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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte IVAN V. MENDENHALL and BRADLEY W. SMITH

Appeal 2019-001528
Application 13/799,559
Technology Center 1700

Before ROMULO H. DELMENDO, MICHAEL P. COLAIANNI, and RAE LYNN P. GUEST, *Administrative Patent Judges*.

DELMENDO, *Administrative Patent Judge*.

DECISION ON APPEAL

Pursuant to 35 U.S.C. § 134(a), the Appellant[1] appeals from the Primary Examiner's final decision to reject claims 1–3, 5–10, 12–16, 21, and 23–27.[2] We have jurisdiction under 35 U.S.C. § 6(b).

We affirm.

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[1] We use the word "Appellant" to refer to "applicant" as defined in 37 C.F.R. § 1.42—namely, "Autoliv ASP, Inc." (Application Data Sheet March 13, 2013), which is also identified as the real party in interest (Appeal Brief filed March 16, 2018 ("Appeal Br.") at 1).

[2] *See* Appeal Br. 9–25; Reply Brief filed November 30, 2018 ("Reply Br.") at 2–9; Final Office Action entered October 19, 2017 ("Final Act.") at 2–5; Examiner's Answer entered October 2, 2018 ("Ans.") at 3–7.

I. BACKGROUND

The subject matter on appeal relates to a gas generant composition, which may be used in passive inflatable restraint systems (Specification filed ("Spec.") ¶¶ 1–5, 26). Representative claim 1 is reproduced from the Claims Appendix to the Appeal Brief, as follows:

> 1. A gas generant composition comprising:
> a fuel;
> an oxidizer comprising basic copper nitrate; and
> an endothermic slag-forming component comprising ***aluminum hydroxide having an average particle size diameter of greater than or equal to about 150 μm, wherein the gas generant composition has a maximum flame temperature at combustion (T_c) of less than or equal to about 1,900K (1,627°C)***.

(Appeal Br. 26 (emphasis added)).

II. REJECTION ON APPEAL

Claims 1–3, 5–10, 12–16, 21, and 23–27 stand rejected under pre-AIA 35 U.S.C. § 103(a) as unpatentable over Zhou et al.[3] ("Zhou") in view of Ochi et al.[4] ("Ochi") (Ans. 3–7; Final Act. 2–5).

III. DISCUSSION

1. Grouping of Claims

The Appellant provides various arguments under separate sub-headings identified by certain groups of claims (Appeal Br. 9–25). We address claims separately from claim 1, which we select as representative, only to the extent that the arguments in support of separate patentability

[3] US 2007/01119530 A1, published May 31, 2007.

[4] US 5,656,793, issued August 12, 1997.

comply with 37 C.F.R. § 41.37(c)(1)(iv). Absent such an argument in support of separate patentability, all claims stand or fall with claim 1. In this regard, we emphasize that merely pointing out what a claim recites and providing a skeletal argument that the prior art references do not disclose or suggest certain claim limitations are not arguments that require our separate consideration. *In re Lovin*, 652 F.3d 1349, 1356–57 (Fed. Cir. 2011).

2. The Examiner's Position

The Examiner finds that Zhou describes a composition for use in an air bag including a fuel such as guanidine nitrate, basic copper nitrate, a slag forming agent such as aluminum hydroxide and iron oxide, and other additives (Ans. 3 (citing Zhou ¶¶ 36, 109, 115, 144). The Examiner acknowledges that Zhou's composition differs from the claimed composition in that Zhou does not disclose the particle size of the slag forming agent (i.e., aluminum hydroxide) (*id.*). To resolve this difference, the Examiner relies on Ochi, which was found to teach the use of a compound such as aluminum hydroxide having a size of less than 300 μm as a flame coolant in a composition for use in an air bag (*id.* (citing Ochi col. 5, ll. 15–45 and col. 8, ll. 45–53)). Based on these findings, the Examiner concludes that "[i]t would have been obvious to one having ordinary skill in the art . . . to use the larger particle size of the slag [forming] agent as taught by Ochi since Ochi suggests that it will improve the performance of the air bag composition" (*id.*). Alternatively, the Examiner asserts that "[i]t [would] also [have been] obvious to vary the parameters of the gas generating composition to achieve a desired result" and that "[i]t is well-settled that optimizing a result effective variable is well within the expected ability of a person of ordinary skill in the subject art" (*id.*).

