

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

GC CORPORATION AND GC AMERICA, INC.,
Petitioner,

v.

ARDENT, INC.,
Patent Owner.

IPR2018-00940
Patent 6,802,894 B2

Before JEFFREY B. ROBERTSON, CHRISTOPHER L. CRUMBLEY, and
WESLEY B. DERRICK, *Administrative Patent Judges*.

CRUMBLEY, *Administrative Patent Judge*.

JUDGMENT
Final Written Decision
Determining All Challenged Claims Unpatentable
35 U.S.C. § 318(a)

I. INTRODUCTION

We have jurisdiction to hear this *inter partes* review under 35 U.S.C. § 6. This Final Written Decision is issued pursuant to 35 U.S.C. § 318(a) and 37 C.F.R. § 42.73. For the reasons discussed herein, Petitioner has shown by a preponderance of the evidence that claims 1–34 of US Patent No. 6,802,894 B2 (“the ’894 patent”) are unpatentable.

A. Procedural History

GC Corporation and GC America, Inc. (collectively “GC”) filed a Petition requesting an *inter partes* review of claims 1–34 of the ’894 patent (Ex. 1002). Paper 1 (“Pet.”). Ardent Inc., the owner of the ’894 patent, filed a Preliminary Response to the Petition. Paper 6, “Prelim. Resp.” On November 9, 2018, upon consideration of the Petition and Preliminary Response, applying the standard set forth in 35 U.S.C. § 314(a), we instituted an *inter partes* review of all challenged claims on all grounds asserted. Paper 7 (“Inst’n Dec.”).

In the Scheduling Order, which sets times for taking action in this proceeding, we cautioned Patent Owner that “any arguments for patentability not raised in the [Patent Owner] response may be deemed waived.” Paper 8, 5. Patent Owner, however, did not file a Patent Owner Response. Paper 9, 2. Further, neither party requested oral argument. *Id.*

We authorized the parties to file a joint paper “providing the Board with the current status of any related District Court and ITC proceedings, . . . specify[ing], . . . any ITC determination bearing on the validity of [any] claim.” *Id.* On September 18, 2019, the Parties filed a joint paper, as

authorized, with certain papers from US ITC Investigation 337-TA-1050. Paper 10 (“the Status Report”); Exs. 1016, 1017.¹

We have before us: the Petition; a Preliminary Response containing arguments that were not preserved because no Patent Owner Response was filed; and, to the extent applicable, papers from a related ITC proceeding. The record, therefore, is essentially the same as that at institution, where we determined that there was a reasonable likelihood that at least one claim of the ’940 patent was unpatentable. Nonetheless, Petitioner bears the burden to show, by a preponderance of the evidence, that the challenged claims are unpatentable, and we have reevaluated the record in this light.

For the reasons that follow, we determine that Petitioner has shown by a preponderance of the evidence that claims 1–34 of the ’894 patent are unpatentable.

B. Related Proceedings

As indicated above, the ’894 patent was—but is no longer—the subject of litigation in both *Ivoclar Vivadent AG v. GC America Inc.*, No. 1:17-cv-02083 (N.D. Ill.) and *In the Matter of Certain Dental Ceramics, Products Thereof, and Methods of Making the Same*, Inv. No. 337-TA-1050, U.S. International Trade Commission (the “ITC proceeding”). Status Report, 1–2; Inst’n Dec. 3; Paper 3, 2. The proceeding in the District Court was dismissed without prejudice on January 8, 2019. *Id.*

¹ The Status Report states that it was being filed along with a copy of the ITC’s Commission Opinion as Exhibit 1018, but the record does not contain the Opinion or, for that matter, an Exhibit 1018. For completeness of the record, we have entered the Commission Opinion (U.S. ITC Inv. No. 337-TA-1050 (Feb. 11, 2019) (public version)) as Exhibit 3002.

In the ITC proceeding, the Chief Administrative Law Judge issued an Initial Determination on July 23, 2018, construing various terms of the claims of the '894 patent and making findings regarding the claims' validity. Ex. 3001. As we discussed in our Institution Decision, and as further explained below, the Initial Determination found that, of the claims challenged in this proceeding, claims 1, 2, 17, 21, and 34 of the '894 patent are invalid. Ex. 3001, 112.

After we instituted this *inter partes* review trial, the ITC published a "Notice of Commission Decision to Review in Part" the ALJ's Initial Determination. Status Report, 1; Ex. 1016. At the conclusion of the review, the ITC published a "Notice of Commission Determination of No Violation of Section 337" (Ex. 3002, "Commission Opinion") in which the full Commission affirmed, with modified reasoning, the Initial Determination. *Id.* at 2; Ex. 3002. The Commission Opinion was appealed to the Court of Appeals for the Federal Circuit, but subsequently voluntarily dismissed. *Id.* The ITC's determination that claims 1, 2, 17, 21, and 34 of the '894 patent are invalid has, therefore, been made final.

A patent identified by the Parties as related, US Patent No. 6,455,451 B1 ("the '451 patent"), is the subject of a concurrent *inter partes* review proceeding—IPR2018-00941. Inst'n Dec. 2; Paper 3, 2. The '451 patent was also the subject of the ITC proceeding, but, unlike the '894 patent, the asserted claims of the '451 patent were ultimately terminated from the proceeding prior to issuance of any determination by the ITC. IPR2018-00941, Paper 9, 2.

C. The '894 Patent

The '894 patent, entitled "Lithium Disilicate Glass-Ceramics," issued October 12, 2004, from application No. 10/179,881 ("the '881 application"). Ex. 1002, codes (10), (45), (54), (21). The '881 application, filed on June 25, 2002, was a continuation-in-part of application No. 09/640,941, which itself was a continuation-in-part of application No. 09/458,919, filed December 10, 1999. *Id.* at code (63). The patent also lists a set of provisional applications, the earliest of which was filed on December 11, 1998. *Id.* at code (60).

