

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

BEDRA, INC., BERKENHOFF GMBH,
and POWERWAY GROUP CO. LTD.,
Petitioner,

v.

SEONG, KI CHUL,
Patent Owner.

Case IPR2018-00667
Patent 6,482,535 B2

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

KAISER, *Administrative Patent Judge*.

DECISION

Denying Institution of *Inter Partes* Review
35 U.S.C. § 314

INTRODUCTION

A. Background

Berkenhoff GmbH, bedra, Inc., and Powerway Group Co., Ltd. (collectively, “Petitioner”) filed a Petition (Paper 2, “Pet.”) requesting an *inter partes* review of claims 1–5 of U.S. Patent No. 6,482,535 B2 (Ex. 1002, “the ’535 patent”). Seong, Ki Chul¹ (“Patent Owner”) filed a Preliminary Response (Paper 7, “Prelim. Resp.”).

We have authority to determine whether to institute an *inter partes* review. 35 U.S.C. § 314(b); 37 C.F.R. § 42.4(a). The standard for instituting an *inter partes* review is set forth in 35 U.S.C. § 314(a), which provides that an *inter partes* review may not be instituted unless “there is a reasonable likelihood that the petitioner would prevail with respect to at least 1 of the claims challenged in the petition.”

After considering the Petition, the Preliminary Response, and the evidence currently of record, we determine that Petitioner has not demonstrated a reasonable likelihood that it would prevail with respect to at least one of the claims challenged in the Petition. Accordingly, we do not institute an *inter partes* review.

B. Related Matters

The parties note that the ’535 patent has been asserted against bedra, Inc. in *Ki Chul Song v. BEDRA, Inc.*, Case No. 1:18-cv-00396 (N.D. Ill.). Pet. 8; Paper 5, 3. In addition, the ’535 patent previously was challenged by a different petitioner in IPR2016-00762. Pet. 1–4.

¹ Various spelled “Sung, Ki Chul” and “Ki Chul Song.” Prelim. Resp. 1; Paper 5, 3.

C. The Asserted Grounds of Unpatentability

Petitioner contends that claims 1–5 of the ’535 patent are unpatentable based on the following grounds (Pet. 33–56):²

Statutory Ground	Basis	Challenged Claims
§ 102(a)	Tomalin ³	1–5
§ 103(a)	Tomalin and Takano ⁴	4 and 5
§ 103(a)	Mukherjee ⁵ and Briffod I ⁶	1–5

D. The ’535 Patent

The ’535 patent “relates to a porous electrode wire for use in electrical discharge machining device[s]” Ex. 1002, 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 1:22–35. The invention of the ’535 patent is described as having the purposes of “improv[ing] machining speed by increasing the surface area of

² Petitioner also relies on a Declaration from Dr. Dandridge Tomalin. Ex. 1004.

³ Tomalin, U.S. Patent No. 5,945,010, issued Aug. 31, 1999 (Ex. 1009, “Tomalin”).

⁴ Takano, Japanese Patent Publication No. S60-262930, published Dec. 26, 1985 (Ex. 1020, “Takano”).

⁵ Mukherjee, U.S. Patent No. 5,808,262, issued Sept. 15, 1998 (Ex. 1005, “Mukherjee”).

⁶ Briffod, U.S. Patent No. 5,196,665, issued Mar. 23, 1993 (Ex. 1015, “Briffod I”).

the wire which will be in contact with cooling liquid,” “improv[ing] machining speed by allowing the contact of the cooling liquid . . . with [the] inner part of the wire,” and “provid[ing] a coated wire . . . with improved flushability without decreasing the machining accuracy.” *Id.* at 3:27–44. 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 3:45–52. The patent also describes drawing this wire to a new diameter, “thereby forming cracks in the alloy layer and the coating layer.” *Id.* at 3:54–58. The first metal is described as “copper or brass having 63–67 wt % copper and 33–37 wt % zinc.” *Id.* at 3:59–60. The second metal is described as “zinc, aluminum or tin.” *Id.* at 3:60–61.

E. Illustrative Claim

Claims 1–5 of the ’535 patent are challenged. Claim 1 is independent and illustrative; it recites:

1. An electrode wire for use in electrical discharge machining comprising:
 - a core wire made of first metal including copper;
 - an alloy layer formed on the core wire, wherein the alloy layer is formed by a diffusing reaction between the first metal and a second metal and the alloy layer has a crack structure on its surface.

