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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte ZHIHUA GUO, URANCHIMEG LESTER, JAWED ASRAR, KIARASH ALAVI SHOOSHTARI, and MINGFU ZHANG

Appeal 2019-002070
Application 13/675,414
Technology Center 1700

Before ROMULO H. DELMENDO, BEVERLY A. FRANKLIN, and CHRISTOPHER L. OGDEN, *Administrative Patent Judges*.

DELMENDO, *Administrative Patent Judge*.

DECISION ON APPEAL

The Appellant[1] appeals under 35 U.S.C. § 134(a) from the Primary Examiner's final decision to reject claims 1, 3, 7, 10–15, 17–20, 41, and 43–55.[2] We have jurisdiction under 35 U.S.C. § 6(b).

We affirm in part.

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[1] We use the word "Appellant" to refer to "applicant" as defined in 37 C.F.R. § 1.42—namely, "JOHNS MANSVILLE" (Application Data Sheet filed November 13, 2012 at 5). The Appellant identifies "Johns Mansville International, Inc." as the real party in interest (Appeal Brief filed August 9, 2018 ("Appeal Br.") at 3 (not paginated)).

[2] *See* Appeal Br. 5–13; Reply Brief filed January 14, 2019 ("Reply Br.") at 2–6 (not paginated); Final Office Action entered December 22, 2017 ("Final Act.") at 2–13; Examiner's Answer entered November 16, 2018 ("Ans.") at 3–16.

I. BACKGROUND

The subject matter on appeal relates to carbohydrate binder compositions with modified rheologies for adhering together fibers such as glass fibers (Specification filed November 13, 2012 ("Spec.") ¶¶ 1, 8). Representative claims 1 and 41 are reproduced from the Claims Appendix to the Appeal Brief, as follows:

> 1. A carbohydrate binder composition comprising a reducing sugar, a nitrogen-containing compound, and a thickening agent, wherein:
>
> ***the nitrogen-containing compound is a reaction product of urea (H_2N-CO-NH_2) and glyoxal***,
>
> ***the binder composition has a Brookfield viscosity of 7 to 50 centipoise at 20°C as measured with a Brookfield viscometer using spindle 18 at 60 rpm***,
>
> the binder composition is formaldehyde-free and forms a polymerization product, and
>
> ***the thickening agent has a concentration of 0.03 wt.% to 0.3 wt.% of the binder composition***.
>
> 41. A formaldehyde-free, carbohydrate binder composition comprising:
>
> a carbohydrate;
>
> a nitrogen-containing compound; and
>
> ***a thickening agent***, wherein:
>
> the carbohydrate reacts with the nitrogen-containing compound when the carbohydrate binder composition is cured and forms a polymerization product,
>
> the carbohydrate is selected from the group consisting of dextrose, fructose, allose, galactose, xylose, ribose, maltose, cellobiose, and lactose, and
>
> ***the nitrogen-containing compound is a reaction product of an organic anhydride and an alkanol amine***,
>
> ***the binder composition has a Brookfield viscosity of 7 to 50 centipoise at 20°C as measured with a Brookfield viscometer using spindle 18 at 60 rpm***, and

the thickening agent has a concentration of 0.03 wt.% to 0.3 wt.% of the binder composition.

(Appeal Br. 14, 16–17 (emphases added)).

II. REJECTIONS ON APPEAL

The claims on appeal stand rejected, as follows:

A. Claims 54 and 55 under 35 U.S.C. § 112, ¶ 2, as indefinite;

B. Claims 1, 3, 7, 10–15, 17–20, 49, 50, 52, and 54 under 35 U.S.C. § 103(a) as unpatentable over Hansen,[3] North,[4] and Quincy et al.[5] ("Quincy");

C. Claims 41, 43–45, 51, 53, and 55 under 35 U.S.C. § 103(a) as unpatentable over Hansen and Quincy;

D. Claims 46 and 48 under 35 U.S.C. § 103(a) as unpatentable over Hansen, Quincy, and Tutin et al.[6] ("Tutin"); and

E. Claim 47 under 35 U.S.C. § 103(a) as unpatentable over Hansen, Quincy, and Gestner et al.[7] ("Gestner").

III. DISCUSSION

Rejection A (Indefiniteness). Although the Appellant acknowledges a rejection under 35 U.S.C. § 112, ¶ 2 (Appeal Br. 3),[8] the Appellant does

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[3] EP 2 230 222 A1, published September 22, 2010.