The '894 patent relates to lithium disilicate based glass-ceramics useful in fabricating dental restorations made by heat pressing into refractory investment molds. *Id.* at (57). The glass-ceramics are formed by first melting a glass composition and forming the melt into shaped glass pieces. *Id.* at 2:57–63. The resulting glass is then heat-treated to form a glass-ceramic, through a process that comprises nucleation and then crystal growth steps. *Id.* at 2:64–3:1. Between the forming and heat treatment steps, the glass may first be annealed in the range of 300–600° C for a time between 15 minutes and 8 hours. *Id.* at 5:36–38.

D. Illustrative Claims

Of the challenged claims, only claim 1 is independent and reads as follows:

1. A method of making a lithium disilicate dental product comprising:
melting a starting glass composition at a temperature within the range
of about 1200 to about 1600° C.;
forming the molten glass into shaped blanks;

annealing the glass blanks at temperatures in the range of 300° to about 600° C. for a time in the range of about 15 minutes to about 8 hours;

subjecting the glass blanks to one or more heat treatments in the temperature range of from about 400° to about 1100° C. to convert the glass blanks into glass-ceramic blanks.

Ex. 1001, 16:15–28.

Claims 2–34 depend from claim 1 and either add steps to the claimed method (e.g., claim 4 adds the step of “pressing the blanks into the dental product”), or specify certain components, by weight percentages, of the glass ceramic.

E. Instituted Grounds of Unpatentability

We instituted trial on the following grounds of unpatentability. Inst’n Dec. 5–6.

Reference(s)	35 U.S.C. § ²	Claims Challenged
Petticrew ³ and Beall ⁴	103	1, 2, 4–10, 12, 16, 17, 19–24, 31–34
WO196 ⁵ and Barrett ⁶	103	1–34
Barrett	102(b)	1, 2, 5–7, 9, 31–34

² The relevant sections of the Leahy-Smith America Invents Act (“AIA”), Pub. L. No. 112–29, took effect on March 16, 2013. Because the application to which the ’894 patent claims priority was filed before that date, our citations to Title 35 are to its pre-AIA version.

³ International Patent Appln. No. WO 95/32678 to Petticrew, published Dec. 7, 1995 (Ex. 1003).

⁴ US Patent No. 5,219,799 to Beall et al., issued June 15, 1993 (Ex. 1004).

⁵ International Patent Appln. No. WO 00/34196 to Brodtkin et al., published June 15, 2000 (Ex. 1005). Because Brodtkin is the first-named inventor on both this reference and the challenged ’894 patent, for clarity we refer to the reference by its abbreviated application number.

⁶ US Patent No. 4,189,325 to Barrett et al., issued Feb. 19, 1980 (Ex. 1006).

Reference(s)	35 U.S.C. § ²	Claims Challenged
Schweiger ⁷ and Barrett	103	1, 2, 4–7, 9, 12, 16–17, 19, 31–34

GC asserts that Petticrew, Beall, WO196, and Barrett are each prior art to the '894 patent under 35 U.S.C. § 102(b) because each was published or issued more than a year prior to the earliest priority date of the '894 patent. Pet. 17–19. GC asserts that Schweiger qualifies as prior art under 35 U.S.C. § 102(e) because it issued from an application filed before the priority date of the '894 patent. Id. at 19.

Finally, GC asserts that WO196, an international application related to the '894 patent, is prior art to the '894 patent under § 102(b) because the application that issued as the '894 patent is a continuation-in-part that added new matter, thus only entitling its claims to a priority date of June 25, 2002. Id. at 15. Ardent admitted that that the '894 patent is unable to claim priority to prior applications due to the continuation-in-part application. Prelim. Resp. 17.

Ardent did not challenge the prior art status of any cited reference. Reviewing GC's contentions in light of the entire record, we find that the references asserted by GC qualify as prior art to the challenged claims of the '894 patent.

⁷ US Patent No. 6,420,288 B2 to Schweiger et al., issued July 16, 2002 (Ex. 1007).

II. ANALYSIS

A. *Level of Ordinary Skill in the Art*

Petitioner contends that a person of ordinary skill in the art at the time of the invention

would have had knowledge and experience relating to the design, production and use of glass-ceramic compositions for various applications would have been able to design compositions for specific products, taking into account such variables as desired mechanical properties and the application for which the glass-ceramic composition is being used [and] would have had a bachelor's or advanced degree, such as an M.S. or Ph.D. in chemistry, physics, ceramics, materials science and engineering, or chemical engineering, coupled with 2-5 years of academic or industry experience in the area of glass-ceramic research and development or similar work.

Pet. 25–26 (*citing* Ex. 10018 ¶ 46).

Absent opposition from Patent Owner, we accept and adopt Petitioner's description of the level of ordinary skill in the art because it is consistent with the level of skill reflected in the asserted prior art references. In that regard, the prior art itself is sufficient to demonstrate the level of skill in the art at the time of the invention. *See Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001) (explaining that specific findings regarding ordinary skill are not required “where the prior art itself reflects an appropriate level and a need for testimony is not shown” (*quoting Litton*

⁸ Exhibit 1001 is the Declaration of Dr. Arthur E. (“Buddy”) Clark, a technical declarant retained for this proceeding whose testimony was submitted in support of GC's Petition. Ex. 1001 ¶ 10.

Indus. Prods., Inc. v. Solid State Sys. Corp., 755 F.2d 158, 163 (Fed. Cir. 1985))).