Ex. 1002, 7:16–8:6.

ANALYSIS

A. Claim Construction

In an *inter partes* review, we construe 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); see *Cuozzo Speed Techs. LLC v. Lee*, 136 S. Ct. 2131, 2144 (2016) (upholding the use of the broadest reasonable interpretation standard). Claim terms generally are given their ordinary and customary meaning, as would be understood by one of ordinary skill in the art in the context of the entire 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 necessary to resolve the controversy. See *Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017) (citing *Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999) (“[O]nly those terms need be construed that are in controversy, and only to the extent necessary to resolve the controversy.”)).

The only claim term whose meaning is in dispute is the phrase “crack structure.” Pet. 31–33; Prelim. Resp. 9–11. Patent Owner argues that this phrase should be given its dictionary definition, “an arrangement of narrow breaks.” Prelim. Resp. 10–11. Petitioner argues that “[t]he ’535 patent does not limit the description of ‘cracks’ to any specific structure or configuration,” so it would be inappropriate to interpret “crack” as limited to a “narrow break.” Pet. 32–33. Instead, Petitioner argues that “crack structure” should be construed as “porous structures on the wire surface” because the ’535 patent “describes the ‘cracks’ synonymously with ‘porous’ ‘spongy-like’ surface structures.” *Id.* at 32 (citing Ex. 1002, at [54], [57],

1:16–20, 3:41–44, 4:30–34, 4:44–45, 4:57–61, 4:67–5:2, 5:23–29, 5:32–39, 6:15–21).

On the present record, we are persuaded that Patent Owner’s construction is correct. Although it is true that the ’535 patent describes “produc[ing] uniform cracks in the coating layer and the alloy layer to form a porous structure on the surface,” Ex. 1002, 6:51–52, it is not clear on the present record that this necessarily means the cracks themselves are the surface pores. Instead, “the porous nature of the wire” merely “*arises from* the cracks in the alloy layer and the coating layer.” *Id.* at 4:32–33 (emphasis added). Thus, the ’535 patent does not necessarily treat the cracks as synonymous with the pores; it also may allow the creation of pores merely as a result of the creation of separate cracks.

In addition, the ’535 patent places restrictions on the shape of cracks that are more consistent with Patent Owner’s proposed construction than with that proposed by Petitioner. The ’535 patent consistently describes the cracks as directional and oriented perpendicular to the length of the wire. *Id.* at 4:43–45 (“the alloy layer includes cracks having a direction perpendicular to the longitudinal direction of the wire”), 5:35–37 (“the cracks have a direction approximately perpendicular to the longitudinal direction of the wire”), 6:53–55 (“These cracks are propagated through the grain boundary of the coating layer and the direction of the propagation is perpendicular to the longitudinal direction of the wire”). Interpreting “crack” as synonymous with “pore,” which refers to any small hole or opening without any limit on shape, Ex. 2004, is inconsistent with the description of cracks in the ’535 patent as directional. Far more consistent with this description is Patent Owner’s proposed construction of “crack” as “narrow break.”

Accordingly, on the present record, we construe “crack structure” as “an arrangement of narrow breaks.”

B. Grounds Based on Tomalin

Petitioner argues that claims 1–5 are unpatentable as anticipated by Tomalin, and that claims 4 and 5 are unpatentable as obvious over the combination of Tomalin and Takano. Pet. 33–47. Both of these asserted grounds depend on whether Tomalin is prior art under 35 U.S.C. § 102(a) or § 103(a), as Petitioner alleges. Patent Owner argues that Tomalin is not prior art to the ’535 patent, because the ’535 patent is entitled to a priority date of July 30, 1997, the filing date of the Korean application from which the ’535 patent claims priority.⁷ Prelim. Resp. 19–29 (citing Ex. 1013⁸). Petitioner argues that the ’535 patent should not benefit from the filing date of the Korean application because the Korean application does not provide written-description support for the claims of the ’535 patent. Pet. 15–24. Specifically, Petitioner argues that the Korean application does not describe the “cracks through an alloy layer” that are a limitation of every challenged claim. *Id.*; see Ex. 1002, 7:16–8:15 (reciting “wherein . . . the alloy layer has a crack structure on its surface” as a limitation of every claim).

Under 35 U.S.C. § 119, “the claims set forth in a United States application are entitled to the benefit of a foreign priority date if the corresponding foreign application supports the claims in the manner required by [35 U.S.C. §] 112.” *In re Gosteli*, 872 F.2d 1008, 1010 (Fed. Cir. 1989).