3. The Appellant's Contentions

The Appellant contends that Zhou and Ochi "collectively fail to establish a *prima facie* case of obviousness, because neither reference teaches or otherwise suggests the claimed cool burning gas generant compositions comprising the endothermic slag-forming component with the specific average particle diameter size of greater than or equal to 150 µm" (Appeal Brief 10). The Appellant argues that Zhou teaches compositions having combustion temperatures higher than those recited in claim 1 (e.g., 2,036°K to 2,168°K) (*id.* at 11 (citing Zhou Tables 9 and 10)). As for Ochi, the Appellant acknowledges that Ochi teaches a flame coolant formed of aluminum hydroxide having a particle size of less than 300 µm but argues that "[n]owhere does *Ochi* teach using aluminum hydroxide as a slag forming agent for cool burning gas generants" and that "*Ochi's* gas generant compositions are entirely distinct from those claimed or those described in *Zhou*" (*id.* at 11–12).

The Appellant urges that although aluminum oxide formed from the aluminum hydroxide during combustion could be considered as a slagging agent in high combustion temperature gas generants, "it was highly unanticipated that aluminum oxide/aluminum hydroxide could function as a slagging agent in the claimed cool burning formulations" (*id.* at 12). According to the Appellant, "[t]his is because aluminum oxide is present in a solid form during and after combustion, thus contravening conventional understanding of the mechanism of slag formation for gas generants in an airbag system" (*id.* (citing Declaration of Ivan V. Mendenhall filed July 5, 2017 ("Mendenhall Declaration" or "Mendenhall Decl.") ¶¶ 6–7). The

Appellant urges that "prior to the claimed invention, aluminum hydroxide would not be considered a suitable candidate by a person having ordinary skill in the art for a slag forming component for a cool burning gas generant having a maximum flame temperature at combustion (T_c) of less than or equal to about 1,900K (1,627°C)" (*id.* at 13). The Appellant also posits that "[i]t was surprising and unexpected that fewer large-sized aluminum hydroxide particles would be more effective at slagging as compared to more small-sized particles in a cool burning gas generant" and that

> where aluminum hydroxide is used as the endothermic slag-forming component with distinct particles sizes (50% particle size distributions of 87 µm and 158 µm, respectively) in a gas generant that contains copper (as basic copper nitrate oxidizer), an unexpected and substantial difference in tank wash values (total particulate escaping the combustion filter) is observed so that the improvement with a large particle size ranges from 64% up to 87%.

(*Id.* at 14, 19–20 (citing Mendenhall Decl. ¶¶ 7–10 and Spec. ¶¶ 57–65 (Examples 1 and 2))). In the Appellant's view, the Examiner failed to consider the proffered evidence in support of nonobviousness (*id.* at 22–24).

4. Opinion

The Appellant's arguments fail to identify reversible error in the Examiner's rejection. *In re Jung*, 637 F.3d 1356, 1365 (Fed. Cir. 2011).

Zhou describes a gas generating composition for use in an air bag, wherein the composition has, *inter alia*, a low combustion temperature (Zhou ¶ 14; Abstract). Specifically, Zhou discloses that the composition comprises (a) a fuel component in the form of at least one specified guanidine derivative (e.g., nitroguanidine (NQ)), (b) a specified basic metal nitrate such as basic copper nitrate (BCN), and (c) a binder and/or slag-forming agent (*id.* ¶¶ 36–38, 108–109). Zhou teaches that the binder and/or slag-forming agent includes various materials such as a metal hydroxide (e.g., aluminum hydroxide) (*id.* ¶¶ 115–116, 144). Furthermore, Zhou describes working examples in which the gas generating composition includes nitroguanidine (NQ) fuel, basic copper nitrate (BCN), sodium salt of carboxymethylcellulose (CMCNa), and aluminum hydroxide (*id.* ¶¶ 230, 240 (Table 7, Examples 47–49)).

Zhou does not provide the combustion temperature (T_c) data for the compositions containing aluminum hydroxide as described in Examples 47–49. Nevertheless, a person having ordinary skill in the art would have drawn a reasonable inference from Zhou's teachings as a whole that the combustion temperature (T_c) would vary depending on the compositional makeup. Specifically, Zhou discloses some gas generating compositions (e.g., those that include guar gum binder) having combustion temperatures (T_c) higher than 1,900° K (*id.* ¶¶ 242–243 (Tables 9–10, Examples 84–111)), but also discloses other compositions (e.g., those containing sodium salt of carboxymethylcellulose and/or Fe_2O_3) having combustion temperatures (T_c) lower than 1,900° K—e.g., as low as 1,732° K (*id.* ¶ 236 (Table 3, Examples 9–17)).

Hence, the key difference between Zhou's composition and the claimed composition is in the absence of a disclosure in the prior art of the aluminum hydroxide having "an average particle size diameter of greater than or equal to about 150 μm," as recited in claim 1. As the Examiner concludes, however, Ochi bridges this gap.

