

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

PUNGKUK WIRE MANUFACTURING COMPANY,
Petitioner,

v.

SEONG, KI CHUL,
Patent Owner.

Case IPR2016-00763
Patent 6,306,523 B1

Before JO-ANNE M. KOKOSKI, KRISTINA M. KALAN, and
CHRISTOPHER M. KAISER, *Administrative Patent Judges*.

KALAN, *Administrative Patent Judge*.

FINAL WRITTEN DECISION
35 U.S.C. § 318(a) and 37 C.F.R. § 42.73

INTRODUCTION

Pungkuk Wire Manufacturing Company (“Petitioner”) filed a Corrected Petition to institute an *inter partes* review of claims 1–18 of U.S. Patent No. 6,306,523 B1 (Ex. 1001, “the ’523 patent”). Paper 4 (“Pet.”). Seong, Ki Chul (“Patent Owner”) filed a Corrected Preliminary Response to the Petition. Paper 13 (“Prelim. Resp.”). On September 8, 2016, the Board instituted trial to review the patentability of claims 1–4, 6, 9–11, and 14–18 of the ’523 patent. Paper 14 (“Dec.”). Thereafter, Patent Owner filed a Response (Paper 37, “PO Resp.”), and Petitioner filed a Reply (Paper 40, “Reply”). Patent Owner filed a Motion to Exclude certain evidence submitted by Petitioner. Paper 63. Petitioner filed an opposition to the Motion to Exclude (Paper 65), and Patent Owner filed a reply to the opposition (Paper 66). An oral hearing was held June 7, 2017, and a transcript of the hearing is included in the record. Paper 69 (“Tr.”).

We have jurisdiction under 35 U.S.C. § 6, and we issue this Final Written Decision pursuant to 35 U.S.C. § 318(a) and 37 C.F.R. § 42.73. We conclude that Petitioner has not established by a preponderance of the evidence that any of claims 1–4, 6, 9–11, and 14–18 of the ’523 patent are unpatentable. In addition, we dismiss Patent Owner’s motion to exclude evidence.

The ’523 Patent

The ’523 patent “relates to a porous electrode wire for use in electrical discharge machining and the method of manufacturing the same.” Ex. 1001, at [57]. The patent describes electrical discharge machining of a workpiece as “melting the workpiece during the arc discharge” created by applying “a

high frequency voltage” between an “electrode wire” and a “start hole” in the workpiece, along with “removing the machining particles using a machining liquid and an instantaneous vaporization power between the wire and the workpiece.” *Id.* at 1:20–33.

The invention of the ’523 patent is described as having the purposes of improving machining speed “by increasing the surface area of the wire which will be in contact with cooling liquid” and “by allowing the contact of the cooling liquid not only with the surface of the wire but also with inner part of the wire,” and providing a coated wire “with improved flushability without decreasing the machining accuracy.” *Id.* at 3:23–39. The patent describes achieving these purposes by “hot dip galvanizing” a wire made of a first metal by “passing the wire . . . through a molten [bath] of a second metal . . . thereby forming an alloy layer by the diffusion reaction between the first metal and the second metal . . . and a coating layer made of the second metal.” *Id.* at 3:40–49. The patent also describes drawing this wire to a new diameter, “thereby forming cracks in the alloy layer and the coating layer.” *Id.* at 3:51–53. The first metal “may use copper or brass having 63–67 wt % copper and 33–37 wt % zinc.” *Id.* at 3:54–55. The second metal “may use zinc, aluminum or tin.” *Id.* at 3:55–56.

Claim 1 of the ’523 patent is independent and is illustrative of the claimed subject matter. It is reproduced below.

1. A method of manufacturing a coated electrode wire for use in electrical discharge machining comprising:
 - providing an intermediate wire having a first diameter and made of a first metal including copper;
 - hot dip galvanizing the intermediate wire through a molten bath of a second metal having vaporization temperature lower than the first metal for a desired time and

temperature, wherein an alloy layer is formed on the intermediate wire by diffusion reaction of the first metal and the second metal, having hardness higher and lower elongation than the first metal and second metal, and wherein a coating layer is formed on the alloy layer; and drawing the intermediate wire having the alloy layer and the coating layer to form a coated electrode wire having a second diameter, wherein cracks are formed during the drawing step in the alloy layer and the coating layer due to the high hardness and low elongation.