B. Claim Construction

In an *inter partes* review based on a petition filed prior to November 13, 2018, the Board interprets claim terms in an unexpired patent according to their broadest reasonable construction in light of the specification of the patent in which they appear. 37 C.F.R. § 42.100(b) (2017).⁹ Under that standard, we interpret claim terms using “the broadest reasonable meaning of the words in their ordinary usage as they would be understood by one of ordinary skill in the art, taking into account whatever enlightenment by way of definitions or otherwise that may be afforded by the written description contained in the applicant’s specification.” *In re Morris*, 127 F.3d 1048, 1054 (Fed. Cir. 1997). Only those terms which are in controversy need to be construed and only to the extent necessary to resolve the controversy. *See Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017); *see also U.S. Surgical Corp. v. Ethicon, Inc.*, 103 F.3d 1554, 1568 (Fed. Cir. 1997) (holding claim construction is not necessary when it is not “directed to, or has been shown reasonably to affect, the determination of obviousness”).

GC asked that we construe five claim terms: 1) *dental product*; 2) *blank*; 3) *annealing*; 4) *pellet*; and 5) *about*. Pet. 20–23. The ITC

⁹ A recent amendment to this rule does not apply here because the Petition was filed prior to November 13, 2018. *See* Changes to the Claim Construction Standard for Interpreting Claims in Trial Proceedings Before the Patent Trial and Appeal Board, 83 Fed. Reg. 51340 (Oct. 11, 2018) (amending 37 C.F.R. § 42.100(b) effective November 13, 2018) (now codified at 37 C.F.R. § 42.100(b) (2019)).

Determination construed three of these terms, and we have considered these constructions and the ITC's reasoning supporting them. *See* Ex. 3001, 44–51, 54–58. Although Ardent contended that construction of these terms is unnecessary, and did not provide proposed constructions of its own, we have also reviewed the constructions for the terms it proposed in the ITC proceeding. The proposed or adopted constructions are as follows:

Claim Term	GC Proposed Construction	Ardent Proposed Construction	ITC Adopted Construction
<i>dental product</i>	a material that has been shaped for placement into a patient's mouth	a product that is particularly well-suited for dental applications, such as for making dental restorations	plain and ordinary meaning, which does not exclude glass-ceramic blanks
<i>blank</i>	a small piece of material in a form (such as a cylinder or rectangular block) suitable for further processing into a dental restoration		
<i>annealing</i>	heating in a separate heat treatment step to relieve internal stresses	the process of slowly heating, slowly cooling, or isothermal maintenance of glass, which relieves internal stresses in the glass	a separate step from the heat treatment step
<i>pellet</i>	an ingot having a cylindrical shape		
<i>about</i>	approximately, or ± 2 units in the least significant figure position	approximately	approximately

At institution of trial, we agreed with Ardent and determined that it was unnecessary to explicitly construe any of these claim terms in order to resolve the question of whether trial should be instituted. Inst’n Dec. 9. On review of the entire record, we construe the claim terms as follows.

We determine that the phrase *dental product* encompasses both “a dental appliance shaped for placement into a patient’s mouth,” as well as “glass-ceramic blanks,” as this is consistent with the ITC’s determination, as well as the ordinary meaning of the phrase and the written description of the ’894 patent cited by GC. Ex. 1002, Abstract, 2:36–44, 3:17–18, 5:62–65; Ex. 3001, 54–58.

We determine that the term *blank* encompasses “a small piece of material in a form (such as a cylinder or rectangular block) suitable for further processing into a dental restoration,” as this is consistent with the ordinary meaning of the phrase and written description of the ’894 patent. Ex. 1002, 3:12–17, 3:24–25.

We determine that the term *annealing* requires heating to relieve internal stresses, and that this heating must take place in a separate step from the “heat treatment” step of the claims. This is consistent with the ITC’s determination¹⁰ as well as the ordinary meaning of the phrase, the prosecution history (Ex. 1008, 152), and the written description of the ’894 patent. Ex. 1002, 5:35–40, 9:45–53; Ex. 3001, 44–49.

We determine that the term *pellet* encompasses “an ingot having a cylindrical shape,” as this is consistent with the word’s plain and ordinary

¹⁰ In their joint Status Report, the parties stated that “[t]he Commission’s discussion of the term ‘annealing’ is relevant to the Board’s analysis.” Status Report, 3.

meaning as well as the written description of the '894 patent cited by GC. Ex. 1002, 4:6, 5:33–34.

We determine that the term *about* encompasses the meaning “approximately,” as this is consistent with the word’s plain and ordinary meaning, but decline to further construe the term as GC urges because it is not necessary to resolve the controversy before us. *See Nidec Motor Corp.*, 868 F.3d at 1017.

C. Relevant Legal Principles

In order to find a claim anticipated and thus unpatentable under 35 U.S.C. § 102, we must find not only that all elements of a claim are disclosed within the four corners of a single prior art reference, but that the elements are “arranged as in the claim.” *Net MoneyIN, Inc. v. VeriSign, Inc.*, 545 F.3d 1359, 1369 (Fed. Cir. 2008).

A patent claim is unpatentable under 35 U.S.C. § 103 if the difference between the claimed subject matter and the prior art are such that the subject matter, as a whole, would have been obvious at the time the invention was made to a person of ordinary skill in the art to which the subject matter pertains. *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). The question of obviousness is resolved on the basis of underlying factual determinations, including: (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art; (3) the level of skill in the art; and (4) objective evidence of nonobviousness. *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966).

