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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte KOICHI KAWAGUCHI and YUICHI HARA

Appeal 2019-002074
Application 13/504,268
Technology Center 1700

Before ADRIENE LEPIANE HANLON, KAREN M. HASTINGS, and
GEORGE C. BEST, *Administrative Patent Judges*.

HANLON, *Administrative Patent Judge*.

DECISION ON APPEAL

A. STATEMENT OF THE CASE

The Appellant¹ filed an appeal under 35 U.S.C. § 134(a) from an Examiner's decision finally rejecting claims 34, 38, 44, and 49–57. We have jurisdiction under 35 U.S.C. § 6(b).

We AFFIRM.

¹ We use the word “Appellant” to refer to “applicant” as defined in 37 C.F.R. § 1.42. Appellant identifies the real party in interest as The Yokohama Rubber Co. Appeal Brief dated July 9, 2018 (“Br.”), at 2.

The claims on appeal are directed to a pneumatic tire comprising an innerliner. The innerliner comprises a thermoplastic resin composition produced by melt-kneading an acid anhydride-modified or epoxy-modified rubber with an ethylene-vinylalcohol copolymer resin and a crosslinking agent to prepare a first resin composition and melt-mixing the first resin composition with a second resin composition. The second resin composition is produced by crosslinking a crosslinkable elastomer while melt-kneading the elastomer with a polyamide resin and a crosslinking agent. Br. 19.

The Appellant discloses that an ethylene-vinylalcohol copolymer (EVOH) film laminated with an adhesive layer is known to improve the inner pressure retention performance and reduce the weight of pneumatic tires. Spec. 1, l. 33–2, l. However, according to the Appellant,

it is known that EVOH has a disadvantage that it is brittle, particularly at low temperature, and therefore improving the durability at low temperature of EVOH while making the most of the excellent gas barrier properties of EVOH, in resin compositions to which EVOH has been blended [is desired].

Spec. 3, ll. 4–9.

The Appellant is said to

have found that a thermoplastic resin composition having excellent gas barrier properties as well as low temperature durability and also having reduced drop in gas barrier properties due to fatigue can be obtained by melt-mixing together two resin compositions, i.e., a resin composition which has been obtained by dispersing an acid anhydride-modified or epoxy-modified rubber in ethylene-vinylalcohol copolymer resin and a resin composition obtained by crosslinking (dynamic crosslinking) a crosslinkable elastomer in a polyamide resin while melt-kneading them

Spec. 3, l. 33–4, l. 6.

Claim 34 is reproduced below from the Claims Appendix to the Appeal Brief.

34. A pneumatic tire comprising an innerliner comprising a thermoplastic resin composition produced by the method comprising:

(I) melt-kneading an (A) acid anhydride-modified or epoxy-modified rubber with a (B) ethylene-vinylalcohol copolymer resin and a first crosslinking agent to prepare a first resin composition in which the (A) acid anhydride-modified or epoxy-modified rubber is dispersed in a continuous phase consisting of the (B) ethylene-vinylalcohol copolymer resin, wherein the (A) acid anhydride-modified or epoxy-modified rubber is selected from the group consisting of acid anhydride-modified products of ethylene- α -olefin copolymers, epoxy-modified products of ethylene- α -olefin copolymers, acid anhydride-modified products of ethylene-unsaturated carboxylic acid copolymers and epoxy-modified products of ethylene-unsaturated carboxylic acid copolymers, and mixtures thereof,

(II) crosslinking a (C) crosslinkable elastomer while melt-kneading the crosslinkable elastomer with a (D) polyamide resin and a second crosslinking agent to prepare a second resin composition in which crosslinked elastomer particles are dispersed in the (D) polyamide resin, and

(III) melt-mixing together the first resin composition with the second resin composition.

Br. 19.

The claims on appeal stand rejected as follows:

(1) claims 34, 38, 44, and 49–54 under 35 U.S.C. § 103(a) as unpatentable over Tsou et al.² in view of Hoch et al.;³ and

² US 2008/0275187 A1, published November 6, 2008 (“Tsou”).

³ US 2006/0142485 A1, published June 29, 2006 (“Hoch”).