Reviewed Ground of Unpatentability

The Board instituted trial to review the patentability of the challenged claims on the following ground:

Claims Challenged	Basis	Reference
1–4, 6, 9–11, and 14–18	§ 102	Mukherjee ¹

ANALYSIS

Claim Construction

In an *inter partes* review, the Board interprets a claim term in an unexpired patent according to its broadest reasonable construction in light of the specification of the patent in which it appears. 37 C.F.R. § 42.100(b). Under that standard, absent any special definitions, we assign claim terms their ordinary and customary meaning, as understood by a person of ordinary skill in the art, in the context of the entire patent disclosure. *In re Translogic Tech., Inc.*, 504 F.3d 1249, 1257 (Fed. Cir. 2007). Only terms which are in controversy need to be construed, and then only to the extent

¹ Mukherjee, U.S. Patent No. 5,808,262, issued Sept. 15, 1998 (Ex. 1002, “Mukherjee”).

necessary to resolve the controversy. *Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999). For this reason, we do not construe terms for which constructions were proposed during the trial but for which construction is not necessary to resolve this case.

In our Institution Decision, we addressed, but did not construe, the terms “elongation,” certain product-by-process terms, and “cracks.” Dec. 6–8. The parties do not contest our treatment of the terms “elongation” or the product-by-process terms in the Institution Decision. See PO Resp. 7–9; Reply. Accordingly, with respect to these terms, we maintain the position taken in the Institution Decision that we did not need to construe these terms. Dec. 6–8.

Regarding the term “cracks,” which we determined in our Institution Decision was not necessary to construe (Dec. 8), Patent Owner argues that the term “cracks” in claims 1 and 14 should be construed to mean “narrow breaks.” PO Resp. 7–9. Petitioner, when asked at oral hearing if it disagreed with Patent Owner’s construction, indicated that Patent Owner’s construction was “fine.” Tr. 18:3–21. In the absence of controversy about the construction of the term, we construe “cracks” as “narrow breaks.”

Prior Art Disclosure

Mukherjee

Mukherjee relates to “[a] process of manufacturing [a] spark erosion electrode . . . for use in electrical discharge machining, the core of the electrode being of comparatively low zinc alpha brass with top layer of highly rich zinc beta and gamma brass.” Ex. 1002, at [57]. Mukherjee discloses using a core wire made from brass containing 61.5% copper. *Id.*

at 6:17, 6:39. It also discloses coating this wire with zinc. *Id.* at 6:37–38. In Mukherjee, the zinc-coated brass wire is drawn “at a reduction of more than 94.3% in area.” *Id.* at 6:58–65. Both before and after this drawing step, Mukherjee discloses annealing the wire, with the second annealing step disclosed as causing the “top layer [of] zinc [to] further penetrate[] towards the core.” *Id.* at 6:49–57, 6:66–7:5. After the first annealing step, but before the drawing and second annealing steps, Mukherjee discloses that the “Kirkendal[l] effect” causes the zinc coating to “transform[] to β - and α -brass.” *Id.* at 7:43–48.

Anticipation of Challenged Claims by Mukherjee

Petitioner argues that claims 1–4, 6, 9–11, and 14–18 are anticipated by Mukherjee. Pet. 22–28. Petitioner relies on four declarations of Dr. Wojciech Misiolek to support its argument. Ex. 1008; Ex. 1016; Ex. 1019; Ex. 1023. Patent Owner disputes the unpatentability of claims 1–4, 6, 9–11, and 14–18. PO Resp. 16–28. Patent Owner supports its assertions with a declaration of Sya Ensha, Ph.D. Ex. 2002. After reviewing the complete record, we conclude Petitioner has not shown by a preponderance of the evidence that Mukherjee discloses each limitation of claims 1–4, 6, 9–11, and 14–18 of the ’523 patent.