The Federal Circuit has held that “where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation.” *E.I. DuPont de*

Nemours & Co. v. Synvina CV, 904 F.3d 996, 1006 (Fed. Cir. 2018) (quoting *In re Aller*, 220 F.2d 454, 456 (CCPA 1955)). “[W]here there is a range disclosed in the prior art, and the claimed invention falls within that range, the burden of production falls on the patentee to come forward with evidence’ of teaching away, unexpected results, or other pertinent evidence of nonobviousness.” *Id.* (quoting *Galderma Labs., L.P. v. Tolmar, Inc.*, 737 F.3d 731, 738 (Fed. Cir. 2013)); cf. *In re Peterson*, 315 F.3d 1325, 1330 (Fed. Cir. 2003) (“[T]he existence of overlapping or encompassing ranges shifts the burden to the applicant to show that his invention would not have been obvious.”). Likewise, there is a rebuttable presumption grounded on a claimed range overlapping a range disclosed in the prior art. *E.I. DuPont de Nemours & Co.*, 904 F.3d at 1007 (quoting *Ormco Corp. v. Align Tech., Inc.*, 463 F.3d 1299, 1311 (Fed. Cir. 2006)) (“The presumption [of obviousness] can be rebutted if it can be shown that the prior art teaches away from the claimed range, or the claimed range produces new and unexpected results.”); cf. *Peterson*, 315 F.3d at 1330–31 (discussing role of evidence of unexpected results or criticality and teaching away in rebutting a *prima facie* case of obviousness in examination of an application). In sum,

“where there is a range disclosed in the prior art, and the claimed invention falls within that range, the burden of production falls upon the patentee to come forward with evidence” of teaching away, unexpected results or criticality, or other pertinent objective indicia indicating that the overlapping range would not have been obvious in light of that prior art.

E.I. DuPont de Nemours & Co., 904 F.3d at 1008 (quoting *Galderma*, 737 F.3d at 738). To be clear, the burden of persuasion always lies with Petitioner, as “[t]he factfinder then assesses [patentee’s] evidence, along with all other evidence of record, to determine whether a patent challenger

has carried its burden of persuasion to prove that the claimed range was obvious.” *Id.* at 1007. “[I]n the absence of evidence indicating that there is something special or critical about the claimed range, an overlap suffices to show that the claimed range was disclosed in—and therefore obvious in light of—the prior art.” *Id.* at 1008.

D. Anticipation of Claims 1, 2, 5–7, 9, and 31–34 by Barrett

GC asserts that claims 1, 2, 5–7, 9, and 31–34 of the ’894 patent are unpatentable as anticipated by the disclosure of Barrett. Pet. 61–66.

1. Barrett (Ex. 1006)

Barrett, issued in 1980, discloses glass-ceramics containing Li_2O , Al_2O_3 , CaO , SiO_2 , platinum, and Nb_2O_5 , which are said to be “highly suitable” for use in dental restorations due to their castability, chemical durability, and mechanical strength. Ex. 1006, Abstract. The glass is prepared by “known processes” which comprise melting, casting, and quenching. *Id.* at 3:15–16. After casting, the glass may be annealed to remove internal stresses (*id.* at 3:20–23), and may be transformed into a glass-ceramic by *in situ* heat treatments (*id.* at 3:32–34). Barrett discloses that the ultimate user may be provided with “intermediate glass ingots” in the shape of cylinders, which may be later processed into a final glass-ceramic article. *Id.* at 4:33–37.

2. Independent Claim 1

GC contends that independent claim 1 is anticipated by Barrett’s process for preparing glass-ceramics, which includes steps of melting, forming, annealing, and heat treating the material. Pet. 61–63. GC sets forth how the melting, annealing, and heat treating steps of Barrett are within the temperature and time ranges required by claim 1. For example,

GC observes that Barrett discloses annealing at 350–500° C for about 4 hours, within claim 1’s temperature range of about 300–600° C and time period of about 15 minutes to about 8 hours. Pet. 62–63 (*citing* Ex. 1006, 4:37–42, 3:20–22).

GC argues that the components of the Barrett composition, in particular the molar ratio of silica to lithia, indicates that the compositions are lithium disilicate glass-ceramics as recited in the preamble of claim 1. Pet. 61–62. Dr. Clark testifies in support of this conclusion, noting that $\text{Li}_2\text{O}—\text{Al}_2\text{O}_3—\text{CaO}—\text{SiO}_2$ glass-ceramics as disclosed in Barrett are known as “LACS” glass-ceramics, and it was “widely known and understood in the field” that a LACS glass-ceramic having the molar ratios disclosed in Barrett would be a lithium disilicate. Ex. 1001 ¶ 127.

GC also contends that the inventors of the ’894 patent admitted in their specification that Barrett discloses a lithium disilicate glass-ceramic. Pet. 61–62. In particular, the ’894 patent recites that “Barrett et al. introduced dental restorations made from castable lithium disilicate glass-ceramics in the $\text{Li}_2\text{O}—\text{CaO}—\text{Al}_2\text{O}_3—\text{SiO}_2$ system nucleated by Pt and Nb_2O_5 .” Ex. 1002, 1:29–32.