Ochi also discloses a gas generator for an air bag having a low combustion temperature (Ochi, col. 1, ll. 10–12; col. 2, ll. 18–22). Specifically, the gas generator contains hydrazodicarbonamide (HDCA) as a reducing agent, oxoacid salt as an oxidizing agent such as a metal nitrate, and a flame coolant such as a metal (e.g., Al) hydroxide to cool the generated gas by causing an endothermic decomposition reaction (*id.* at col. 4, ll. 30–57; col. 5, ll. 18–41). According to Ochi, the flame coolant should have a particular shape and particle size to provide the composition with optimum combustion, that the flame coolant lowers the combustion temperature, and that "[i]t is preferable for the flame coolant to have a particle size of 300 μm or less for satisfactory combustion" (*id.* at col. 5, ll. 43–45; col. 8, ll. 46–52). In this regard, Ochi explicitly states that "in order to minimize the amount of cooling agent needed as cooling mechanism or to minimize the size of the cooling mechanism itself, the range of the gas generator's combustion temperature should be about 1300°C to 1500°C" (*id.* at col. 6, ll. 14–18).

In a working example, Ochi teaches a gas generator composition comprising 30% by weight HDCA, 60% by weight $Sr(NO_3)_2$, and 10% by weight $Al(OH)_3$ (*id.* at col. 14, l. 5–col. 18, l. 50 (*id.* at col. 17, ll. 1–29, Table 6, Example 16)). That composition is described as containing "a flame coolant [i.e., aluminum hydroxide], so that not only was the amount of the gas generated increased, but the gas temperature [was] lower than in the Comparative Examples [containing different components]" (*id.* at col. 17, ll. 61–65).

Given the collective teachings found in Zhou and Ochi as recounted above, a person having ordinary skill in the art would have understood that a compound such as aluminum hydroxide is not only a slag-forming agent, but also a flame coolant that causes an endothermic decomposition—a characteristic that is consistent with the Appellant's description for slag-forming components (Spec. ¶¶ 1, 33). Although Ochi's composition is not identical to that disclosed in Zhou or the claimed composition,[5] we conclude that it is sufficiently similar such that a person having ordinary skill in the art would have been prompted to use Ochi's aluminum hydroxide with an average particle size of 300 μm or less, which would encompass particles having average particle sizes that fall within the range recited in claim 1, in Zhou to optimize the combustion and to minimize the amount of cooling agent needed to achieve a combustion temperature in the range of 1,300°C to 1,500°C (i.e., 1,573°K to 1,773°K), as disclosed in Ochi.

Having concluded that Zhou and Ochi collectively establish a prima facie case of obviousness, we next consider the Appellant's proffered evidence of secondary considerations in support of nonobviousness. As best understood, it appears to be the Appellant's principal position that because "*[a]luminum hydroxide* has a melting temperature of about 2288[°]K" (emphasis added), it would not be suitable for compositions having a combustion temperature (T_c) of less than or equal to about 1,900°K because melting would be required at or near the combustion temperature (Appeal Br. 12–13 (citing Mendenhall Decl. ¶¶ 5–6)). But the Mendenhall Declaration states that a refractory metal such as Al_2O_3—not aluminum hydroxide (i.e., $Al(OH)_3$)—has a melting point of 2,288°K and that, for that reason, Al_2O_3 would not be suitable as a "slag forming component/slagging

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[5] Contrary to the Appellant's argument (Appeal Br. 11–12), Ochi's composition is similar to the claimed composition because the only difference between these compositions is that the former may include metal nitrate such as strontium nitrate as the oxidizing agent (Ochi col. 17, ll. 1–29, Table 6, Example 16) whereas claim 1 specifies an oxidizer comprising basic copper nitrate.

agent" for gas generating compositions with a lower combustion temperature (T_c) such as 1,400°K (Mendenhall Decl. ¶ 6).[6] According to the Declaration, "it was unexpectedly discovered that aluminum hydroxide having a large particle size diameter of 150 µm or greater could enhance slag formation in specific gas generant formulations (comprising copper) that have a maximum combustion flame temperature of less than or equal to about 1900[°] K" (*id.* ¶ 7), "[i]t was highly unanticipated that *aluminum oxide formed from aluminum hydroxide during combustion* could function as a slagging agent in these cool burning formulations" (*id.* (emphasis added)), and that "it was surprising and unexpected that fewer large-sized particles would be more effective at slagging as compared to more small-sized particles, because it was previously believed that melting of *aluminum oxide* would need to occur to form slag" (*id.* ¶ 8 (emphasis added)).