Claims 1 and 14

Independent claim 1 recites, *inter alia*, “wherein cracks are formed during the drawing step in the alloy layer and the coating layer.” Ex. 1001, 7:21–22. Independent claim 14 recites, *inter alia*, “wherein cracks are formed in the alloy later and the coating layer.” *Id.* at 8:25–26.

Petitioner argues that the disclosure of this limitation is inherent in Mukherjee. Pet. 22–24; Reply 2–22. Patent Owner argues that Mukherjee does not expressly disclose the “cracks” limitation of claims 1 and 14 of the ’523 patent, with which Petitioner does not appear to disagree. *See, e.g.*, PO Resp. 2. Patent Owner further argues that Petitioner fails to establish sufficiently that cracks are inherently formed in the alloy layer and coating layer of Mukherjee. PO Resp. 16–28.

A reference inherently discloses an element of a claim “if that missing characteristic is *necessarily* present, or inherent, in the single anticipating reference.” *Schering Corp. v. Geneva Pharms.*, 339 F.3d 1373, 1377 (Fed. Cir. 2003) (citation omitted) (emphasis added). “Inherency, however, may not be established by probabilities or possibilities. The mere fact that a certain thing may result from a given set of circumstances is not sufficient.” *Therasense, Inc. v. Becton, Dickinson & Co.*, 593 F.3d 1325, 1332 (Fed. Cir. 2010) (citing *Cont’l Can Co. USA v. Monsanto Co.*, 948 F.2d 1264, 1269 (Fed. Cir. 1991)). “If, however, the disclosure is sufficient to show that the natural result flowing from the operation as taught *would result* in the performance of the questioned function, it seems to be well settled that the disclosure should be regarded as sufficient.” *Cont’l Can*, 948 F.2d at 1269 (emphasis added). Thus, the question we must answer to determine the inherency of a claim limitation in the prior art is whether the disclosure of the prior art shows that the limitation necessarily would result from following the express disclosure of the prior art, as opposed to showing that the limitation only might result from following the express disclosure of the prior art. Here, Petitioner has not directed us to sufficient evidence of record for us to find that this question should be answered affirmatively.

Petitioner initially directs us to two pieces of evidence to support the inherent disclosure by Mukherjee of the cracks recited in claims 1 and 14. Pet. 22–23 (citing Ex. 1002, 6:36–65; Ex. 1008 ¶¶ 8, 9). In the Reply, Petitioner additionally directs us to several more pieces of evidence. Reply *passim* (citing Ex. 1019 ¶¶ 8–9, 12–13, 16–18 (Third Misiolek Declaration), Ex. 1020 (Wikipedia entry); Ex. 1021 (Testing Report); Ex. 1022 (Hwang Declaration); Ex. 1023 ¶¶ 9, 12–16, 21 (Fourth Misiolek Declaration); Ex. 1024, 28:4–6, 31:4–6, 48:8–9, 84:4 (Ensha Deposition Transcript); Ex. 1025, 3 (Metal Alloys article); Ex. 1026, 6:21–24, 6:50–53, 6:60–63 (Tomalin patent)).

Petitioner’s cited evidence establishes several facts. First, it establishes that Mukherjee discloses a process in which a core wire with a diameter of 3 millimeters is plated with zinc, heated for 24 to 26 hours at temperatures up to 380 degrees Celsius, cooled, then drawn “at a reduction of more than 94.3% in area to get the diameter of the wire [down to] an intermediate shape between 1 [and] 1.25 [millimeters].” Ex. 1002, 6:36–65. Second, it establishes that the Mukherjee process creates an alloy layer of beta brass and gamma brass and an outer zinc layer, each of which has “a lower ductility compared to [the] alpha brass [core of the wire].” Ex. 1008 ¶¶ 7–8. Third, it establishes that the beta brass and gamma brass alloy layer and the outer zinc layer are “exposed to the highest strain” in the wire-drawing process. *Id.* ¶ 8. Fourth, Petitioner’s testing report and supporting testimony establish that a process similar to Mukherjee’s process² created a

² The process used in Petitioner’s testing is only “similar to the processes disclosed in Columns 6 and 7 of *Mukherjee*,” not identical to those

wire with “cracks on the surface of the wire.” Ex. 1021; Ex. 1022; Ex. 1023 ¶¶ 9, 13. Fifth, it establishes that the annealing steps in Mukherjee “cannot transform low ductility gamma brass and eta zinc phases into high ductility phases.” Ex. 1019 ¶¶ 16–18. Sixth, it establishes that gamma brass is “more brittle than zinc.” Ex. 1024, 48:7–9. Finally, it establishes that “it is nearly impossible to cold draw [gamma] phase alloy material because it is very brittle.” Ex. 1026, 6:21–22.