[4] EP 0 402 072 A2, published December 12, 1990.

[5] US 2008/0082151 A1, published April 3, 2008.

[6] US 2011/0054098 A1, published March 3, 2011.

[7] US 6,153,668, issued November 28, 2000.

[8] The Appellant states that claims 1, 3, 7, 10–15, 17–21, 23, 26, 41, and 43–55 stand rejected under 35 U.S.C. § 112, ¶ 2 (*id.*). That is incorrect. Claims 54 and 55 are the only claims rejected on this ground (Final Act. 2).

not provide any arguments against Rejection A (*id.* at 5–13). As Rejection A has not been expressly withdrawn (Ans. 3–16) and no arguments are offered, we summarily sustain this rejection. 37 C.F.R. § 41.37(c)(1)(iv). *See also Hyatt v. Dudas*, 551 F.3d 1307, 1314 (Fed. Cir. 2008) ("In the event of . . . a waiver, the [Board] may affirm the rejection of the group of claims that the examiner rejected on that ground without considering the merits.").

Rejection B (Obviousness). Claims 1 (reproduced above) and 19 are the two independent claims subject to this rejection. Both claims recite, *inter alia*, that the binder composition comprises a "nitrogen-containing compound [that] is a reaction product of (H_2N-CO-NH_2) and glyoxal [$C_2H_2O_2$]" (Appeal Br. 14, 15–16).

The Examiner finds that Hansen describes an aqueous binder composition containing a reducing sugar, an amine component such as a cyclic urea, and a polysaccharide or a starch hydrolysate such as corn syrup (Ans. 3; Final Act. 3). Regarding the amine component that may be a cyclic urea, the Examiner acknowledges that "Hansen may not explicitly disclose that the cyclic urea is a reaction product of urea and glyoxal" (Ans. 3–4; Final Act. 3). To account for this difference, the Examiner relies on North. Specifically, the Examiner finds that North teaches a formaldehyde-free binder for non-woven fibers and fabrics comprising reaction products formed from glyoxal and urea (e.g., 4,5 dihydroxy-imidazolidinone) (Ans. 4; Final Act. 3). Based on these findings, the Examiner concludes:

> It would have been obvious to one having ordinary skill in the art at the time of the invention to have utilized as the cyclic urea nitrogen compound of Hansen a glyoxal/urea reaction product having a glyoxal to urea ratio of optimally about 1:1 (i.e., 4,5 dihydroxyimidazolidinone) in order to provide stable urea

> compounds that can potentially be used along with high levels of polymers in a binder for non-woven fibers and fabrics while avoiding the odor, irritation and severe reactions associated with urea-formaldehydes resins, as taught by North '072 (see page 2 lines 17-32).

(Ans. 4; Final Act. 3–4).

The Examiner also finds that Hansen and North do not explicitly disclose the viscosity values or thickener concentrations recited in claim 1 but relies on inherency based on structural similarity and Quincy (Ans. 4–5; Final Act. 4–5). The Examiner explains that it would have been obvious to a person having ordinary skill in the art to modify the amount of viscosity modifier in the composition resulting from the combination of Hansen and North in order to adjust the viscosity of the binder composition to suit a desired coating process and/or desired performance of a coated fibrous thermal composite, as taught by Quincy (Ans. 5; Final Act. 4).