On this record, the case for the anticipation of claim 1 by Barrett stands unrebutted in the absence of any post-institution Response by Ardent. Although Ardent waived any arguments for patentability raised in the Preliminary Response by not renewing them following institution, we have nevertheless reviewed the record in light of Ardent’s arguments, as summarized in our Decision on Institution. Inst’n Dec. 12–13. Primarily, Ardent argued that that a person of ordinary skill in the art would know that Barrett did not disclose lithium disilicate glass ceramics, despite the

statement in the '894 patent itself that Barrett concerned such compositions. *Id.*

We have also considered the ITC's Initial Determination, as modified by the Commission's Opinion. The arguments for anticipation raised by GC before the ITC, and addressed by the Chief Administrative Law Judge, are similar to those made before us, and Ardent opposed anticipation grounds similar to those expressed in its Preliminary Response. Ex. 3001, 77–80. In the Initial Determination, the ITC found the “description of Barrett in the '894 patent itself” to be supportive of GC's interpretation, despite Ardent's argument that a person of ordinary skill in the art would have understood Barrett differently. *Id.* In its review affirming¹¹ the Initial Determination, the Commission noted that “a person of ordinary skill is entitled to rely on statements in a patent specification as to the prior art.” Ex. 3002, 14 (*quoting PharmaStem Therapeutics, Inc. v. Viacell, Inc.*, 491 F.3d 1342, 1361 (Fed. Cir. 2007) (“Admissions in the specification regarding the prior art are binding on the patentee for purposes of a later inquiry into obviousness.”)). The Commission concluded that “the public notice function of a patent entitles the public to take as true statements in a patent's disclosure, including characterizations of prior art.” *Id.* at 17.

Our analysis generally accords with the ITC's. Even if, in some cases, an obvious mistake in a patent's characterization of the prior art may not later be binding on a patentee, the record here does not demonstrate that the description of Barrett in the '894 patent includes such a mistake. This is

¹¹ The Commission also modified the Initial Determination's anticipation analysis by addressing the question of whether Barrett is non-enabling, an issue that was not raised before us. Ex. 3002, 15–17.

especially so, given the absence of a Patent Owner Response on behalf of Ardent. As we noted in the Institution Decision, independent prior art references of record confirm the '894 patent's description of Barrett, and refer to Barrett as disclosing lithium disilicate glass ceramics. *See* Ex. 1007, 1:32–33 (“Lithium disilicate glass ceramics are disclosed in US Pat. No. 4,189,325 [Barrett]”).

We, therefore, find that Barrett discloses lithium disilicate glass ceramics as required by claim 1. We also find that the remaining limitations of claim 1 are disclosed in Barrett as GC contends (Pet. 61–63), and which Ardent did not contest, even in its Preliminary Response. Barrett discloses melting (Ex. 1006, 3:18–20), forming blanks (*id.* at 4:33–39), annealing (*id.* at 4:37–42), and heat treating (*id.* at 4:47–53, 59–62), all at conditions that satisfy the requirements of the process of claim 1. These elements are “arranged as in the claim,” as they are all disclosed as steps of the process described in Barrett. For these reasons, we conclude that claim 1 is unpatentable as anticipated by Barrett.

3. *Dependent Claims*

Dependent claim 2 requires that the blanks of claim 1 are in the shape of pellets. GC contends that Barrett discloses this limitation when it states that “the ultimate user may be provided with intermediate glass ingots of simple shape . . . preferably cylinders.” Pet. 63 (*citing* Ex. 1006, 4:34–35). In the Institution Decision, we interpreted claim 2's recitation of “blanks” to refer back to claim 1's glass blanks, as opposed to being limited to *glass-ceramic* blanks. Inst'n Dec. 14–15. Upon review of the entire record, and in the absence of any post-institution Response from Ardent, we confirm this

understanding of the claim. Barrett, therefore, discloses glass blanks in the shape of pellets as required by claim 2.

Claim 5 requires that the heat treatment step of claim 1 effects crystallization of lithium disilicate, and that this heat treatment occurs after annealing. GC contends that Barrett discloses heat treatment after annealing, and that this converts the glass into a glass-ceramic through crystallization. Pet. 64 (*citing* Ex. 1006, 4:37–42, 47–53, 59–62). Even in its Preliminary Response, Ardent did not provide any argument against the anticipation of claim 5 beyond its arguments regarding claim 1. Upon review of the entire record, we agree with GC and find that Barrett discloses the additional element of claim 5.

Claim 6 requires that the heat treatment step of claim 1 comprises a first nucleation step and a second crystal growth step. GC contends that Barrett discloses both nucleation and crystal growth. Pet. 64 (*citing* Ex. 1006, 4:47–50). Even in its Preliminary Response, Ardent did not provide any argument against the anticipation of claim 6 beyond its arguments regarding claim 1. Upon review of the entire record, we agree with GC and find that Barrett discloses the additional element of claim 6.

Claim 7 requires that the nucleation step of claim 6 comprises heating the glass blanks to a temperature in the range of about 450 to about 700° C, while claim 9 is similar but requires a temperature in the range of about 500 to about 650° C. GC contends that Barrett discloses heat treatment in the range of about 490 to about 575° C. Pet. 64–65 (*citing* Ex. 1006, 4:50–53). Even in its Preliminary Response, Ardent did not provide any argument against the anticipation of claims 7 or 9 beyond its arguments regarding

claim 1. Upon review of the entire record, we agree with GC and find that Barrett discloses the additional elements of claims 7 and 9.

Claim 31 adds two steps to the process of claim 1, requiring batching the starting glass composition prior to melting and adding additives to the starting glass composition. GC contends that Barrett discloses both batching and additives. Pet. 65 (*citing* Ex. 1006, 5:58–67, 7:64–68); Ex. 1001 ¶¶ 276–77 (*citing* Ex. 1006, 3:16–18, 7:64–68). Even in its Preliminary Response, Ardent did not provide any argument against the anticipation of claim 31 beyond its arguments regarding claim 1. Upon review of the entire record, we agree with GC and find that Barrett discloses the additional steps of claim 31.