⁷ Tomalin’s filing date is September 2, 1997.

⁸ Korean Patent Application 97/36214, filed July 30, 1997 (“Korean application”).

In other words, for the '535 patent to be entitled to the priority date of the Korean application, the Korean application must “contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same.” 35 U.S.C. § 112(a). The question Petitioner presents here is whether the Korean application adequately describes the presence of an alloy layer with the “crack structure on its surface” that is recited in the challenged claims.

Petitioner argues that the Korean application does not provide such a description, because it “*only* discloses cracks within the ‘coating layer’ and *not* within any ‘alloy layer.’” Pet. 19 (citing Ex. 1013, 6, 7, Figs. 2a1, 2a2, 2b) (emphasis in original). But the Korean application describes the “coating layer” as comprising two sub-layers, one of which is the outer zinc coating layer of the '535 patent and the other of which is the inner copper-zinc alloy layer of the '535 patent. Ex. 1013, 7 (“The zinc layer and the copper-zinc alloy layer are dense coating layers.”); *compare* Ex. 1013, Fig. 3 (depicting a core, alloy layers, and a zinc layer), *with* Ex. 1002, Fig. 3b (depicting a core, an alloy layer, and a zinc layer). Thus, on the present record, the Korean application’s description of cracks in the “coating layer” does not necessarily mean that those cracks are confined to the outer zinc layer and fail to reach the inner alloy layer.

Petitioner also argues that, to the extent the Korean application is susceptible to two different interpretations, this is insufficient to meet the written-description requirement. Pet. 21–23 (citing *Hyatt v. Boone*, 146 F.3d 1348, 1353–54 (Fed. Cir. 1998); *Goeddel v. Sugano*, 617 F.3d 1350 (Fed.

Cir. 2010)). At least on the present record, we disagree with Petitioner that two interpretations of the Korean application are possible. First, the evidence of record shows that both the outer zinc layer and the underlying alloy layer would crack when subjected to the process of the Korean application. The outermost portion of the alloy layer is made of a copper-zinc alloy with “a weight ratio of 45:55.” Ex. 1013, 7. According to Dr. Tomalin, this is “a mixed portion of beta/gamma brass.” Ex. 1004 ¶ 51. Gamma-phase brass “crack[s] under cold drawing.” *Id.* ¶ 29 (citing Ex. 1007 ¶¶ 7, 8, 18). Beta-phase brass “may not crack.” *Id.* (citing Ex. 1007 ¶ 12). The Korean application describes cooling the coated wire before drawing it, which is cold drawing. Ex. 1013, 7 (“the hot-dip zinc coated intermediate wire rod is cooled in the air and then drawn to a thin wire having a required diameter”); see Ex. 1004 ¶ 55 (describing the process of the Korean application as “cold drawing”). Thus, the wire in the Korean application is subjected to a process that will cause some of the outermost portion of the alloy layer to crack and that may cause the remainder of that portion of the alloy layer to crack. The most likely result of this is the creation of cracks at the surface of the alloy layer.

We need not speculate, however, about whether cracks will form in the alloy layer of the wire described in the Korean application. Figure 2a2 of the Korean application depicts “a cross-section of a porous electrode wire” that was made “according to the present invention.” Ex. 1013, 6. In the wire shown in Figure 2a2, there is “a core 11 formed of a metal and a coating layer 12 surrounding the core 11.” *Id.* As discussed above, the “coating layer” is in reality two or more sub-layers, where the outermost layer is made of zinc and the underlying layers are copper-zinc alloys. *Id.*

at 7. The coating layer in Figure 2a2 has cracks that penetrate from the surface of the wire all the way to the surface of the core. Ex. 1013, Fig. 2a2. Accordingly, those cracks pass through the transition between the zinc outer sub-layer and the alloy sub-layer underneath. Thus, in a wire made according to the invention of the Korean application, there are cracks on the surface of—indeed, all the way through—the alloy layer.

On the present record, the Korean application provides adequate written-description support for the “alloy layer has a crack structure on its surface” limitation of the challenged claims. Because Petitioner has not argued, much less shown, any additional issues with the ’535 patent being entitled to the priority date of the Korean application, we conclude that the ’535 patent is so entitled and that Tomalin is not prior art to the ’535 patent under either 35 U.S.C. §§ 102(a) or 103(a). Because the grounds relying on Tomalin require Tomalin to be prior art, we determine that Petitioner has not shown a reasonable likelihood that it would prevail in showing that any challenged claim of the ’535 patent is unpatentable on any ground relying on Tomalin.

