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(54) Title: A METHOD OF SHAPING AND HARDENING A SHEET STEEL BLANK

(57) Abstract: In the press-hardening process, if one wishes to have soft portions in the finished product and therefore reduces the cooling rate for these portions so that the material in these portions does not obtain the same high proportion of martensite as the rest of the product, one can improve the elongation at rupture in these soft portions by using annealed sheet steel as the starting blank, even though the hot shaping is done at a temperature in which the steel is austenitic.



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A method of shaping and hardening a sheet steel blank

Field of the invention

The invention pertains to a method of shaping and hardening a sheet steel blank into a product by heating the blank to the austenite state and hot-shaping the blank in a cooled pair of dies and hardening the shaped product while it is still inside the pair of dies, wherein one cools a portion of the product at a reduced cooling rate so that this part does not obtain the same high proportion of martensite as the rest of the product.

Background of the invention

WO 2006/038868 describes a way of using the press-hardening process to obtain soft regions by reducing the cooling rate in these regions so that they do not obtain the same high proportion of martensite as the rest of the product, while the product otherwise remains predominantly martensitic. One can reduce the cooling rate in these regions by having gaps between the pair of shaping dies and the shaped product. Alternatively, one can prevent quick cooling of these regions in other ways, for example, by heating a portion of the pair of dies while the rest of the pair of dies are cooled as usual. The press-hardening process normally makes use of boron steel and one achieves a tensile strength of 1500 MPa or higher. In the vehicle industry, when one uses press-hardened beams with relatively short soft sections in order to control the course of deformation during a collision, these regions will be exposed to large deformation. It is therefore important that the material in these regions have large elongation at rupture. In the press-hardening process, one heats up to the austenite state and gets the same result for the hardened material whether one uses a starting material that was annealed or not. Therefore, one uses the cheaper non-annealed material.

Object of the invention and description of the invention

One purpose of the invention is to use the press-hardening process to make a heat-shaped and hardened products of sheet steel which have soft portions with an elongation at rupture that is better then achieved heretofore.

This is accomplished, according to the invention, by using a blank of annealed sheet. It can be a blank of cold-rolled and recrystallisation-annealed or soft-annealed sheet.

A soft portion of a finished product, which is cooled at a lower rate and thus do not obtain the same high proportion of martensite as the rest of the product, have a lower yield strength and a lower tensile strength whether the starting material is annealed or not. It has been found, surprisingly, that the elongation at rupture is better when annealed starting material is used, than non-annealed, even though the blank is heated during the process to the austenitisation temperature range and hot-shaped in the austenitic state. Preferably, one achieves the lower cooling rate by holding portions of the pair of dies at an elevated temperature, for example, by induction heating, but one can achieve the lower cooling rate in other ways, for example, by gaps between the pair of dies and the shaped product.

The invention is defined by the patent claims.

Patent claims

1. Method of shaping and hardening a sheet steel blank into a product by heating the blank to the austenite state and hot-shaping the blank in a cooled pair of dies and hardening the shaped product while it is still inside the pair of dies, wherein one cools a portion of the product at a reduced cooling rate so that this portion does not obtain the same high proportion of martensite as the rest of the product, **characterised in that** one uses a blank of annealed sheet steel.
2. Method according to claim 1, **characterised in that** one uses gaps between the pair of dies and the shaped product to reduce the cooling rate.
3. Method according to claim 1, **characterised in that** one holds certain portions of the pair of dies at an elevated temperature to reduce the cooling rate of portions of the shaped product.
4. Method according to claim 3, **characterised in that** one uses induction heating to hold the elevated temperature.
5. Method according to any of the preceding claims, **characterised in that** one uses a blank of recrystallisation-annealed sheet steel.
6. Method according to any of the preceding claims, **characterised in that** one uses a blank of soft-annealed sheet steel.
7. Method according to any of the preceding claims, **characterised in that** one uses a blank of cold-rolled sheet.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE2009/000122

A. CLASSIFICATION OF SUBJECT MATTER

IPC: see extra sheet

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: C21D, B21D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-INTERNAL, WPI DATA, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 2006038868 A1 (GESTAMP HARDTECH AB), 13 April 2006 (13.04.2006), the whole document --	1-7
A	US 20070163683 A1 (SCHIESSL G.), 19 July 2007 (19.07.2007), the whole document --	1-7
A	EP 1642991 A1 (SUMITOMO METAL INDUSTRIES, LTD. ET AL), 5 April 2006 (05.04.2006), the whole document -- -----	1-7

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C21D 1/18 (2006.01)

C21D 8/00 (2006.01)

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Paper copies can be ordered at a cost of 50 SEK per copy from PRV InterPat (telephone number 08-782 28 85).

Cited literature, if any, will be enclosed in paper form.

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT/SE2009/000122

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