



US 20100269957A1

(19) **United States**

(12) **Patent Application Publication**  
**Akerstrom et al.**

(10) **Pub. No.: US 2010/0269957 A1**

(43) **Pub. Date: Oct. 28, 2010**

(54) **METHOD OF PRODUCING A PAINTED  
STEEL SHAFT PRODUCT OF HIGH  
STRENGTH**

(76) Inventors: **Paul Akerstrom**, Ranea (SE); **Jan  
Rolf Larsson**, Lulea (SE)

Correspondence Address:

**Mark P Stone**  
**50 Broadway**  
**Hawthorne, NY 10532 (US)**

(21) Appl. No.: **12/734,712**

(22) PCT Filed: **Nov. 11, 2008**

(86) PCT No.: **PCT/SE2008/000637**

§ 371 (c)(1),  
(2), (4) Date: **May 18, 2010**

(30) **Foreign Application Priority Data**

Nov. 26, 2007 (SE) ..... 0702597-6

**Publication Classification**

(51) **Int. Cl.**  
**C21D 8/02** (2006.01)

(52) **U.S. Cl.** ..... **148/537**

(57) **ABSTRACT**

A high-strength product of sheet steel is produced in the press hardening process. A blank is heated to reach austenite structure and hot-stamped in a pair of cooled tools. The product is kept in the tools to rapidly be cooled to harden with the tools as a fixture. The blank has a surface of black oxide before it is shaped and the shaped product is painted directly on the black surface.

**METHOD OF PRODUCING A PAINTED  
STEEL SHAFT PRODUCT OF HIGH  
STRENGTH**

**BACKGROUND OF THE INVENTION AND A  
BRIEF DESCRIPTION OF THE INVENTION**

**[0001]** Press-hardening is an established method of shaping and hardening blanks of sheet steel to a high strength product. This method is used in particular for producing high-strength beams and rails and other components for the vehicle industry. A corrosion protection is often needed and can be provided by painting when the skin, that is, the thick and brittle oxide formed in the process, has been removed by abrasive blasting.

**[0002]** According to the invention, a thin and smooth layer of black oxide can be established before the hot stamping and then the product can be painted directly on this oxide layer. In this way, a corrosion protection can be achieved that is in parity with or even better than the protection that can be provided by abrasive blasting and subsequent painting. It is also a less costly method.

**[0003]** Black oxide is well known for example from U.S. Pat. No. 7,115,174 B2 and comprises FeO as a main component. The teaching of U.S. Pat. No. 7,115,174 B2 is incorporated by way of reference.

**[0004]** The invention is defined by the claims.

**DESCRIPTION OF THE INVENTION**

**[0005]** In one way of carrying out the invention, a steel strip is used that is pre-oxidized to have a black oxide surface, that is, a thin smooth layer of black oxide. This oxide is not brittle and porous as ordinary oxide and it does not absorb moisture. A blank is cut from this strip and the blank is heated to

austenite state in a furnace with inert or slightly reducing or possibly slightly oxidizing atmosphere. The furnace may have sections with sequentially varying atmosphere. The heated blank is quickly moved to the shaping pair of tools in which it is hot stamped. The pair of tools is cooled, usually by internal water channels coupled to an external source, and the shaped product is kept in the tools with the tools as a fixture until the product has hardened by being rapidly cooled. Martensite is dominant in the hardened structure.

**[0006]** In another way of carrying out the invention, the blank is cut from an unoxidized strip, and heated to austenite state in a furnace with a slightly oxidizing atmosphere so that the black oxide is formed in the furnace. Also in this case, the furnace may have sections with sequentially varying atmosphere.

**[0007]** In both examples, the blank with a surface of black oxide can be moved from the furnace to the stamping tools so fast that a protective atmosphere is not needed for the transport, but a protective atmosphere may be preferable.

**1.** A method of producing a painted high strength product of sheet steel, wherein a sheet steel blank is heated to austenitic state and hot stamped and hardened in a cooled pair of tools, characterised in that a blank is used that has a black oxide layer of 1-5  $\mu\text{m}$ , and the shaped and hardened product is painted on the black oxide layer.

**2.** A method according to claim 1, characterised in that the blank is cut from a strip having a surface of black oxide, and the blank is heated in a furnace with inert or slightly oxidising atmosphere.

**3.** A method according to claim 1, characterised in that the blank is cut from an unoxidised band and the blank is heated in a furnace with a slightly oxidising atmosphere.

\* \* \* \* \*