The Appellant contends, *inter alia*, that "[t]he Office has not provided a legitimate suggestion or motivation to modify the references to include a reaction product of urea and glyoxal, and even if there was a legitimate suggestion or motivation, there is no reasonable expectation of success" (Appeal Br. 5). The Appellant argues that, although Hansen discloses that the amine component can be urea or cyclic urea, it does not disclose a reaction product of urea and glyoxal as the cyclic urea (*id.* at 5–6). The Appellant acknowledges that North teaches a reaction product of glyoxal and urea but argues that it does so in the context of a different binder composition—i.e., a binder composition based on an emulsion polymer containing a crosslinking agent, a glyoxal resin, and a catalyst, wherein the glyoxal resin is prepared using a reactant including urea or a cyclic urea (*id.* at 6).

We agree with the Appellant that the Examiner's rejection is not well-founded. Our reasons follow.

Hansen describes an aqueous binder composition comprising (a) a sugar syrup including a reducing sugar and having a dextrose equivalent DE of at least 50 and less than 85, (b) a polycarboxylic acid component (e.g., a polycarboxylic acid anhydride), (c) an amine such as cyclic urea, and optionally (d) a reaction product of a polycarboxylic acid component (b) and an amine (c) (Hansen, Abstract; ¶¶ 47, 55). Hansen further teaches that component (a) may additionally include a carbohydrate compound that yields one or more reducing sugars *in situ*, such as polysaccharide (*id.* ¶ 22), which the current Specification discloses as a thickening agent (Spec. ¶ 27; claims 13 and 14 (Appeal Br. 15)). Hansen does not disclose a "nitrogen-containing compound [that] is a reaction product of (H_2N-CO-NH_2) and glyoxal" as required by claims 1 and 19.

North describes a non-formaldehyde binder for non-woven fiber or fabrics comprising an emulsion polymer (e.g., (meth)acrylate ester copolymers) containing a crosslinking agent (e.g., a latent crosslinking agent such as N-alkylolamides), a glyoxal resin, and a catalyst for promoting crosslinking reaction between the polymer and the glyoxal resin (North Abstract; 3, l. 30–4, l. 1). Regarding the glyoxal resin, North teaches that "[g]lyoxal is a highly reactive monomer which cures quickly and has excellent crosslinking properties" but that "the viscosity of the binder increases so rapidly and is so great that the composition cannot be used" (id. at 2, ll. 33–35). To solve this stability problem with glyoxal *per se*, North teaches using a glyoxal resin prepared by reacting glyoxal with, e.g., urea or cyclic urea (*id.* at 2, ll. 39–55).

Considering Hansen and North individually and collectively, we agree with the Appellant that the articulated reasoning for combining the references (i.e., "to provide stable urea compounds that can potentially be used along with high levels of polymers in a binder for non-woven fibers and fabrics while avoiding the odor, irritation and severe reactions associated with urea-formaldehydes resins" (Ans. 4)) is flawed. North does not disclose providing a glyoxal resin to provide stable urea compounds but, instead, to solve the instability problems associated with glyoxal as a crosslinking agent for an emulsion polymer (North 2, ll. 33–54). Hansen, on the other hand, is not concerned with either glyoxal [$C_2H_2O_2$] or an emulsion polymer of the type disclosed in North (North 3, ll. 30–34) but, rather, a reducing sugar and optionally a carbohydrate such as polysaccharide (Hansen ¶ 22). To the extent that a glyoxal resin may be considered as a cyclic urea, the potentially infinite genus of "cyclic urea" in Hansen is insufficient as a motivation that would have prompted a person having ordinary skill in the art to select North's glyoxal resin, used in a completely different type of binder from that disclosed in Hansen, as a species falling within the genus. *In re Jones*, 958 F.2d 347, 350 (Fed. Cir. 1992) ("[T]hough Richter discloses the potentially infinite genus of "substituted ammonium salts" of dicamba, and lists several such salts, the salt claimed here is not specifically disclosed[,] [n]or . . . is the claimed salt sufficiently similar in structure to those disclosed in Richter.").

For these reasons, we do not uphold Rejection B maintained against claims 1 and 19 and claims dependent thereon.

Rejections C–E (Obviousness). For Rejections C through E, the Appellant's arguments are limited to those directed to claim 41 (Appeal Br.

12). Therefore, consistently with 37 C.F.R. § 41.37(c)(1)(iv), we limit our discussion to claim 41. All other claims subject to Rejections C through E stand or fall with claim 41.