(2) claims 55–57 under 35 U.S.C. § 103(a) as unpatentable over Tsou in view of Hoch, and further in view of Laucius et al.⁴

B. DISCUSSION

1. Rejection (1)

a. Claims 34, 49, 50, and 52–54

The Examiner finds Tsou discloses an innerliner for a pneumatic tire produced by crosslinking a crosslinkable elastomer while melt kneading the elastomer with a polyamide resin and a crosslinking agent to form a composition that is impermeable and is an oxygen barrier. Ans. 3.⁵ The Examiner finds the composition disclosed in Tsou corresponds to the second resin composition formed by Appellant’s claimed crosslinking step (II).

The Examiner finds Tsou’s composition optionally comprises other rubbers and ethylene-vinyl alcohol copolymers. Ans. 3. The Examiner, however, finds Tsou does not disclose a first resin composition formed by Appellant’s claimed melt-kneading step (I) and melt-mixing the first and second resin compositions together as recited in Appellant’s claimed step (III). Ans. 3. The Examiner relies on Hoch to teach those steps.

Hoch discloses that “[t]he use of ethylene-vinyl alcohol copolymers [EVOH] in materials with a high level of barrier properties is known.” Hoch ¶ 2. Hoch discloses:

A disadvantage in using EVOHs as barrier materials is their brittleness. It is therefore obvious that the range of application of ethylene-vinyl alcohol copolymers as barrier materials could be substantially widened if their impact resistance in particular at

⁴ US 3,422,154, issued January 14, 1969 (“Laucius”).

⁵ Examiner’s Answer dated October 11, 2018.

relatively low temperatures could be considerably improved, this being associated with a reduction in brittleness.

Hoch ¶ 4.

Hoch discloses ethylene-vinyl alcohol copolymer mixtures that have good impact resistance and flexibility at low temperatures and retain excellent barrier properties. Hoch ¶ 6. In particular, the Examiner finds Hoch discloses a continuous phase ethylene-vinyl alcohol having a rubber (i.e., ethylene-olefin copolymer modified with maleic anhydride) dispersed therein. Ans. 4 (citing Hoch ¶¶ 8–10, 18). The Examiner finds the ethylene-vinyl alcohol copolymer mixture is produced by melt-kneading the ethylene-vinyl alcohol and the elastomer (Hoch ¶ 34) in the presence of peroxide (i.e., a crosslinking agent) (Hoch ¶ 18). Ans. 4.

The Examiner concludes that it would have been obvious to one of ordinary skill in the art to melt-mix Hoch's melt-kneaded ethylene-vinyl alcohol copolymer mixture (corresponding to the first resin composition formed by Appellant's claimed step (I)) with Tsou's composition as claimed to provide an article having excellent barrier properties and excellent flexibility as taught by Hoch. Ans. 4.

The Appellant argues that "Tsou merely mentions the possibility of optionally including ethylene-vinylalcohol resin along with a voluminous listing of other possible 'engineering resins'." Br. 10. The Appellant argues that "[n]othing in Tsou would have led or motivated a person of ordinary skill in the art to have selected ethylene-vinyl alcohol from amongst the myriad [of] choices therein." Br. 12.

The Appellant's argument is not persuasive of reversible error. Tsou discloses a composition for a tire innerliner comprising a halogenated isobutylene-containing rubber and an engineering resin. *See, e.g.*, Tsou ¶ 71. We recognize Tsou discloses that polyamide resins are preferred engineering resins. Tsou ¶ 68.

However, Tsou also discloses that engineering resins include, *inter alia*, polyvinyl resins, such as ethylene-vinyl alcohol copolymer, and mixtures of *any and all* of the engineering resins specifically disclosed.⁶ Tsou ¶¶ 53–67. Thus, we find that one of ordinary skill in the art would have understood that the teachings of Tsou include engineering resins comprising a mixture of polyamide resin and ethylene-vinyl alcohol copolymer. *See In re Lamberti*, 545 F.2d 747, 750 (CCPA 1976) (“all disclosures of the prior art, including unpreferred embodiments, must be considered”).

