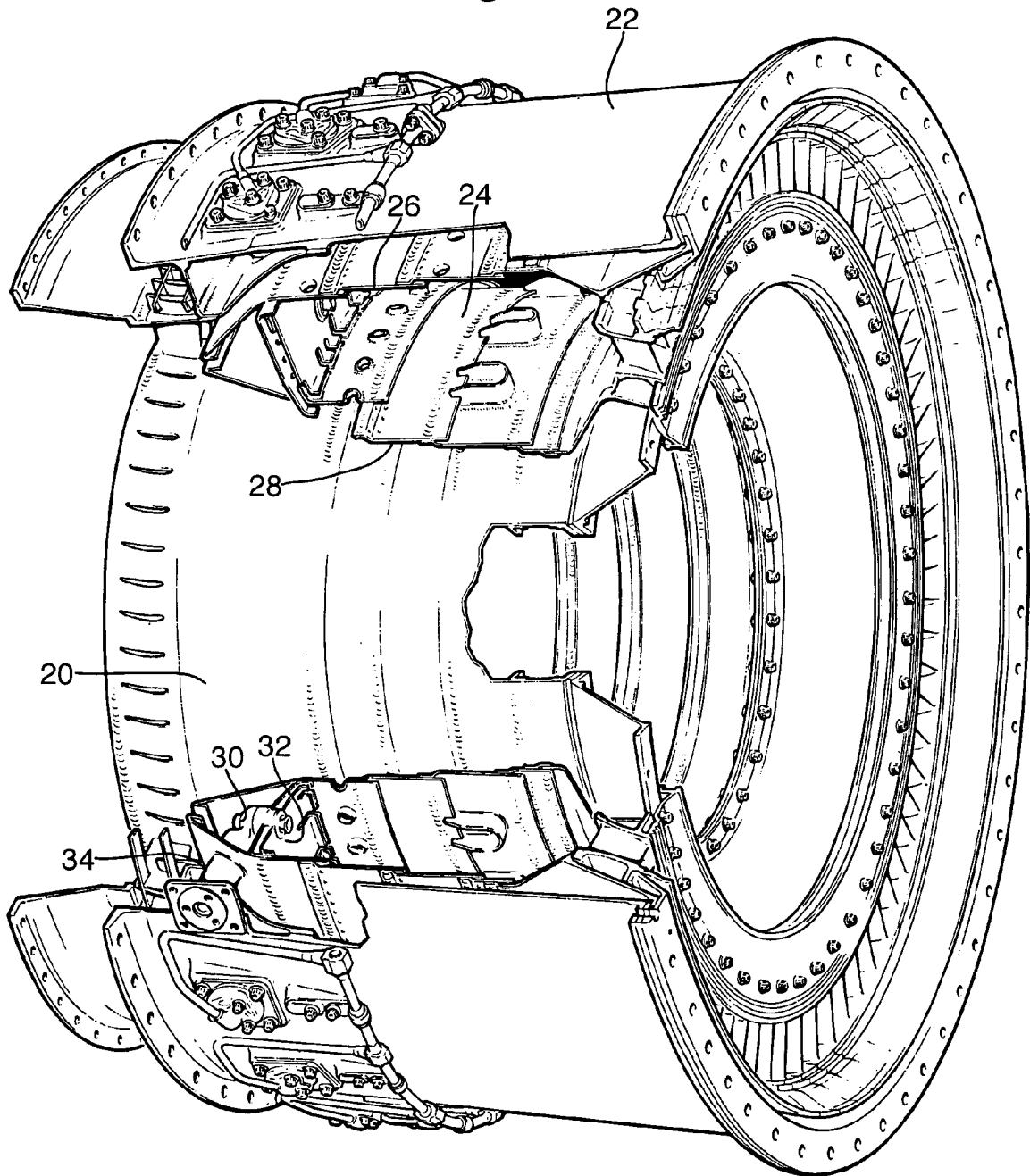


Fig.2.