Claim 32 requires that the additives of claim 31 comprise a color changing metal oxide, while claim 33 specifies that the color changing metal oxide comprises comprises CeO₂, Tb₄O₇, MnO₂, V₂O₅, NiO₂, TiO₂, or a mixture thereof. GC contends that Barrett discloses that its glass may contain small quantities of coloring agents, including CeO₂. Pet. 65 (*citing* Ex. 1006, 5:47–48, 54:62–64). Even in its Preliminary Response, Ardent did not provide any argument against the anticipation of claims 32 or 33 beyond its arguments regarding claim 1. Upon review of the entire record, we agree with GC and find that Barrett discloses the additional elements of claims 32 and 33.

Dependent claim 34 requires that the shaped blanks of claim 1 are formed by pouring the molten glass into molds to form the blanks, and then removing the glass blanks from the molds after they have hardened. GC contends that Barrett forms its ingots by melting, casting, and cooling, after which they are subjected to annealing and thermal crystallization. Pet. 65–

66 (*citing* Ex. 1006, 4:37–50). GC argues that, in order to perform annealing on the ingots, they would have necessarily been removed from the casting mold after cooling. *Id.*

In the Institution Decision, in response to an argument by Ardent, we noted that the “shaped blank” of claim 34 is not required to be a *glass-ceramic* blank, but rather can be a glass blank. Inst’n Dec. 15–16. Upon review of the entire record, and in the absence of any post-institution Response from Ardent, we confirm this understanding of the claim. We also noted that Barrett discloses an embodiment in which the end user is provided with intermediate glass ingots, which are prepared by casting and cooling. *Id.* (*citing* Ex. 1006, 4:37–39). As such, because a glass ingot is “a small piece of material in a form (such as a cylinder or rectangular block) suitable for further processing into a dental restoration” (Ex. 1002, 3:4–9, 3:17–18), it would be a blank within the meaning of the claims. And Barrett discloses that its ingots are of “simple shape (cubes, spheres or, preferably, cylinders).” Ex. 1006, 4:33–39. Thus, Barrett provides a disclosure of making shaped glass blanks by pouring glass into a mold, and GC convincingly argues that the blanks would necessarily be removed after cooling. We, therefore, find that the additional elements of claim 34 are disclosed by Barrett.

For the foregoing reasons, after reviewing the entirety of the record, we determine that claims 1, 2, 5–7, 9, and 31–34 of the ’894 patent are unpatentable as anticipated by the disclosure of Barrett.

E. Obviousness of Claims 1–34 over Barrett and WO196

GC contends that claims 1–34 of the ’894 patent are unpatentable under 35 U.S.C. § 103(a), as having been obvious over the combined

disclosures of WO196 and Barrett. Pet. 48–60. The parties note, in their Status Report, that the combination of WO196 and Barrett was not at issue in the ITC proceeding, but the ITC’s discussion of Barrett in relation to anticipation—as summarized in the prior section—may have relevance to our analysis. Status Report 3–4.

1. WO196 (Ex. 1005)

WO196 is an international counterpart to U.S. application No. 09/458,919, to which the ’894 claims priority through two continuation-in-part applications. Ex. 1002, (63); Ex. 1005, 1. As such, WO196 shares the same inventors and much of its disclosure with the ’894 patent.

GC notes that the primary difference between the disclosures of WO196 and the ’894 patent is that the ’894 patent describes its annealing step as separate from the heat treatment step, and provides some specifics as to the annealing conditions. Pet. 14. According to GC, these disclosures were added through a continuation-in-part application to provide written description support for the claims, which recited a separate annealing step in order to avoid the closest prior art identified by the Examiner (Schweiger, Ex. 1007). Pet. 14. According to GC, the only feature claimed in the ’894 patent arguably not disclosed by WO196, therefore, is a separate annealing step. *Id.* at 49–50.

2. Reason to Combine and Expectation of Success

GC contends that a person of ordinary skill in the art would have had reason to combine WO196 with Barrett. GC first notes that the references are from the same field of endeavor, namely glass-ceramics useful in dental restorations. Pet. 48–49. GC also observes that WO196 specifically mentions Barrett in the background section of its specification, providing an

explicit suggestion in WO196 for a person of ordinary skill in the art to consider Barrett. *Id.* at 49. Finally, GC notes that Barrett describes its annealing step as providing the advantage of relieving internal stresses, which would have given reason to incorporate its annealing step in the process of WO196. *Id.*

In our Institution Decision, we determined that GC had articulated a sufficient reason to combine the references. Though Ardent argued that WO196 notes problems with the chemical durability of Barrett's compositions and, thus, taught away from the combination, we stated that:

[T]he annealing step of Barrett addresses a problem distinct from that of chemical durability—namely, internal stresses within the glass. Even if we accept Ardent's assertion that WO196 disparages Barrett's chemical durability, we are not persuaded that a person of ordinary skill in the art would have been discouraged from adopting Barrett's annealing step to address a separate problem.

Inst'n Dec. 18. We then concluded that "[t]he glass compositions of WO196 and Barrett are formed through similar procedures of melting, casting, and cooling; it would have been reasonable to expect that the internal stresses noted by Barrett were also present in WO196 and that WO196's product would be similarly improved by annealing." *Id.* (citing *KSR International Co. v. Teleflex Inc.*, 550 U.S. 398, 417 (2007)).

