UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE
THE PATENT TRIAL AND APPEAL BOARD

Ex parte TIM SIEVERS[1]
and Andreas Lohner

Appeal 2014-007250[2]
Application 12/245,140
Technology Center 1700

Before ADRIENE LEPIANE HANLON, MARK NAGUMO, and BRIAN D. RANGE, *Administrative Patent Judges*.

NAGUMO, *Administrative Patent Judge*.

DECISION ON APPEAL

Tim Sievers and Andreas Lohner ("BU:ST") timely appeal under 35 U.S.C. § 134(a) from a non-final rejection[3, 4] of claims 1–6, which

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[1] The real party in interest is identified as BU:ST GmbH ("BU:ST"). (Appeal Brief, filed 3 February 2014 ("Br."), 3.)

[2] Heard 25 August 2016. The Official Transcript, which was not available when this Opinion was entered, will be made of record.

[3] Office action mailed 1 May 2013 ("Office Action"; cited as "OA").

[4] A Request for Continued Examination under 37 C.F.R. §1.114 was filed on 23 November 2010.

are all of the pending claims. We have jurisdiction. 35 U.S.C. § 6.

We reverse.

OPINION

A. Introduction[5]

The present application has a lengthy examination history, including an appeal in parent application 10/719,585, in which the rejections, which were based on most of the same references, were affirmed.[6] We assume familiarity with the prior Opinion. Following the Board's decision, BU:ST filed the present continuation application, presenting independent claims 1 and 6, which add additional limitations relating to the mechanical finishing recited in the claims previously presented. In due course, the Examiner entered a final rejection, whereupon BU:ST filed a Request for Continued Examination. Subsequently, BU:ST filed a declaration by Mr. Tim Sievers,[7] one of the inventors, as evidence supporting non-obviousness, but the Examiner maintained the rejections of record and added three rejections based in part on an additional reference, Abe (full cite at 5 n.15, *infra*.) This appeal followed.

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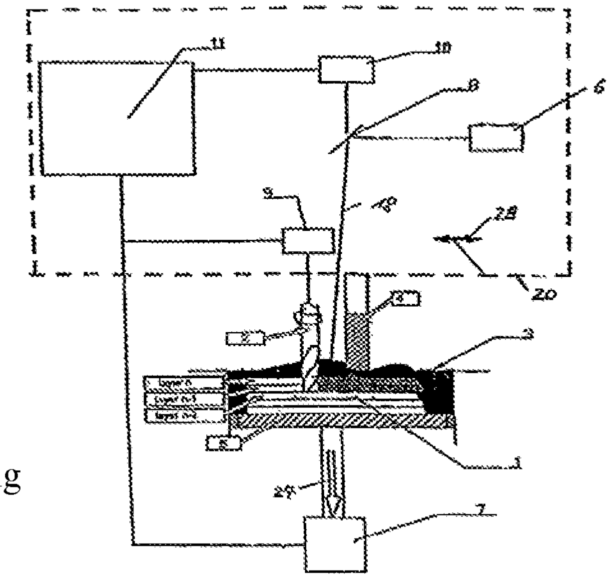
[5] Application 12/245,140, *Method and apparatus for the production of a workpiece of exact geometry*, filed 3 October 2008 as a continuation of 10/719,585, filed 21 November 2003, now abandoned, which was filed as a continuation of PCT/EP02/05574, on 21 May 2002, claiming the benefit of an application filed in Germany on 21 May 2001. We refer to the "'140 Specification," which we cite as "Spec."

[6] Appeal 2008-2273, decided 6 August 2008 ("Op1").

[7] Tim Sievers, Declaration under 37 C.F.R. §1.132, filed 23 November 2010 ("Sievers").

The subject matter on appeal relates to a method "for the production of a work piece with exact geometry and a high surface quality, a 'form tool' in particular." (Spec 13, Abstract.) Figure 1, below right, illustrates a device for carrying out the method. Powdered starting material **3**[8] is provided via dressing bar **4** with an exactly predetermined layer thickness **s** on movable working table **5**, and is compacted (melted or sintered) by beam **18** under control of processing unit **20** to form the "n^{th} trace." (*Id.* at 6 [00028]–7 [00029][9].)