The Appellant also argues:

[A]lthough Tsou mentions the possibility of optionally including other rubbers in combination with the halogenated isobutylene-containing elastomer, nothing in Tsou would have led or motivated a person of ordinary skill in the art to have employed an acid anhydride-modified or epoxy-modified rubber of the type required by the present invention.

Br. 12.

Tsou discloses that “[o]ptionally, other rubbers or elastomers can be used in combination with the halogenated isobutylene-containing elastomer.” Tsou ¶ 69. Those elastomers include epoxylated natural rubber and maleic acid-modified ethylene propylene rubbers. Tsou ¶ 69; *see also Lamberti*, 545 F.2d at 750 (“all disclosures of the prior art, including unpreferred embodiments, must be considered”). Nonetheless, the Examiner relies on Hoch, not Tsou, to teach the

⁶ The Appellant argues that “a prior art reference which teaches or suggests a preferred embodiment different from the claimed subject matter weighs against a determination of obviousness.” Br. 12 (citing *In re Baird*, 16 F.3d 380, 382–83 (Fed. Cir. 1994)). In contrast to the facts in *Baird*, ethylene-vinyl alcohol copolymer is expressly disclosed in Tsou. *See Baird*, 16 F.3d at 382 (finding that a generic formula encompassing more than 100 million different diphenols would not have suggested bisphenol A).

combination of EVOH and an acid anhydride-modified or epoxy-modified rubber as claimed. Ans. 4.

The Appellant argues that “Hoch is not concerned with pneumatic tires and is not reasonably pertinent to the problems addressed by the present invention.” Br. 14. Therefore, the Appellant argues that Hoch is not analogous art. Br. 14. In that regard, the Appellant argues that Hoch does not teach or suggest that the disclosed compositions “have excellent gas barrier properties as well as excellent low temperature durability and fatigue resistance” which “are important for innerliners for pneumatic tires.” Br. 13.

The test of whether a reference is from a nonanalogous art is first, whether it is within the field of the inventor’s endeavor, and second, if it is not, whether it is reasonably pertinent to the particular problem with which the inventor was involved. *See In re Wood*, 599 F.2d 1032, 1036 (CCPA 1979). “A reference is reasonably pertinent if, even though it may be in a different field from that of the inventor’s endeavor, it is one which, because of the matter with which it deals, logically would have commended itself to an inventor’s attention in considering his problem.” *In re Clay*, 966 F.2d 656, 659 (Fed. Cir. 1992).

According to the Appellant’s Specification, a problem addressed by the Appellant’s invention is to “improve the fatigue resistance of tire innerliners, and thereby reduce the drop in the gas barrier properties due to fatigue.” Spec. 2, l. 36–3, l. 1. The Appellant discloses:

[I]t is known that EVOH has a disadvantage that it is brittle, particularly at low temperature, and therefore improving the durability at low temperature of EVOH *while making the most of the excellent gas barrier properties of EVOH*, in resin compositions to which EVOH has been blended [is desired].

Spec. 3, ll. 4–9 (emphasis added).

Hoch also recognizes that “[a] disadvantage in using EVOHs as barrier materials is their brittleness.” Hoch ¶ 4. Hoch discloses that an object of the invention is “to provide ethylene-vinyl alcohol [EVOH] copolymer mixtures which have good impact resistance and flexibility at low temperatures⁷ with retention of the *excellent barrier properties*.” Hoch ¶ 6 (emphasis added). Thus, we find Hoch is reasonably pertinent to the particular problem with which the Appellant was involved and is analogous art.

The Appellant argues that Hoch teaches away from the combination proposed by the Examiner because “Hoch discloses that the thermoplastic EVOH exhibited a clear improvement in notched impact resistance as compared to elastomer-modified polyamide.” Br. 14. The Appellant relies on Hoch Experiments 5 and 6 for support. Br. 14 (citing Hoch ¶¶ 39–48).

