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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte XIAOCHUAN XIONG and JEFF WANG

Appeal 2018-003649
Application 14/441,971
Technology Center 1700

Before TERRY J. OWENS, BEVERLY A. FRANKLIN, and LILAN REN,
Administrative Patent Judges.

OWENS, *Administrative Patent Judge.*

DECISION ON APPEAL

STATEMENT OF THE CASE

The Appellant (GM Global Technology Operations LLC) appeals under 35 U.S.C. § 134(a) from the Examiner's rejection of claims 1–15. We have jurisdiction under 35 U.S.C. § 6(b).

The Invention

The claims are to a method for treating a cast iron workpiece and to a rotational member formed by that method.

Claim 1 is illustrative:

1. A method for treating a cast iron workpiece to increase a useful life thereof, the method comprising:
either i) stress relieving the workpiece, or ii) refraining from stress relieving the workpiece;

machining the workpiece to provide a finish surface thereon;

deforming the finish surface of the workpiece by rubbing the finish surface against a blunt tool, thereby forming a nanocrystallized surface layer at the finish surface; and

nitrocarburizing the workpiece, the nanocrystallized surface layer accelerating diffusion of nitrogen atoms and carbon atoms therethrough, the nitrocarburizing taking place:

i) if the workpiece is stress relieved, for a period of time ranging from about 1 hour to about 2 hours at a temperature ranging from about 550°C to about 570°C, or

ii) if the workpiece is not stress relieved, for a period of time ranging from about 5 hours to about 10 hours at a temperature ranging from about 370°C to about 450°C, thereby rendering the nanocrystallized surface layer into i) a friction surface, or ii) a corrosion-resistant surface by the nitrocarburizing.

The References

Gunzner	US 5,265,500	Nov. 30, 1993
Holly	US 2008/0000550 A1	Jan. 3, 2008

W.P. Tong et al., *Nitriding Iron at Lower Temperatures*, 299 *Science* 686–88 (2003).

W.L. Li et al., *Fabrication of a gradient nano-micro-structured surface layer on bulk copper by means of a surface mechanical grinding treatment*, 59 *Scripta Materialia* 546–49 (2008).

The Rejections

The claims stand rejected under 35 U.S.C. § 103(a) as follows: claims 1–10 and 12–15 over Holly in view of Tong and Li, and claim 11 over Holly in view of Tong, Li, and Gunzner.

OPINION

We reverse the rejections.

The claims require nitrocarburizing a nanocrystallized-surface cast iron workpiece for about 1 hour to about 2 hours at about 550°C to about 570°C if the workpiece has been stress relieved, and for about 5 hours to about 10 hours at about 370°C to about 450°C if the workpiece has not been stress relieved. To meet that claim requirement the Examiner relies upon the combined disclosures of Holly and Tong (Final Act. 4).

Holly nitrocarburizes a cast iron brake rotor in a salt bath at a preferred temperature of 580°C (¶ 60). “The depth of the nitride compound that is formed is dependent on the length of time (dwell time) of the brake rotor at this temperature” (*id.*). An exemplified combination of temperature and dwell time, regardless of whether the brake rotor has been stress relieved, is 579°C for between one and two hours (¶¶ 33, 34, 40).

Tong, before nitriding an iron plate’s surface, repeats multidirectional impacts of the surface with flying 8 mm diameter stainless steel balls to plastically deform the surface such that coarse grains progressively are refined into nanocrystalline grains, thereby enhancing the surface layer’s nitrogen diffusion which greatly enhances iron nitriding kinetics so the nitriding temperature can be as low as 300°C, much lower than conventional nitriding temperatures above 500°C (pp. 686–688).

The Examiner finds that “Tong teaches that the nanocrystalline surface allows for lower processing temperatures to avoid deterioration of the workpiece” (Final Act. 4), but the Examiner does not point to support for that finding in Tong.

The Examiner concludes that “[i]t would have been obvious to one of ordinary skill at the time of the invention to select an appropriate temperature lower than that of Holly, including those temperatures within

the range of the instant claim, in order to avoid deterioration of the workpiece, and one of ordinary skill in the art at the time of the invention could have done so with predictable results and a reasonable expectation of success” (Final Act. 4), and “it would have been obvious to one of ordinary skill at the time of the invention to select an appropriate dwell time at the chosen temperature to achieve the desired treatment depth” (*id.*).

The Examiner does not establish that the applied references would have led one of ordinary skill in the art to either combination of temperature and time required by the Appellant’s claims for nitrocarburizing a nanocrystallized-surface cast iron workpiece. Thus, the record indicates that the Examiner’s rejections are based upon impermissible hindsight in view of the Appellant’s disclosure. *See In re Warner*, 379 F.2d 1011, 1017 (CCPA 1967) (“A rejection based on section 103 clearly must rest on a factual basis, and these facts must be interpreted without hindsight reconstruction of the invention from the prior art.”). Accordingly, we reverse the rejections.

DECISION

The rejections under 35 U.S.C. § 103(a) of claims 1–10 and 12–15 over Holly in view of Tong and Li, and claim 11 over Holly in view of Tong, Li, and Gunzner are reversed.

The Examiner’s decision is reversed.

REVERSED