C. Asserted Obviousness over Mukherjee and Briffod I

Petitioner argues that the subject matter of claims 1–5 would have been obvious to a person of ordinary skill in the art given the teachings of Mukherjee and Briffod I. Pet. 47–56.

1. 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 gam[m]a brass.” Ex. 1005, 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 effect” causes the zinc coating to “transform[] to β - and α -brass.” *Id.* at 7:43–48. Petitioner argues that the transformation is to “ β -and γ -brass” and that “ β - and α -brass” is a typographical error. Pet. 25–26 n.3. For purposes of this decision, we treat Mukherjee as though it discloses a transformation to “ β -and γ -brass,” as Petitioner argues it does.

2. *Briffod I*

Briffod I relates to “[a] wire electrode for electro-erosion cutting consisting of a core of electrically conductive material” that “is covered with a film of multiple fine layers,” which “may be diffused into one another in order to provide alloys of desired structure and composition.” Ex. 1015, at [57]. The core wire of Briffod I may be made of copper or brass. *Id.* at 4:23–26. Briffod I discusses “a laminated wire made from a layer of zinc deposited on a layer of copper or brass.” *Id.* at 2:42–50. In such a wire, “[a]lloys become increasingly enriched in zinc from the core to the surface. This gives a succession of layers of variable properties along the wire radius, as each phase of the brass has different properties.” *Id.* According to Briffod I, gamma-phase brass made according to this method and having “approximately 60–70% zinc” is “an extremely fragile phase, with an

attendant risk of rupture if the layer exceeds a few microns.” *Id.* at 2:61–65. This is in contrast to beta- and alpha-phase brass, which “have satisfactory mechanical properties.” *Id.* at 2:65–67. There is also a benefit to gamma-phase brass, though: as a phase containing a relatively high amount of zinc, it has more of a heat shield effect than alpha- and beta-phase brass do. *Id.* at 2:67–3:2. Briffod I teaches that the advantages of using gamma-phase brass can be obtained without causing the disadvantageous risk of rupture, by depositing zinc and copper “alternately in multiple fine layers,” then heat-treating the wire to produce various brass phases throughout the wire’s diameter, allowing the production of thin layers of gamma-phase brass that “are fairly flexible offering satisfactory mechanical strength and breaking strength,” as well as “high electro-erosion wear resistance.” *Id.* at 3:12–23. Producing a wire in this way allows cold drawing of the wire, which produces “savings in time, space and installation and energy costs” that “are obvious.” *Id.* at 5:21–26.

3. *Analysis*

Petitioner argues that all limitations of claims 1–5 are taught or suggested by the combination of Mukherjee and Briffod I. Pet. 47–56. In addition, Petitioner argues that a person of ordinary skill in the art would have had a reason to combine the teachings of Mukherjee with those of Briffod I. *Id.* Patent Owner argues that a person of ordinary skill in the art would not have used the teachings of Briffod I to produce the wire of the challenged claims, because those claims require cracks in an alloy layer, and Briffod I teaches away from producing such cracks. We agree with Patent Owner.

As discussed above, claim 1 of the '535 patent recites a limitation requiring the electrode wire to have “an alloy layer” that “has a crack structure on its surface.” Ex. 1002, 7:16–8:6. All of the other challenged claims depend directly or indirectly from claim 1 and, therefore, contain this limitation as well. 37 C.F.R. § 1.75(c). Petitioner does not rely on Mukherjee to teach or suggest the recited “crack structure,” because, according to Petitioner, Mukherjee “only explicitly discloses cracks in the surface coating layer and does not explicitly disclose ‘cracks’ in an alloy layer resulting from a drawing process.” Pet. 47–48 (citing Ex. 1005, 4:56–63). Instead, Petitioner relies on Briffod I to “disclose[] cracks in an alloy layer via cold drawing gamma brass.” *Id.* at 48 (citing Ex. 1015, 2:67–3:2, 3:17–24, 5:21–26). Specifically, Petitioner relies on Briffod I’s statement that gamma-phase brass will “rupture if the layer exceeds a few microns.” *Id.* (citing Ex. 1015, 2:61–67).