This evidence does not establish, however, that a necessary result of Mukherjee’s drawing process is a wire with cracks formed in its alloy layer and in its coating layer. Regarding the alloy layer, although the beta and gamma brass alloy is a brittle material (Ex. 1008 ¶¶ 7–8; Ex. 1019 ¶¶ 16–18; Ex. 1024, 48:7–9), and the strain of drawing is concentrated in that brittle layer (Ex. 1008 ¶ 8), Petitioner does not provide sufficient evidence establishing that drawing necessarily creates cracks in the beta and gamma brass. The closest evidence provides that “it is *nearly* impossible to cold draw [gamma] phase alloy material.” Ex. 1026, 6:21–22 (emphasis added). This statement, however, falls short of establishing that drawing of beta and gamma phase brass cannot be accomplished without the formation of cracks in the alloy layer. First, the statement does not say that drawing of a gamma phase alloy is impossible, only “nearly impossible.” Additionally, the statement relates to gamma phase alloy only, not the mixture of beta and gamma phase alloys present in Mukherjee.

processes. Reply 10; *see also* Ex. 1023 ¶¶ 17–20 (describing differences between the testing process and the Mukherjee process).

Neither is Dr. Misiolek's testimony sufficient to support a finding that the Mukherjee process necessarily creates cracks in the alloy layer or in the coating layer. In his initial declaration, Dr. Misiolek states that "[t]he wire drawing process disclosed by Mukherjee *would crack* the outside beta and gamma brass alloy layer and the outer zinc layer of the coated wire."

Ex. 1008 ¶ 8 (emphasis added). As support for this statement, Dr. Misiolek testifies that "beta brass, gamma brass, and zinc each have a lower ductility compared to alpha brass and these layers are exposed to the highest strain."

Id. Dr. Misiolek does not sufficiently explain, however, why the lower ductility of beta brass, gamma brass, and zinc means that the alloy layer and the coating layer necessarily would crack as a result of the Mukherjee drawing process. The presence of a relatively brittle alloy layer and zinc layer, and the application of a relatively large amount of strain to those layers, seem to make the formation of cracks more likely, but it is not clear from Dr. Misiolek's testimony why the presence of such circumstances makes the formation of cracks completely certain. The testimony in Dr. Misiolek's third declaration does not make the reasoning any more clear. Ex. 1019 ¶ 9 (testifying that "the drawing process in column 6 of Mukherjee would cause cracks to form on the surface of the wire" without explaining why). Thus, Dr. Misiolek's testimony is conclusory and entitled to little weight. 37 C.F.R. § 42.65(a).

Moreover, there is evidence of record that, in any given wire drawing process, "whether cracks actually occur depends on multiple factors, including . . . the temperature used during the [drawing] process, and . . . the speed of the drawing." Ex. 2002 ¶ 14. Dr. Misiolek does not dispute this testimony, and Petitioner does not direct us to any evidence to the contrary.

Ex. 1019 ¶¶ 14–18; Reply 16–28. Mukherjee does not disclose either the speed of its wire drawing process or the temperature at which that process takes place. Ex. 1002, 6:58–65. Accordingly, there is insufficient evidence of record to find that wires produced using the Mukherjee process always and inevitably must have cracks in the alloy layer and in the coating layer.