{Fig. 1 depicts a device for making a workpiece}

The deposition and compacting are repeated until enough layers have been deposited and compacted that there is, in the words of claim 1, "substantially no thermal impact [from the compacting step of the $n + x^{th}$ trace] having a distorting effect on the subject (n^{th}) layer trace."[10] At least one of the vertical side walls is then finished mechanically by mill tool **2**. (*Id.* at 7 [00029].)

8 Throughout this Opinion, for clarity, labels to elements are presented in bold font, regardless of their presentation in the original document.

9 We cite both the page and paragraph number because the Specification at page 7 follows [00029] with [0010], etc.

10 The Specification explains that all layers previously deposited below the n^{th} layer are referred to as $n - x^{th}$ layers, and all layers positioned above the n^{th} layer are referred to as $n + x^{th}$ layers. (Spec. 3 [00098].)

According to the ’140 Specification, the claimed process differs from the prior art, represented by Celiker (full cite at 6 n.13, *infra*), in that the radiation-induced compaction and the mechanical finishing are conducted while the compacted region (i.e., the trace), remains surrounded by the powdered starting material. (Spec. 2 [0003].)

The ’140 Specification explains that the basic trace width corresponds to the “sphere of action” of the radiation, and that wider traces are made by overlapping individual traces. (Spec. 4 [00010].) The Specification teaches that the material characteristics of the edge contour can be adjusted by precise control of the compacting beam. (*Id*. at [00012].) Moreover, “[w]ith increasing beam power or energy supplied per area unit, the proportion of molten phase of the material increases, which results in a high compacting of the material and thus in good mechanical properties.” (*Id*. at [00013].) However, “[a] disadvantage of a high beam intensity is the thermal effect, which may lead to a subsequent powder adherence in the $n - 1^{st}$ or in further layers. By the respectively repeated thermal impact of the $n - x^{th}$ layers already formed, a so-called distortion of the contour of the work piece may occur.” (*Id.*)

The Specification reveals that the invented method

> takes this thermal influence of the work piece contour into account by performing the mechanical finishing after the completion of a certain number of layers only. In accordance with the invention, the finishing is only performed with layers which are, by their distance to the currently produced layer, not subject to a thermal impact effecting a distortion of the work piece.

(*Id*. at 5 [00014].)

Claim 1 is representative and reads:

A method for the production of a work piece
by the successive compacting, by means of electromagnetic radiation or particle radiation, of powdered starting material that has been applied horizontally in layers, so that each layer consisting of at least one trace comprises
substantially vertical lateral faces and
two one substantially horizontal upper face which, in turn, forms the basis for a possible subsequent layer,

wherein at least one of the two vertical side walls is subject to mechanical finishing subsequent to the compacting of said powdered starting material that has been applied horizontally in layers, and

wherein the work piece to be formed is surrounded by said powdered starting material during its production and during the mechanical finishing,

wherein the mechanical finishing of a vertical side wall of a subject (nth) layer is performed after the generation of at least one subsequent ($n + x^{th}$) layer only and

wherein mechanical finishing of the at least one subsequent ($n + x^{th}$) layer is not performed at the same time as mechanical finishing of the subject (n^{th}) layer, and

wherein mechanical finishing of the subject (nth) layer is started only after a sufficient enough number of subsequent ($n +x^{th}$) layers are created
such that a distance between the subject (nth) layer and a most recently formed one of the at least one subsequent ($n + x^{th}$) layer is sufficiently great that there exists substantially no thermal impact having a distorting effect on the subject (n^{th}) layer.

(Claims App., Br. 25; indentation, paragraphing, and emphasis added; *see* 37 C.F.R. §1.75(i) (2014): "[w]here a claim sets forth a plurality of elements or steps, each element or step of the claim should be separated by a line indentation.")