Thus, Petitioner equates Briffod I’s “rupture” of the gamma-phase brass with the “crack structure” required by the challenged claims. Setting aside the issue of whether a “rupture” is indeed a “crack structure,” an issue on which the parties disagree, Petitioner does not make clear why a person of ordinary skill in the art would have been motivated to process Mukherjee’s wire in a way that would produce Briffod I’s rupture. Petitioner argues that a person of ordinary skill in the art would have been motivated to achieve the benefits of Briffod I: savings in time and space, as well as installation and energy costs, plus improved heat shielding and electro-erosion wear resistance due to the presence of a gamma-phase brass coating on the electrode wire. Pet. 49–50 (citing Ex. 1015, 2:67–3:2, 3:17–24, 5:21–26).

But these advantages ignore the way in which Briffod I disparages Mukherjee's method and the ruptures it might cause. When Briffod I says that gamma-phase brass "is an extremely fragile phase" and has a "risk of rupture," it is discussing "the example above of a wire consisting of layers of [copper] and zinc." Ex. 1015, 2:61–65. The example to which Briffod I refers is a "laminated wire made from a layer of zinc deposited on a layer of copper or brass," causing "strata" to develop, each "corresponding to the different phases of the brass." *Id.* at 2:42–46. These "[a]lloys become increasingly enriched in zinc from the core to the surface." *Id.* at 2:46–48. This is Mukherjee's process. Ex. 1005, 6:17–7:48. And Briffod I describes this process as producing a gamma-phase brass layer that has a "risk of rupture," language that suggests that a person of ordinary skill in the art would interpret Briffod I as stating that obtaining such a rupture is not a good idea. Ex. 1015, 2:61–65. Moreover, Briffod I contrasts the rupture-prone gamma-phase brass layer with layers made of other brass phases that "have satisfactory mechanical properties." *Id.* at 2:65–67. This suggests that the gamma-phase brass is unsatisfactory. Briffod I also describes the tendency of thick layers of gamma-phase brass to rupture as a "disadvantage." *Id.* at 3:17–18. Taken together, all of this language constitutes disparagement by Briffod I of producing a wire with a thick gamma-phase brass layer that is prone to rupturing. The disparagement is particularly clear given that Briffod I proposes a way of achieving the advantages of a gamma-phase brass coating layer without having to suffer the disadvantages: by creating thin layers of gamma-phase brass rather than using a single thick layer on the outside of the wire. *Id.* at 3:12–23. Thus, the risk of rupture is not simply the price that must be paid for the improved

heat shielding and electro-erosion wear resistance of a gamma-phase brass coating layer. Instead, according to Briffod I, rupture is a detrimental result that can and should be avoided.

Given the way in which Briffod I disparages Mukherjee's method of plating a brass wire with zinc and then heat-treating it to create a thick gamma-phase brass coating layer, and, given the lengths to which Briffod I goes to explain how to avoid the results of following that method, we find that Briffod I teaches away from a combination with Mukherjee. *In re Fulton*, 391 F.3d 1195, 1201 (Fed. Cir. 2004) (a reference teaches away if it criticizes, discredits, or otherwise discourages the claimed solution). At the very least, the language of Briffod I certainly discourages the creation of both the thick gamma-phase brass layer of Mukherjee and the cracks in that layer that are required by the challenged claims. The mere fact that Briffod I teaches some benefits that can be obtained by using a thin, non-ruptured, gamma-phase brass coating layer does not mean that the person of ordinary skill in the art would ignore Briffod I's warning about using a thick, rupture-prone coating layer of gamma-phase brass. Thus, Petitioner's identification of the benefits of Briffod I's thin layer is insufficient to demonstrate that a person of ordinary skill in the art would have been motivated to combine Briffod I and Mukherjee in a way that would have resulted in obtaining the ruptures of Briffod I in the wire of Mukherjee.

Accordingly, we determine that Petitioner has not shown a reasonable likelihood that it would prevail in showing that any challenged claim of the '535 patent is unpatentable over the combination of Mukherjee and Briffod I.

CONCLUSION

Upon consideration of the Petition, the Preliminary Response, and the evidence before us, we determine that Petitioner has not demonstrated a reasonable likelihood that it would prevail in showing that any challenged claim of the '535 patent is unpatentable on any of the grounds asserted in the Petition. Accordingly, we do not institute *inter partes* review on any of Petitioner's asserted grounds.

ORDER

It is hereby

ORDERED that, pursuant to 35 U.S.C. § 314, the Petition is denied, and no *inter partes* review is instituted.

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