We also concluded that GC had shown that there would have been a reasonable expectation of success in combining the references, sufficient to merit institution of trial. *Id.* at 19. Though Ardent had argued that the compositions of Barrett and WO196 are different and would have different annealing points, we stated that GC's argument was not "that the person of ordinary skill in the art would have incorporated Barrett's annealing step,

with the exact same annealing conditions, into WO196's process without modification." *Id.* Rather, we concluded that a person of ordinary skill in the art would have had a reasonable expectation of success in adapting the annealing step of Barrett to the compositions disclosed in WO196, and that Ardent had not provided any evidence that such a modification would have been outside the level of ordinary skill. *Id.*

With respect to the evidence on the reason to combine, the record now stands exactly as it did at the time of institution, as Ardent has not filed a Patent Owner Response or further evidence. We have reviewed the record anew, and confirm our prior determinations as to the reason to combine and reasonable expectation of success. We find that a person of ordinary skill in the art, seeking to improve the process of WO196, would have looked to Barrett's teaching that an annealing step may be used to reduce internal stresses and improve the resulting glass-ceramic composition. We also find that such a modification would have been within the level of ordinary skill, and that the skilled artisan would have had a reasonable expectation of success in doing so.

3. *Independent Claim 1*

GC sets forth how each limitation of claim 1 is disclosed by the combined disclosures of WO196 and Barrett. Pet. 49–52. We note that Ardent did not argue in its Preliminary Response that any limitation of claim 1 is missing from the combined disclosures. Upon review, GC's description of the prior art disclosures is accurate and we find that WO196 discloses the melting (Ex. 1005, 3¹²:25–26), forming (*id.* at 3:29), and heat treatment (*id.*

¹² We cite to the page number of the original document, not the pagination supplied by Petitioner.

at 3:31–4:2) steps of claim 1. The conditions at which the steps are performed in WO196 are identical to those claimed. And, as discussed in the preceding section, Barrett discloses an annealing step as required by claim 1. Ex. 1006, 4:37–42, 3:20–22. The combined disclosures of the references, therefore, teach each and every limitation of claim 1. Because we have found above that a person of ordinary skill in the art would have had reason to combine the references with a reasonable expectation of success, and the record contains no evidence or argument pertaining to objective indicia of nonobviousness, we conclude that claim 1 would have been obvious over the combined disclosures of Barrett and WO196.

4. Dependent Claims 2–16 and 31–34

GC maps each of the additional limitations of dependent claims 2–34 onto the disclosures of WO196 or Barrett. Pet. 52–60. Claims 17–30 (the “range claims”) specify that the glass ceramic comprise particular components in particular weight amounts, and will be addressed below. The remaining dependent claims 2–16 and 31–34 specify particular conditions for performing the steps of claim 1 or recite additional steps. Prior to institution, Ardent did not argue any of these latter claims separately of claim 1, relying only on its contention that GC had failed to establish a *prima facie* case of obviousness as to claim 1. We have reviewed GC’s uncontested evidence regarding these additional limitations and find its arguments to have merit, as set forth below.

Claims 2, 5–7, 9, and 31–34 were addressed above in relation to whether Barrett anticipates those claims. To the extent that Barrett alone disclosed the additional elements of the dependent claims, the combination of WO196 and Barrett does as well. We also note that GC has asserted that

WO196 also discloses many of the elements of these dependent claims. *See* Pet. 53–60. We find these assertions to be supported by the entirety of the record. For instance, WO196 discloses the exact temperature ranges required for the nucleation step of claims 7 and 9. Ex. 1005, 4:3–5. Similarly, WO196 discloses the use of pigments, including three of the metal oxides specified in claim 33. *Id.* at 5:21–22; 6:8–9.

In addition to the claims covered by the anticipation ground, GC also contends that WO196 discloses the additional elements of claims 3, 4, 8, and 10–16. Pet. 53–56. Again, we agree, and summarizing our findings below.

Claim 3 requires that the blanks of claim 1 are in the shape of rods. WO196 includes an example in which the glass-ceramic compositions were used to make glass-ceramic pellets, which were then used to make rods. Ex. 1005, 12:5. We find that this discloses the rod-shaped blanks required by claim 3.

Claim 4 depends from the method of claim 2, and adds a step of pressing the blanks into a dental product. We find that WO196 discloses this step, in its teaching that the “blanks may be used for pressing cores or other frameworks or shapes for dental restorations.” Ex. 1005, 4:12–14.

Claim 8 requires that claim 6’s crystal growth step comprise heating the nucleated glass to between about 800° to about 1000° C, and claim 10 is similar but specifies a range of about 830° to about 930° C. Both of these ranges are explicitly disclosed in WO196 as appropriate temperatures for its crystal growth step. *Id.* at 4:5–7.

In a similar vein, the additional limitations of claims 11–16 are explicitly and identically disclosed in WO196, either in its written description or its claims. *See* Ex. 1005, 4:8–9 (heat treatment conditions of

claim 11); 4:19–20 (machinability requirement of claim 12); claim 20 (dental core with one or more coatings of claim 13); claim 21 (listing of specific coatings in claim 14); claim 22 (firing temperature and coefficient of thermal expansion of claim 15); claim 23 (types of dental restorations of claim 16).

Based on the foregoing, we find that each and every limitation of claims 2–16 and 31–34 is taught by the combined disclosures of WO196 and Barrett. Because we have found above that a person of ordinary skill in the art would have had reason to combine the references with a reasonable expectation of success, and the record contains no evidence or argument pertaining to objective indicia of nonobviousness, we conclude that these claims would have been obvious over the combined disclosures of Barrett and WO196.

5. Dependent Claims 17–30 (the “Range Claims”)

Each of dependent claims 17–30 recites weight percentages for various compounds that comprise the glass-ceramic produced by the method of claim 1. For example, claim 17 requires that the glass ceramic of claim 1 comprise, in weight percent:

about 62 to about 85% SiO₂;
about 1.5 to about 10% Al₂O₃;
about 8 to about 19% Li₂O;
about 2.5 to about 7% K₂O; and
about 0.5 to about 12% P₂O₅.

Ex. 1002, 17:10–16.

