

Title (en)  
WARM ROLLING METHOD

Title (de)  
WARMWALZVERFAHREN

Title (fr)  
PROCEDE DE LAMINAGE A CHAUD

Publication  
**EP 1642988 A4 20061115 (EN)**

Application  
**EP 04734146 A 20040520**

Priority  
• JP 2004007277 W 20040520  
• JP 2003180290 A 20030520

Abstract (en)  
[origin: EP1642988A1] A multi-directional warm-rolling method for manufacturing an ultrafine grain steel material with an ultrafine grain structure of 3 µm or smaller in average grain size. When rolling of two passes or more is performed for a steel material in the rolling temperature range of 350 to 800°C, a rolling by an oval shape caliber and a rolling by the other shape caliber are performed at least one time so that a large amount of strain can be introduced into the material by a simple means with less section reduction ratio and less number of passes. Steel materials having the ultrafine grain structure and excellent strength and ductility can be manufactured by this method.

IPC 8 full level  
**B21B 1/00** (2006.01); **C21D 8/06** (2006.01); **B21B 1/16** (2006.01); **B21B 1/18** (2006.01); **C21D 8/00** (2006.01); **C21D 8/02** (2006.01)

CPC (source: EP KR US)  
**B21B 1/18** (2013.01 - EP US); **C21D 8/005** (2013.01 - EP US); **C21D 8/06** (2013.01 - EP KR US); **C21D 8/0231** (2013.01 - EP US)

Citation (search report)  
• [X] DE 3545952 A1 19860710 - SUMITOMO METAL IND [JP]  
• [X] US 5325697 A 19940705 - SHORE TERENCE M [US], et al  
• [A] WO 0220189 A2 20020314 - MORGAN CONSTRUCTION CO [US]  
• [A] US 6205835 B1 20010327 - BALVE KARL-HEINZ [DE], et al  
• [E] EP 1559804 A1 20050803 - NAT INST FOR MATERIALS SCIENCE [JP] & WO 2004035851 A1 20040429 - NAT INST FOR MATERIALS SCIENCE [JP], et al  
• [A] PATENT ABSTRACTS OF JAPAN vol. 2000, no. 13 5 February 2001 (2001-02-05)  
• [A] PATENT ABSTRACTS OF JAPAN vol. 007, no. 092 (M - 208) 16 April 1983 (1983-04-16)  
• See references of WO 2004104235A1

Designated contracting state (EPC)  
DE FR GB IT

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**EP 1642988 A1 20060405**; **EP 1642988 A4 20061115**; **EP 1642988 B1 20110720**; CN 100366761 C 20080206; CN 1791688 A 20060621; JP 2004346420 A 20041209; JP 4221497 B2 20090212; KR 100749381 B1 20070814; KR 20060035603 A 20060426; TW 200510084 A 20050316; TW I266659 B 20061121; US 2006191613 A1 20060831; WO 2004104235 A1 20041202

DOCDB simple family (application)  
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