

Title (en)
METHOD FOR PRESS HARDENING OF STEEL

Title (de)
VERFAHREN ZUM PRESSHÄRTEN VON STAHL

Title (fr)
PROCÉDÉ DE DURCISSEMENT D'ACIER À LA PRESSE

Publication
EP 2864505 B1 20200506 (DE)

Application
EP 13732131 A 20130625

Priority
• DE 102012105580 A 20120626
• EP 2013063282 W 20130625

Abstract (en)
[origin: DE102012105580B3] Press hardening of steel, comprises cold pre-forming a steel sheet made of a hardenable steel alloy, transforming in a mold, which has the contour of the preformed component, heating to perform a complete austenitization, and cooling at a speed higher than the critical hardening speed, such that a quenching of the preformed element takes place. A press hardness number is determined e.g. for adjusting the suitable steel alloy to known plant geometry, where the press hardness number is equal to the cooling rate in the mold/theoretical press cooling rate. Press hardening of steel, comprises either: cold pre-forming a steel sheet made of a hardenable steel alloy, transforming in a mold, which has the contour of the preformed component, heating to perform a complete austenitization, and cooling at a speed higher than the critical hardening speed, such that a quenching of the preformed element takes place; or heating a sheet of a steel with a composition, which allows a press hardening, to a temperature above the austenitizing temperature, hot molding in a mold, cooling at a speed which is higher than the critical hardening speed, such that hardening takes place, where the austenitic structure is transformed into a martensitic structure optionally with residual austenite. A press hardness number is determined for: adjusting the suitable steel alloy to known plant geometry, and the cooling rate achieved during operation in the mold; or adjusting a required mold to a given grade of steel, where the press hardness number is equal to the cooling rate in the mold/theoretical press cooling rate. The cooling rate in the mold is predetermined for a required thickness. The determination of the theoretical press cooling rate for steel material, which contain greater than 5 ppm boron dissolved in the starting material is represented by: theoretical press cooling rate is equal to $1750 / (28.5\% \text{ carbon} + 3.5\% \text{ silicon} + 2.3\% \text{ manganese} - 2\% \text{ aluminum} + 4\% \text{ chromium} + 3\% \text{ nickel} + 25\% \text{ molybdenum} - 20\% \text{ niobium} - 6.3) \geq 7$. The determination of the theoretical press cooling rate for steel material, which contain less than 5 ppm boron dissolved in the starting material is represented by: $2750 / (28.5\% \text{ carbon} + 3.5\% \text{ silicon} + 2.3\% \text{ manganese} - 2\% \text{ aluminum} + 4\% \text{ chromium} + 3\% \text{ nickel} + 25\% \text{ molybdenum} - 20\% \text{ niobium} - 7) \geq 8$, where: when press hardness number is less than 1 the complete hardening by martensite formation does not takes place; when press hardness number is equal to 1 an undeformed or preformed sheet is cured via an indirect process; and when press hardness number is less than 1, in addition to the indirect process, the sheet is thermoformed or increased security against plastic deformation during hardening takes place.

IPC 8 full level
C21D 1/673 (2006.01); **C21D 1/18** (2006.01); **C21D 6/00** (2006.01); **C21D 8/00** (2006.01); **C21D 11/00** (2006.01); **C22C 38/02** (2006.01); **C22C 38/04** (2006.01); **C22C 38/06** (2006.01); **C22C 38/44** (2006.01); **C22C 38/46** (2006.01); **C22C 38/48** (2006.01); **C22C 38/50** (2006.01); **C22C 38/54** (2006.01); **C22C 38/58** (2006.01)

CPC (source: EP US)
C21D 1/18 (2013.01 - EP US); **C21D 1/673** (2013.01 - EP US); **C21D 6/004** (2013.01 - EP US); **C21D 6/005** (2013.01 - EP US); **C21D 6/008** (2013.01 - EP US); **C21D 8/005** (2013.01 - EP US); **C21D 11/00** (2013.01 - EP US); **C21D 11/005** (2013.01 - EP US); **C22C 38/02** (2013.01 - EP US); **C22C 38/04** (2013.01 - EP US); **C22C 38/06** (2013.01 - EP US); **C22C 38/44** (2013.01 - EP US); **C22C 38/46** (2013.01 - EP US); **C22C 38/48** (2013.01 - EP US); **C22C 38/50** (2013.01 - EP US); **C22C 38/54** (2013.01 - EP US); **C22C 38/58** (2013.01 - EP US); **C21D 2211/008** (2013.01 - EP US)

Citation (examination)
MERKLEIN ET AL: "Determination of Material and Process Characteristics for Hot Stamping Processes of Quenchenable Ultra High Strength Steels with Respect to a FE-based Process Design", vol. 1, no. 1, 15 April 2009 (2009-04-15), pages 411 - 426, XP009505257, ISSN: 0096-736X, Retrieved from the Internet <URL:http://www.jstor.org/stable/26282671> DOI: 10.4271/2008-01-0853

Designated contracting state (EPC)
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR

DOCDB simple family (publication)
DE 102012105580 B3 20130425; CN 104487599 A 20150401; CN 104487599 B 20160831; EP 2864505 A1 20150429; EP 2864505 B1 20200506; ES 2791713 T3 20201105; US 2015152517 A1 20150604; US 9982319 B2 20180529; WO 2014001336 A1 20140103

DOCDB simple family (application)
DE 102012105580 A 20120626; CN 201380033524 A 20130625; EP 13732131 A 20130625; EP 2013063282 W 20130625; ES 13732131 T 20130625; US 201314408712 A 20130625