Unlike claims 1 and 19, claim 41 (reproduced above) recites a formaldehyde-free, carbohydrate binder composition including a carbohydrate, which reacts with a "nitrogen-containing compound [that] is a reaction product of an organic anhydride and an alkanol amine" (Appeal Br. 17). In addition, the binder composition includes 0.03 wt.% to 0.3 wt.%, based on the weight of the binder composition, of a thickening agent, such that "the binder composition has a Brookfield viscosity of 7 to 50 centipoise at 20°C as measured with a Brookfield viscometer using spindle 18 at 60 rpm" (*id.*).

As indicated above, the Examiner's basic position is that Hansen discloses, or would have suggested, a binder composition including a reducing sugar, an additional carbohydrate such as polysaccharide, which the Appellant discloses as a thickening agent, and a reaction product of at least one carboxylic acid anhydride (i.e., an organic acid anhydride) and at least one alkanolamine (Ans. 8; Final Act. 7–8). Regarding the binder composition's viscosity, the Examiner finds, *inter alia*, that "the reducing sugars and the nitrogen containing compounds taught by Hansen are similar to those described in paragraphs [0031] and [0038] of the Specification," and, therefore, the compositions disclosed or suggested by the prior art would be expected to have the viscosities specified in the claim (Ans. 9; Final Act. 9). According to the Examiner, the viscosity would have been adjusted "to suit a desired coating process and/or desired performance of a

coated thermal composite, as taught by Quincy" (Ans. 9; Final Act. 8) (citing Quincy ¶¶ 38, 40, 41).

The Appellant's arguments, as recounted above, are unpersuasive to identify reversible error. *In re Jung*, 637 F.3d 1356, 1365 (Fed. Cir. 2011).

As the Examiner correctly finds, Hansen describes a binder composition including the following components: a sugar syrup containing a reducing sugar and having a dextrose equivalent DE of at least 50 as component (a); a polycarboxylic acid component as component (b); an amine as component (c); and, e.g., a reaction product of at least one polycarboxylic acid anhydride and at least one alkanolamine as component (d) (Hansen Abstract; ¶¶ 9, 55–56). Hansen further teaches the inclusion of an additional carbohydrate such as a polysaccharide, which the Inventors disclose as a thickening agent (*see* Spec. ¶ 27; *see also* claims 13 and 14 (Appeal Br. 15)). Therefore, Hansen teaches a binder that is compositionally indistinguishable from the composition recited in claim 41 but does not specifically disclose the amount for the additional carbohydrate (polysaccharide) or the viscosity.

Quincy discloses an exothermic composition formed from a variety of components including binders, which may serve as an adhesive for bonding one thermal composite to another thermal composite (Quincy ¶¶ 27, 29). According to Quincy, a water-soluble organic polymer such as polysaccharides may be used as the binder (*id.* ¶ 32). Furthermore, Quincy teaches that viscosity modifiers (e.g., xanthan gum—a polysaccharide) may be added in an amount of from about 0.001 wt.% to about 5 wt.% and that the viscosity of the coating formulations may vary depending on the coating method or type of binder (*id.* ¶¶ 38, 40–41). Quincy teaches, however, that

"[g]enerally, the viscosity is less than about 2×10^6 centipoise, in some embodiments less than about 2×10^5 centipoise, in some embodiments less than about 2×10^4 centipoise, and in some embodiments, less than about 2×10^3 centipoise, such as measured with a Brookfield DV-1 viscometer with an LV spindle" (*id.* ¶ 41).

