

## Title (en)

Method for producing a magnetic grain oriented steel strip

## Title (de)

Verfahren zur Herstellung von kornorientiertem Elektroband

## Title (fr)

Procédé de fabrication de bande en acier magnétique à grains orientés

## Publication

**EP 1752548 A1 20070214 (DE)**

## Application

**EP 05016834 A 20050803**

## Priority

EP 05016834 A 20050803

## Abstract (en)

Production of grain-oriented electric steel strip by continuous thin-slab casting, involves a continuous hot-rolling stage on a line-mounted multiple-stand milling train at 900-1200[deg]C, with reductions of more than 40% in the first pass, more than 30% in the second pass and not more than 30% in the last pass. Production of grain-oriented electric steel strip based on a continuous thin-slab casting process, involves (a) melting steel containing (apart from iron and unavoidable impurities) 2.5-4.0 weight % silicon, 0.01-0.10 weight % carbon, 0.02-0.50 weight % manganese, 0.005-0.04 weight % sulfur and selenium (total), and optionally up to 0.07 weight % aluminum, up to 0.015 weight % nitrogen, up to 0.035 weight % titanium, up to 0.3 weight % phosphorus, up to 0.2 weight % (each) of one or more of the elements arsenic, tin, antimony, tellurium or bismuth, up to 0.3 weight % (each) of one or more of the elements copper, nickel, chromium, cobalt or molybdenum and up to 0.012 weight % (each) of one or more of the elements boron, vanadium or niobium, (b) secondary metallurgical processing of the melt in a vacuum unit and/or a pan furnace, (c) continuous casting to form a strip, (d) cutting the strip into thin slabs, (e) heating to 1050-1300[deg]C for not more than 60 minutes in an in-line furnace, (f) continuous hot-rolling in a line-mounted multiple stand mill train to give rolled strip with a thickness of 0.5-4.0 mm, using a temperature of 900-1200[deg]C for the first pass with a reduction of more than 40%, a reduction of more than 30% in the second pass and a reduction of not more than 30% in the last pass, (g) cooling the strip, (h) rolling the strip into a coil, (i) optionally annealing the strip after coiling or before cold-rolling, (j) cold-rolling to cold-rolled strip with a final thickness of 0.15-0.50 mm, (k) annealing with recrystallisation and decarbonisation, (l) treating the strip surface with a scale separator, (m) final annealing to develop a Goss structure, (n) optional coating with electrical insulation followed by stress-relieving annealing and (o) optional domain refinement.

## IPC 8 full level

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## CPC (source: EP KR US)

**B21B 1/46** (2013.01 - KR); **B22D 11/12** (2013.01 - KR); **C21D 8/12** (2013.01 - KR); **C21D 8/1222** (2013.01 - EP US); **C21D 8/1261** (2013.01 - EP US); **C22C 38/02** (2013.01 - EP KR US)

## Citation (applicant)

- JP 2002212639 A 20020731 - NIPPON STEEL CORP
- JP S56158816 A 19811207 - KAWASAKI STEEL CO
- DE 19745445 C1 19990708 - THYSSENKRUPP STAHL AG [DE]

## Citation (search report)

- [DY] WO 9919521 A1 19990422 - THYSSENKRUPP STAHL AG [DE], et al
- [Y] EP 1473371 A2 20041103 - USINOR [FR]
- [A] EP 0484904 A2 19920513 - NIPPON STEEL CORP [JP]
- [A] EP 1356126 B
- [A] US 4592789 A 19860603 - KAWAMO YAKICHIRO [JP], et al
- [A] PATENT ABSTRACTS OF JAPAN vol. 2002, no. 11 6 November 2002 (2002-11-06)
- [A] PATENT ABSTRACTS OF JAPAN vol. 006, no. 044 (C - 095) 19 March 1982 (1982-03-19)
- [A] PATENT ABSTRACTS OF JAPAN vol. 018, no. 443 (C - 1239) 18 August 1994 (1994-08-18)

## Citation (third parties)

Third party :

- US 5190597 A 19930302 - KOBAYASHI HISASHI [US], et al
- BARISONI M. ET AL: "I Materiali Magnetici impiegati nelle macchine elettriche: proprietà dei prodotti attuali e tendenze di sviluppo", LA METALLURGIA ITALIANA, vol. 83, no. 10, 1991, pages 905 - 914, XP003026798
- ERIK ULLMAN: "Liber", 2008, ISBN: 9789147051786, pages: 1-7,218 - 219, XP003027201
- D.E. NEWQUIST ET AL: "Grain-Oriented Silicon electrical steel from Italy and Japan", U.S. INTERNATIONAL TRADE COMMISSION, May 1994 (1994-05-01), pages 1 - 8, XP003026799
- "Processing of electrical sheet", THE MAKING, SHAPING AND TREATING OF STEEL, 1985, pages 1 - 1324, XP003027202

## Cited by

DE102017220721A1; DE102017220718A1; DE102017220714B3; DE102014104106A1; EP2942417A1; DE102008029581A1; WO2009012963A1; WO2019096735A1; DE102013208618A1; US10597539B2; WO2019096734A1; EP3693496A1; WO2020161094A1; WO2019096736A1; EP3495430A1; WO2019110777A1; US11873408B2

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RU 2383634 C2 20100310; SI 1752548 T1 20160930; TW 200710225 A 20070316; TW I402352 B 20130721; US 2009139609 A1 20090604;  
US 8038806 B2 20111018; WO 2007014867 A1 20070208; ZA 200800662 B 20090729

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EP 2006064479 W 20060720; HU E05016834 A 20050803; JP 2008524480 A 20060720; KR 20087005313 A 20060720;  
MX 2008001413 A 20060720; PL 05016834 T 20050803; RU 2008107949 A 20060720; SI 200532060 A 20050803; TW 95127714 A 20060728;  
US 99766806 A 20060720; ZA 200800662 A 20080122