

Title (en)  
DUAL-ALLOY DISK SYSTEM

Publication  
**EP 0431019 A4 19910731 (EN)**

Application  
**EP 89909656 A 19890728**

Priority  
• US 8903292 W 19890728  
• US 22590788 A 19880729  
• US 37792589 A 19890710

Abstract (en)  
[origin: GB2239826A] Two pieces of metal are bonded together at a surface by placing the two pieces into contact at the surface and forging the two pieces in a die which causes substantial displacement of the metal originally at the surface in a direction parallel to and outwardly from the edges of the surface and into vents in the face of the die and within the die impressions. The strain and displacement fields are controlled by the die and vent geometry which is designed to concentrate the strain and displacement along the original bondline. In this way, up to 99.9 %+ of the defects which are potentially present at the original surface are efficiently displaced with moving metal away from the original contact between the two pieces of metal into sacrificial ribs that form in the vents and the remaining defects are subjected to significant strain. A portion of the displaced metal which contains many of the defects and which forms the sacrificial ribs is removed from the resulting bonded workpiece as the sacrificial ribs are removed from the workpiece. The result is a bond with superior properties and with a bond surface which can be located very precisely both in orientation and location (e.g., radial distance from the center of a disk). This system is particularly appropriate for forming dual-alloy high-pressure turbine disks for gas turbines in which an annular peripheral ring of a second superalloy is bonded to a central core of a first superalloy. The system is particularly effective if, prior to forging, surfaces to be bonded are closely shape-conforming, are very clean, and are diffusion-bonded using hot isostatic pressing while the surfaces are gas-free. The sacrificial ribs are formed by vents in the impressions of the forging dies. The vents are adjacent to the outer edges of the bond surface. The system may be accomplished by using one or more strikes in the same dies or same die geometry, or may include multiple strikes in which only one side of the bond is in proximity to a vent during each strike. Subsequent strikes would process the bondline resulting from the previous strikes, but with the rib removed. The die impressions would be so shaped that the resulting die cavity would closely conform to the original workpiece shape, except for the vents, so that metal displacement and strain would be concentrated at the bondline.

IPC 1-7  
**B21J 5/00**; **B21K 1/32**; **F01D 5/02**

IPC 8 full level  
**F01D 5/14** (2006.01); **B21J 5/00** (2006.01); **B21J 5/02** (2006.01); **B21K 1/32** (2006.01); **B21K 1/36** (2006.01); **B21K 3/04** (2006.01); **B21K 25/00** (2006.01); **B23K 20/00** (2006.01); **F01D 5/02** (2006.01)

CPC (source: EP)  
**B21J 5/00** (2013.01); **B21K 1/32** (2013.01); **F01D 5/02** (2013.01)

Citation (search report)  
[A] EP 0171344 A1 19860212 - UNITED TECHNOLOGIES CORP [US]

Cited by  
KR101347034B1

Designated contracting state (EPC)  
AT BE CH DE FR GB IT LI LU NL SE

DOCDB simple family (publication)  
**WO 9002479 A2 19900322**; **WO 9002479 A3 19900531**; AT E107558 T1 19940715; AU 4156593 A 19930930; AU 4180989 A 19900402; DE 68916432 D1 19940728; DE 68916432 T2 19950119; EP 0431019 A1 19910612; EP 0431019 A4 19910731; EP 0431019 B1 19940622; GB 2239826 A 19910717; GB 2239826 B 19921021; GB 9001813 D0 19900905; JP 2721721 B2 19980304; JP H04500040 A 19920109

DOCDB simple family (application)  
**US 8903292 W 19890728**; AT 89909656 T 19890728; AU 4156593 A 19930628; AU 4180989 A 19890728; DE 68916432 T 19890728; EP 89909656 A 19890728; GB 9001813 A 19900126; JP 50904489 A 19890728