Thus, although Quincy teaches exothermic compositions that are formulated with generally higher viscosities than those recited in claim 41, it provides evidence that the amount of viscosity modifier (i.e., thickening agent) is a result-effective variable that may be adjusted to meet the particular requirements of a given coating application. Under these circumstances, a person having ordinary skill in the art would have optimized the amount for each component in Hansen's composition, including the polysaccharide, to achieve a suitable viscosity for binding mineral fibers such as glass fibers (Hansen ¶¶ 2, 8), which is the same coating application disclosed in the current application for the claimed composition (Spec. ¶ 2). Indeed, Hansen teaches that binder additives and adjuvants such as carbohydrates "may be used in conventional amounts generally not exceeding 20 wt.% of the binder solids" and provides general guidance on the amounts for components (a)–(c) (Hansen ¶¶ 69–71). *In re Applied Materials, Inc.*, 692 F.3d 1289, 1295 (Fed. Cir. 2012) ("'[D]iscovery of an optimum value of a result effective variable . . . is ordinarily within the skill of the art.'") (quoting *In re Boesch*, 617 F.2d 272, 276 (CCPA 1980)).

The Appellant argues that "[n]either Hansen nor Quincy teach[es] or suggest[s] the thickening agent in the binder composition of independent claim 41" and that "the recited concentration range of thickening agent

provides surprising results over Hansen" (Appeal Br. 12 (italics omitted); *see also id.* 8–10). In support of "surprising results," the Appellant refers to Figure 1 in Kiarash Alavi's Declaration filed November 10, 2016[9] (¶ 10) and Table 2 of the Specification (Spec. ¶ 80).

The Appellant is incorrect that neither Hansen nor Quincy teaches a thickening agent. As we found above, both Hansen and Quincy teach adding a polysaccharide—a compound disclosed in the current Specification as a thickening agent. As for "surprising results," we discern no reversible error in the Examiner's finding that the results appear to show a generally linear relationship between thickening agent concentration and the properties of interest (hot/wet tension, strength, and viscosity). Mere differences in results do not suffice to establish unexpected results. *In re Harris*, 409 F.3d 1339, 1344 (Fed. Cir. 2005) ("The 32-43% increase in stress-rupture life, however, does not represent a 'difference in kind' that is required to show unexpected results.") (quoting *In re Huang*, 100 F.3d 135, 139 (Fed. Cir. 1996)). *Compare In re Soni*, 54 F.3d 746, 748, 751 (Fed. Cir. 1995) ("[W]hen an applicant demonstrates *substantially* improved results . . . and *states* [in the specification] that the results were *unexpected*, this should suffice to establish unexpected results *in the absence of* evidence to the contrary.").

Moreover, the results are limited to hydroxyethyl cellulose and a single example of xanthan gum with specific combinations with other specific components and are, therefore, not commensurate in scope with claim 41, which recites any "thickening agent" over a varied concentration

[9] The Appellant refers to a Declaration filed November 11, 2016, but the Declaration was actually filed November 10, 2016.

range combined with a nitrogen-containing compound that may be reacted from a wide variety of reactants. *See, e.g.*, *In re Grasselli*, 713 F.2d 731, 743 (Fed. Cir. 1983) ("With respect to appellants' broad claims to a catalyst with 'an alkali metal,' the experiments detailed in Friedrich III, being limited to sodium only, are not commensurate in scope, and are, therefore, insufficient to rebut the prima facie case."). Alternatively, claim 41 should have been narrowed to be commensurate in scope with the proffered showing. *In re Harris*, 409 F.3d 1339, 1344 (Fed. Cir. 2005).

For these reasons, and those well-stated by the Examiner, we uphold Rejections C–E.

IV. CONCLUSION

In summary:

Claims Rejected	35 U.S.C. §	Reference(s)/ Basis	Affirmed	Reversed
54, 55	112, ¶ 2	Indefiniteness	54, 55	
1, 3, 7, 10–15, 17–20, 49, 50, 52, 54	103(a)	Hansen, North, Quincy		1, 3, 7, 10–15, 17–20, 49, 50, 52, 54
41, 43–45, 51, 53, 55	103(a)	Hansen, Quincy	41, 43–45, 51, 53, 55	
46, 48	103(a)	Hansen, Quincy, Tutin	46, 48	
47	103(a)	Hansen, Quincy, Gestner	47	
Overall Outcome			41, 43–48, 51, 53, 55	1, 3, 7, 10–15, 17–20, 49, 50, 52,

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 IN PART