For these claims, GC directs us to WO196’s disclosure, in Table 1, of compositions having various ranges of components. Pet. 56–58 (*citing*

Ex. 1005, 8). GC also relies on various exemplary compositions disclosed in Table 2, which have components that fall within the ranges claimed. *Id.* (*citing* Ex. 1005, 13). As we noted in our Institution Decision, most of the claimed ranges correspond *exactly* to the ranges disclosed in Table 1 of WO196, for example as we set forth below for claims 17 and 19:

	Claim 17	Table 1, Range 1	Claim 19	Table 1, Range 2
SiO ₂	62–85%	62–85%	64–70%	64–70%
Al ₂ O ₃	1.5–10%	1.5–10%	1.5–6%	1.5–6%
Li ₂ O	8–19%	8–19%	10–15%	10–15%
K ₂ O	2.5–7%	2.5–7%	2.5–5%	2.5–5%
P ₂ O ₅	0.5–12%	0.5–12%	2–7%	2–7%

Indeed, as GC observes, the ranges of claim 17 are disclosed in Range 1 of Table 1; those of claim 19 are disclosed in Range 2 of Table 1; those of claim 21 are disclosed in Range 3 of Table 1; those of claim 23 are disclosed in Range 4 of Table 1; those of claim 25 are disclosed in Range 5 of Table 1; and those of claim 27 are disclosed in Range 6 of Table 1. The intervening dependent claims 18, 20, 22, 24, 26, and 28 recite additional components of the preceding odd-numbered claim, and those additional component ranges are also exactly disclosed in the respective Ranges of Table 1. *See, e.g.*, Ex. 1005, 6 (Table 1, Range 1, containing the additional components in the ranges recited as optional in claim 18).

Finally, with respect to claims 29 and 30, we find that the component amounts recited in these claims are disclosed exactly in particular examples of Table 2. The amounts of the components required in claim 29 correspond to Example 11 of Table 2, and the amounts required in claim 30 correspond to Example 13 of Table 2. Ex. 1005, 11 (Table 2).

The Range Claims, therefore, are an attempt to claim what was already disclosed to the public by the inventors in WO196, and which is prior art to the '894 patent. As discussed above, we have concluded that the underlying method of claim 1 would have been obvious in view of the combined disclosures of WO196 and Barrett; the addition of specific components and weight percentage amounts, when those were already publicly known, does not make the resulting claim nonobvious. Ardent has not provided us with any evidence of objective indicia of nonobviousness, or argued that the ranges claimed have any criticality or demonstrate unexpected results. We, therefore, conclude that the Range Claims (claims 17–30) would have been obvious over the cited prior art at the time of the invention.

F. Obviousness of Claims 1, 2, 4–10, 12, 16, 17, 19–24, and 31–34 Over Petticrew and Beall, and of Claims 1, 2, 4–7, 9, 12, 16–17, 19, 31–34 Over Schweiger and Barrett

GC also contends that claims 1, 2, 4–10, 12, 16, 17, 19–24, and 31–34 would have been obvious over the combined disclosures of Petticrew and Beall, and that claims 1, 2, 4–7, 9, 12, 16–17, 19, 31–34 would have been obvious over the combined disclosures of Schweiger and Barrett. Pet. 28–48, 66–74.

The grounds of unpatentability based on Barrett and WO196 in combination with Barrett are dispositive as to all challenged claims, while those based on Petticrew in view of Beall or Schweiger in view of Barrett are not. We decline, accordingly, to reach the latter grounds. *See SAS Inst., Inc. v. Iancu*, 138 S. Ct. 1348, 1359 (2018) (holding a petitioner “is entitled to a final written decision addressing all of the claims it has challenged”).

III. CONCLUSION¹³

For the foregoing reasons, we conclude that GC has established, by a preponderance of the evidence, that claims 1–34 are unpatentable.

Claims	35 U.S.C. §	References	Claims Shown Unpatentable	Claims Not shown Unpatentable
1, 2, 5–7, 9, 31–34	102(b)	Barrett	1, 2, 5–7, 9, 31–34	
1–34	103	WO196, Barrett	1–34	
1, 2, 4–10, 12, 16, 17, 19–24, 31–34	103	Petticrew, Beall		
1, 2, 4–7, 9, 12, 16–17, 19, 31–34	103	Schweiger, Barrett		
Overall Outcome			1–34	

IV. ORDER

In consideration of the foregoing, it is hereby:

ORDERED that Petitioner has demonstrated by a preponderance of the evidence that claims 1–34 of the '894 patent are *unpatentable*; and

¹³ Should Patent Owner wish to pursue amendment of the challenged claims in a reissue or reexamination proceeding subsequent to the issuance of this decision, we draw Patent Owner's attention to the April 2019 Notice Regarding Options for Amendments by Patent Owner Through Reissue or Reexamination During a Pending AIA Trial Proceeding. See 84 Fed. Reg. 16,654 (Apr. 22, 2019). If Patent Owner chooses to file a reissue application or a request for reexamination of the challenged patent, we remind Patent Owner of its continuing obligation to notify the Board of any such related matters in updated mandatory notices. See 37 C.F.R. § 42.8(a)(3), (b)(2).

FURTHER ORDERED that because this is a Final Written Decision, any party to the proceeding seeking judicial review of the decision must comply with the notice and service requirements of 37 C.F.R. § 90.2.

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PETITIONER:

Carrie A. Beyer
Nikola Colic
DRINKER BIDDLE & REATH LLP
carrie.beyer@dbr.com
nick.colic@dbr.com

PATENT OWNER:

Cedric C.Y. Tan
Ahmed Abdel-Rahman
PILLSBURY WINTHROP SHAW PITTMAN LLP
cedric.tan@pillsburylaw.com
ahmed.abdelrahman@pillsburylaw.com