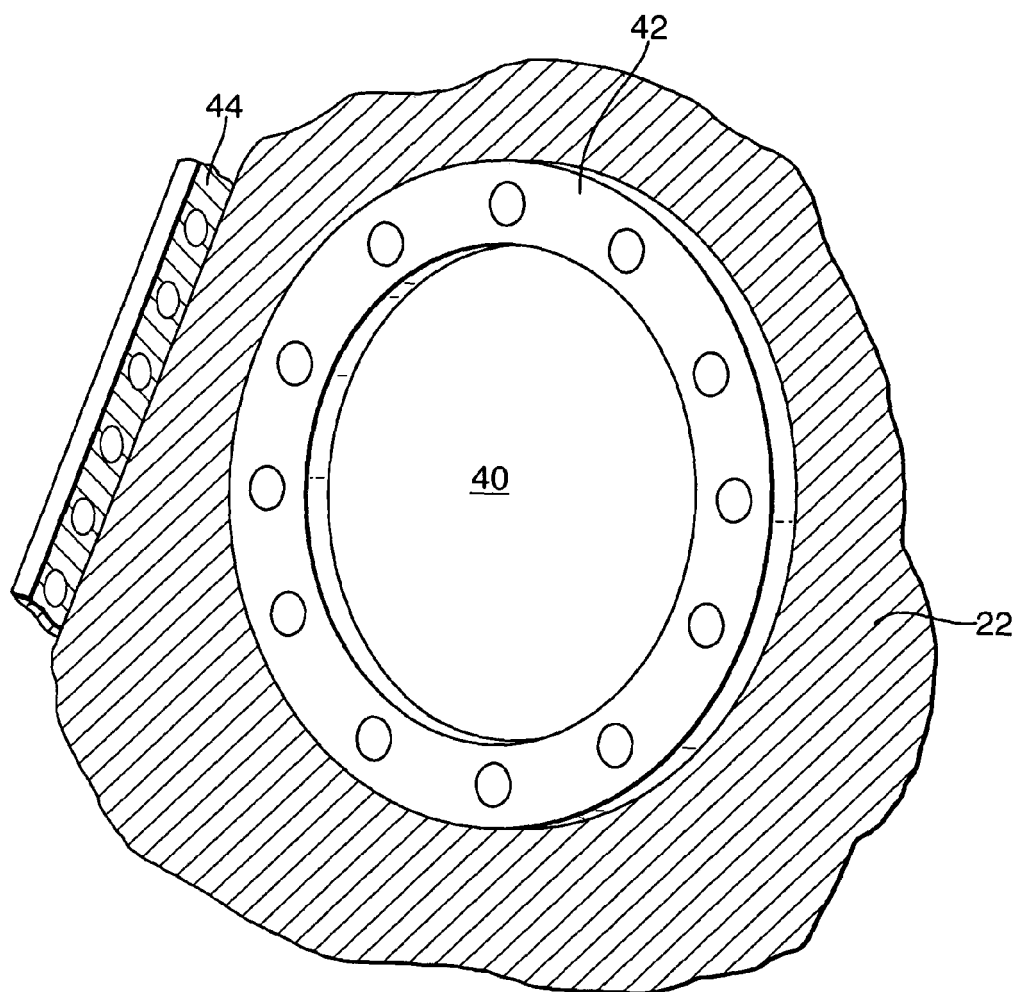


Fig.3.