The Examiner maintains the following grounds of rejection[11]:

A. Claims 1, 2, 4, and 5 stand rejected under 35 U.S.C. § 103(a) in view of the combined teachings of Benda[12] and Celiker.[13]

A1. Claim 3 stands rejected under 35 U.S.C. § 103(a) in view of the combined teachings of Benda, Celiker, and Prinz.[14]

A2. Claim 3 stands rejected under 35 U.S.C. § 103(a) in view of the combined teachings of Benda, Celiker, and Abe.[15]

A3. Claim 6 stands rejected under 35 U.S.C. § 103(a) in view of the combined teachings of Benda and Celiker.

B. Claims 1–5 stand rejected under 35 U.S.C. § 103(a) in view of the combined teachings of Abe and Celiker.

B2. Claim 6 stands rejected under 35 U.S.C. § 103(a) in view of the combined teachings of Abe and Celiker.

B. Discussion

Findings of fact throughout this Opinion are supported by a preponderance of the evidence of record.

The claims are rejected in view of the same prior art relied on in the previous appeal, with the addition of Abe.[16] The thrust of the rejections, and

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[11] Examiner's Answer mailed 16 April 2014 ("Ans.").

[12] John A. Benda and Aristotle Parasco, *Method for performing temperature-controlled laser sintering*, U.S. Patent No. 5,427,733 (1995).

[13] Tanju Celiker et al., *Method and device to produce metallic workpieces*, DE 195 33 960 A1 (1997) (USPTO translation).

[14] Fritz B. Prinz and Lee E. Weiss, *Method and apparatus for fabrication of three-dimensional metal articles by weld deposition*, U.S. Patent No. 5,207,371 (1993).

[15] Satoshi Abe et al., *Method of making sintered object*, U.S. Patent Application Publication 2003/0185698 A1 (2 October 2003), based on an application filed 27 November 2002.

the focus of BU:ST's appeal remain the same: whether Celiker teaches or suggests processes in which unmelted powder is blown off or vacuumed away from a working region after melting by laser irradiation and before machine finishing of at least one vertical side of the trace.

The Examiner finds (OA 4, l. 17, through 5), as did the Board in the previous appeal (Op1 5, item (3)), that Celiker teaches, in numerous cited places, preferred embodiments in which, after laser processing of metal-containing powder layers, "unmelted powder is blown off and/or vacuumed away from a working region." (Celiker 5, ll. 6–7.) Such preferred embodiments, the Examiner and the Board found, are also claimed by Celiker in claim 19, which reads, "[m]ethod according to at least one of Claims 1–18, characterized in that unmelted powder is blown off and/or vacuumed away from a working region." The Examiner reasons that it would have been obvious to combine the unpreferred methods in which the powder is not blown off or vacuumed away, with the processes taught by Benda or by Abe.

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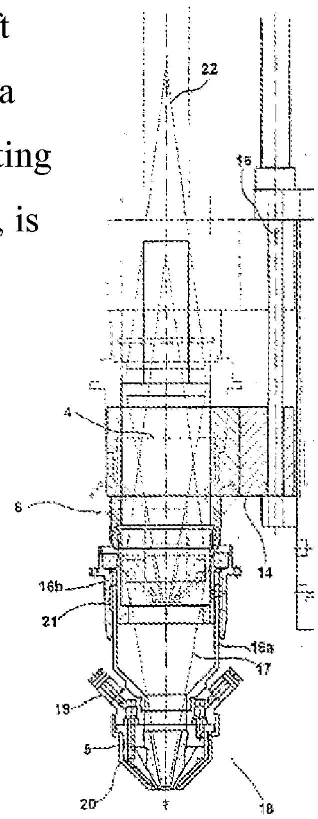
[16] We evaluate the rejection solely on the substantive issues raised by BU:ST, which has not challenged the status of Abe as prior art.