The problem with the Appellant's position, however, is that aluminum hydroxide has a much lower melting point (300°C or 573°K) than aluminum oxide (2,288°K). Claim 1 does not require aluminum oxide or aluminum oxide prepared from calcination of aluminum hydroxide as the slag-forming component—it merely recites "an endothermic slag-forming component comprising aluminum hydroxide" (Appeal Br. 26). Such a slag-forming component is explicitly disclosed in Ochi, as we found above. Indeed, as the Examiner finds (Ans. 6), Ochi would have suggested that using aluminum hydroxide with a particle size of less than 300 µm would lower combustion temperature—specifically, to a combustion temperature (T_c) to about 1,300–

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[6] Aluminum hydroxide, $Al(OH)_3$, has a melting point of 300°C (https://www.chemicalbook.com/ChemicalProductProperty_EN_CB9243680.htm).

1,500°C (1,573–1,773°K) (Ochi at col. 5, ll. 18–45; col. 6, ll. 14–18; col. 7, ll. 31–33; col. 8, ll. 46–52; col. 17, ll. 1–29 (Table 6, Example 16)). As the Examiner aptly points out, "[n]either [Zhou nor Ochi] mentions an adverse impact of the inclusion of aluminum hydroxide" but instead provides explicit motivation to include them (Ans. 6; *see also* Final Act. 5). Neither the Appellant nor the Declarant meaningfully addresses the prior art teachings.

As for the allegation that Examples 1 and 2 of the current Specification demonstrates unexpected results in terms of tank wash values (i.e., total particulate escaping the combustion filter) (Appeal Br. 19–20 (citing Mendenhall Decl. ¶¶ 9–10)), we concur with the Examiner that the Appellant fails to offer a comparison between the claimed subject matter and the closest prior art (Final Act. 5). According to the Mendenhall Declaration, Figures 3 and 4 (Comparative Example 1), which are macroscopic photographs of a slag formed from *conventional* gas generant (Spec. ¶¶ 14–15; 57–59), show combustion slag when aluminum hydroxide having an average diameter of less than or equal to 90 μm is used in a cool burning formulation having a combustion temperature of about 1,400°K (Mendenhall Decl. ¶ 9). The Specification states, however, that Comparative Example 1, which is representative of a prior art composition, used an aluminum hydroxide with a particle size distribution of 10% 54 μm, 50% 87 μm, and 90% 152 μm (Spec. ¶ 58 (Table 2)) but provides no information on the actual *average* particle diameter. Similarly, the Specification states that Example 2, which is representative of the claimed invention, used an aluminum hydroxide with a particle size distribution of 10% 115 μm, 50% 158 μm, and 90% 228 μm but provides no information on the actual average particle diameter (*id.*). Therefore, the Declarant's statements as to the average particle sizes are not supported by any objective evidence (e.g., data),[7] and, therefore, it is not possible to ascertain whether Comparative Example 1 and Example 2 are representative of the closest prior art and the claimed invention, respectively. Here, Ochi would have suggested using aluminum hydroxide having particle sizes of 300 µm or less to lower combustion temperatures (T_c), as we found above. But we have not been directed to any comparison against a composition that is representative of Ochi's disclosure (e.g., Ochi's Example 16). Also, to the extent that Zhou does not mention average particle sizes, the Appellant must show a criticality for the specified range defined by "average particle diameter of greater than or equal to about 150 µm" (Appeal Br. 26), which reads on *any* average diameters equal to or greater than about 150 µm, such as 150 µm, 300 µm, or even 1,000 µm. That has not been done. *In re Inland Steel Co.*, 265 F.3d 1354, 1366 (Fed. Cir. 2001) ("Inland did not offer ***comprehensive*** test results for the magnetic properties of steel produced under the '574 claims at antimony levels greater than 0.02%.") (emphasis added).

Under these circumstances, we discern no reversible error in the Examiner's determination that the proffered Declaration evidence is insufficient to rebut the prima facie case of obviousness. Therefore, we sustain the Examiner's rejection as maintained against claim 1.

The Appellant also points out what certain dependent claims recite (e.g., claim 8, which recites amounts for the components) (Appeal Br. 18). Even if we were to assume that the Appellant's argument complies with 37 C.F.R. § 41.37(c)(1)(iv) for separate consideration, it fails because the

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[7] *See In re Geisler*, 116 F.3d 1465, 1470 (Fed. Cir. 1997).

Appellant does not address the prior art amounts, which fall within the scope of or overlap the ranges recited in the claims (Zhou ¶¶ 117, 137–138; Ochi col. 8, l. 53–col. 9, l. 14 and Example 16 (Table 4)). Therefore, we also sustain the rejection as maintained against these claims.

For these reasons, we uphold the Examiner's rejection.

IV. CONCLUSION

In summary:

Claims Rejected	35 U.S.C. §	Evidentiary Basis	Affirmed	Reversed
1–3, 5–10, 12–16, 21, 23–27	103(a)	Zhou, Ochi	1–3, 5–10, 12–16, 21, and 23–27	

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a).

AFFIRMED