Finally, the testing reported in Exhibit 1021 and discussed in Exhibits 1022 and 1023 does not establish that the drawing process of Mukherjee necessarily results in the formation of cracks in the alloy layer and the coating layer. Most importantly, the testing was performed under conditions different than those described in Mukherjee, rendering it unhelpful in determining whether any particular result would be achieved when using Mukherjee’s process. Additionally, the cracks reported in the test were located on the surface of the wire. Ex. 1021, 99–103; Ex. 1023 ¶ 14. As indicated in the ’523 patent, not all zinc-coated brass wires transform their entire zinc coating to brass upon undergoing heat treatment; rather, some have an outer layer of zinc remaining. Ex. 1001, 5:9–10 (observing “that the alloy layer (22) and the coating layer (23) are formed sequentially on the brass core wire (21)”), Fig. 3b (depicting relative location of these layers). Petitioner does not explain whether the wire produced by the Mukherjee process or by Petitioner’s testing process detailed in Exhibit 1021 lacks a remaining zinc coating (in which case it would fail to satisfy all the limitations of challenged claims 1 and 14), or retains a zinc coating (in which case the results of the testing, which depict only cracks in the outer layer of the wire, would fail to demonstrate that the alloy layer has cracks, as required by claims 1 and 14). Dr. Misiolek suggests that a zinc coating remains present in the Mukherjee process. Ex. 1008 ¶ 8 (referring to “the

outer zinc layer of the coated wire” and “the outside beta and gamma brass alloy layer” separately and in the plural as “these layers”). Thus, even to the extent that Petitioner’s testing shows that drawing a wire according to Mukherjee’s process necessarily would create cracks in the surface of the wire, it is unclear whether those cracks would be in the alloy layer, or in an overlying outer zinc layer. Because the challenged independent claims require cracks in both the alloy layer and the coating layer, and because Petitioner’s testing only reported cracks located on the surface of the wire, at least one element of the challenged independent claims remains unproven by the proffered test results.

Therefore, we cannot find that Mukherjee anticipates claims 1 and 14 of the ’523 patent.

Other Claims

Petitioner also contends that claims 2–4, 6, 9–11, and 15–18 are anticipated by Mukherjee. Pet. 22–28. Claims 2–4, 6, and 9–11 depend, directly or indirectly, from claim 1; claims 15–18 depend, directly or indirectly, from claim 14. Ex. 1001, 7:24–31, 7:35–36, 8:1–8, 8:29–40. Accordingly, each incorporates all the limitations of the respective independent claim from which it depends. 37 C.F.R. § 1.75(c). Because, as discussed above, there is insufficient evidence of record to find that claims 1 and 14 are anticipated by Mukherjee, there also is insufficient evidence of record to find that claims 2–4, 6, 9–11, and 15–18 are anticipated by Mukherjee.

Patent Owner's Motion to Exclude

Patent Owner moves to exclude Exhibits 1020, 1021, 1022, 1023, 1025, and 1026. Paper 63. We do not consider the merits of Patent Owner's Motion to Exclude because, as explained above, even if the disputed evidence is considered, Petitioner has not shown by a preponderance of the evidence that claims 1–4, 6, 9–11, and 14–18 of the '523 patent are unpatentable as anticipated by Mukherjee. Accordingly, Patent Owner's Motion to Exclude is dismissed as moot.

CONCLUSION

For the reasons given, we are not persuaded that Petitioner has shown by a preponderance of the evidence that claims 1–4, 6, 9–11, and 14–18 of the '523 patent are anticipated by Mukherjee. In addition, Patent Owner's Motion to Exclude is dismissed as moot.

ORDER

Accordingly, it is

ORDERED that Petitioner has not shown by a preponderance of the evidence that claims 1–4, 6, 9–11, and 14–18 of the '523 patent are unpatentable;

FURTHER ORDERED that Patent Owner's Motion to Exclude is dismissed as moot; and

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

IPR2016-00763
Patent 6,306,523 B1

FOR PETITIONER:

Kevin W. Raudebaugh
Steve Y. Cho
Katherine M. Mead
Yong Seong Kim
AMPACC LAW GROUP, PLLC
kwr@ampacc.com
cho@ampacc.com
k2m@ampacc.com
ysk@ampacc.com

FOR PATENT OWNER:

John K. Park
Mark L. Sutton
PARK LAW FIRM
park@parklaw.com
mlsutton@parklaw.com