BU:ST argues, inter alia, that Celiker describes processes in which a metal-containing powder "is supplied into the melt region [of the laser] coaxial to the melt beam." (Br. 12, ll. 13–14.) The left hand portion of Celiker Fig. 2, shown right, illustrates a combined laser head **4** and powder head **5**. (Metal cutting head **7**, immediately adjacent to the right of the Figure, is not shown here.) Laser light is brought to laser head **4** via optical fiber **22**. (*Id.* at 10, ll. 25–26.) "Powder is guided coaxially to the laser beam **17** into its melt region through outlet openings of the powder ducts **20** located concentric to the laser beam **17** and is melted in the melt region." (*Id.* at 9, ll. 29–31.) Inert gas ducts (not illustrated) supply inert gas for the melting process and to "bundle" the powder beam. (*Id.* at ll. 31–33.)



{Celiker Fig. 2 (left portion) illustrates combined laser head **4** and powder head **5**}

Thus, rather than irradiating a pre-formed layer of powder (as do Benda[17] and Abe[18]), Celiker sprays powder into the focus of a laser beam. BU:ST urges that "[f]rom Figure 1 [not reproduced here], it can also be seen that the excess powder (which is not sintered) from the powder head will not accumulate around the working piece [**1**], but will be dispersed over the cooling plate **24** driven by the momentum provided by the powder head."

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[17] Benda col. 3, l. 60, to 4, l. 2, describing spreading powder **64** across powder bed **38** by roller **68**.

[18] Abe 1 [0004] describes a layer of metallic powder is deposited, forming a metallic bed, which is then sintered by an optical sintering beam.

(Br. 13, ll. 2–5.) BU:ST concludes that "even a combination of Benda and Celiker neither suggests nor renders the feature obvious that each layer is mechanically finished while the laser is still surrounded by powdered starting material." (Br. 13, ll. 11–13.)

It has not escaped our attention that a similar argument was deemed non-persuasive by the Board in the previous Opinion for lack of "conclusive evidence" that the excess powder would be dispersed over the cooling plate and not surround the work piece (Op1 7, 1st full para., citing the Reply Brief at 3). There has never been any dispute that the evidence of record indicates that the powder that surrounds the workpiece in Benda, Abe, and in the claimed method, is easily removed by vacuuming or blowing. Moreover, there is no credible evidence that the non-sintered powder in any of the processes changes in any significant way, as a result of the sintering of the powder within the active region of the sintering beam. Based on the additional arguments referring to Figures 1 and 2 of Celiker, and the descriptions of those Figures in Celiker, we conclude that the preponderance of the evidence supports BU:ST's characterization that the excess, non-sintered powder would not pile up and surround the workpiece.

In this regard, we note that the term "surround," as it appears in the appealed claims, describes the powder layer in the areas not exposed by the laser beam. The non-exposed layers are not significantly altered by the exposed region (here we neglect edge effects, e.g., some melting or sintering of particles immediately adjacent to the exposed particles). Thus, the exposed trace is surrounded by a full-height layer of powder. To be clear, in the context of the appealed claims, a workpiece having a light coat of starting material particles on its sides is not "surrounded" by powdered starting material. Consistent with the ordinary meaning of "surround" and consistent with how "surrounded" is used in the claims and in the context of the specification, "surrounded by said powdered starting material during its production and during the mechanical finishing" requires that the workpiece be enclosed by powder on all sides during production and mechanical finishing.

With this understanding of the teachings of Celiker, it becomes clear that the optional vacuuming of residual powder refers to removing at most a relatively light coat of powder from the workpiece. The Examiner has not come forward with evidence and argument indicating why such an optional teaching would apply to the work pieces of Benda or Abe, which are fully-surrounded by powdered starting material. Put another way, even if Celiker teaches that, in non-preferred embodiments, powder removal prior to completion of production and finishing is not required, the preponderance of the evidence set forth by the Examiner in the record does not establish that removal of powder is also not required when the work piece is completely surrounded by powder (as in claim 1).

The Examiner's findings regarding the remaining references do not cure the deficiencies of Celiker.

Because the premise has been shown to be incorrect, that the teachings of Celiker regarding the optional removal of excess starting material powder can be applied reasonably to the processes taught by Benda or Abe, we reverse the rejections of record.

C. Order

It is ORDERED that the rejection of claims 1–6 is reversed.

REVERSED