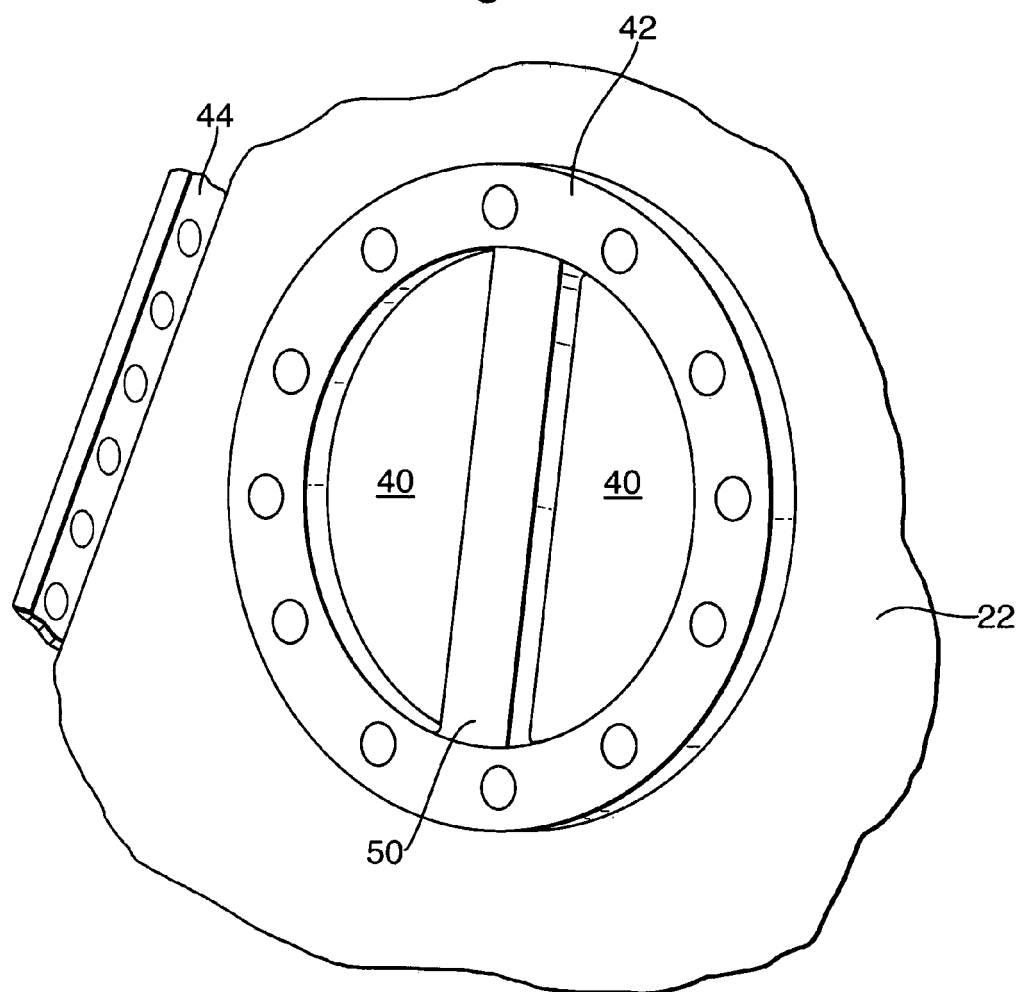
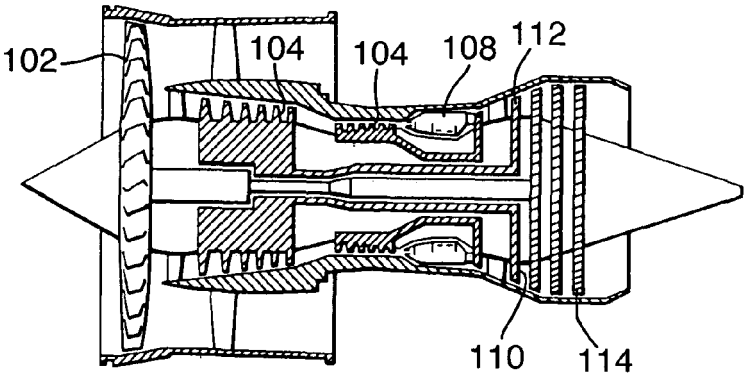


Fig.4.





European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 05 25 6724

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 2 488 911 A (HEPBURN WILLIAM M ET AL) 22 November 1949 (1949-11-22)	1-4,9,10	F23R3/60
Y	* column 3, line 45 - column 4, line 11; figure 1 *	5,7,8	
X	US 2 513 325 A (HUNDSTAD RICHARD L) 4 July 1950 (1950-07-04)	1,2,9,10	
Y	* column 3, line 13 - line 41; figures 2-5 *	5,7,8	
Y	US 3 019 605 A (REGINALD FREDERICK) 6 February 1962 (1962-02-06) * column 2, line 43 - line 60 * * column 3, line 67 - column 4, line 38; figures 7,8 *	5,7,8	
A	PATENT ABSTRACTS OF JAPAN vol. 010, no. 044 (M-455), 21 February 1986 (1986-02-21) & JP 60 194234 A (HITACHI SEISAKUSHO KK), 2 October 1985 (1985-10-02) * abstract; figures 1,2,4,5 *	1	TECHNICAL FIELDS SEARCHED (IPC)
A	EP 1 329 669 A (GENERAL ELECTRIC COMPANY) 23 July 2003 (2003-07-23) * the whole document *	1	F23R
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 8 March 2006	Examiner Theis, G
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

5

EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 05 25 6724

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

08-03-2006

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 2488911	A	22-11-1949	NONE	
US 2513325	A	04-07-1950	NONE	
US 3019605	A	06-02-1962	DE 1066385 B GB 839009 A	29-06-1960
JP 60194234	A	02-10-1985	NONE	
EP 1329669	A	23-07-2003	CN 1432762 A JP 2003232520 A US 2003131603 A1	30-07-2003 22-08-2003 17-07-2003