In Hoch Experiment 5, KA 8962 (i.e., an amorphous ethylene-propylene copolymer having an ethylene content of 48% by weight and a grafted-on maleic anhydride content of 2% by weight (Hoch ¶ 27)) and EVOH were mixed and extruded to form pellets. Hoch ¶ 39. The pellets were processed to give test specimens, and notched impact resistance was determined for each of the test specimens. Hoch ¶¶ 40–41. Hoch discloses that the notched impact strength for those test specimens was “markedly above the values found for pure EVOH” (Hoch ¶ 44) and “a clear improvement” over a prior art elastomer-modified polyamide (Grilon BFZ) in Hoch Example 6 (Hoch ¶ 48).

It is unclear on this record why Hoch Examples 5 and 6 teach away from the combination proposed by the Examiner. Rather, it appears that Hoch Examples 5

⁷ The Appellant does not direct us to any evidence establishing that good impact resistance and flexibility at low temperatures would not be useful for a pneumatic tire innerliner.

and 6 support modifying Tsou's elastomer composition, as proposed by the Examiner, to improve its notched impact strength.

Finally, the Appellant argues that the claimed invention achieves unexpected results. For support, the Appellant directs our attention to Comparative Examples 1–7 and Examples 1–7 as shown in Tables 1 and 2, respectively, in the Specification. Br. 15. The Appellant argues:

The difference between comparative examples 1-7 and examples 1-7 is that the comparative examples 1-7 were prepared by kneading and mixing operations conducted in a single stage and examples 1-7 were prepared by the multi-step process required by the present invention. A comparison of the test results in Tables 1 and 2 shows that the thermoplastic resin composition prepared in accordance with the present invention exhibit excellent gas barrier properties as well as excellent low temperature durability and fatigue resistance.

Br. 15.

We recognize that the “Low temperature durability ($\times 10^3$)” values reported in Table 2 are higher than the values reported in Table 1 and the “Rate of change in gas permeability after fatigue (%)” values reported in Table 2 are lower than the values reported in Table 1.⁸ The Appellant, however, does not direct us to any evidence establishing that the values reported in Table 2 would have been unexpected by one of ordinary skill in the art. *See In re Freeman*, 474 F.2d 1318, 1324 (CCPA 1973) (for a showing of “unexpected results” to be probative evidence of non-obviousness, the applicant must establish that the difference between the results obtained through the claimed invention and those of the prior art would not have been expected by one skilled in the art at the time of invention).

⁸ Notably, at least the “Rate of change in gas permeability after fatigue (%)” values reported in Tables 1 and 2 do not appear to be significantly different.

Moreover, the starting materials identified in Tables 1 and 2 are different. For example, the crosslinkable elastomer identified in Table 1 is brominated isobutylene-paramethylstyrene copolymer and the crosslinkable elastomer identified in Table 2 is maleic acid-modified ethylene-ethyl acrylate copolymer. Thus, the results reported in Tables 1 and 2 are not probative of unexpected results. *See In re Dunn*, 349 F.2d 433, 439 (CCPA 1965) (“The cause and effect sought to be proven is lost here in the welter of unfixed variables.”).

Based on the foregoing, a preponderance of the evidence of record weighs in favor of the Examiner’s conclusion of obviousness. Therefore, the obviousness rejection of claims 34, 49, 50, and 52–54 is sustained.

b. Claims 38, 44, and 51

Claim 38 and 51 recite:

[T]he amount of the (A) acid anhydride-modified or epoxy-modified rubber contained in the thermoplastic resin composition is 70 to 180 parts by weight with respect to 100 parts by weight of the (B) ethylene-vinylalcohol copolymer resin.

Br. 21, 23. Similarly, claim 44 recites:

[T]he amount of the (A) maleic anhydride-modified ethylene- α -olefin copolymer contained in the thermoplastic resin composition is 70 to 180 parts by weight with respect to 100 parts by weight of the (B) ethylene-vinylalcohol copolymer resin.

Br. 22.

The Examiner finds, and the Appellant does not dispute, that Hoch teaches “5 to 70 parts by weight rubber with respect to 100 parts by weight of ethylene vinylalcohol.” Ans. 4 (citing Hoch ¶ 10). “Although the disclosed range is not identical to the claimed range,” the Examiner explains that “the disclosed range overlaps the claimed range” and thus renders the claimed range obvious. Final 4; *see also In re Peterson*, 315 F.3d 1325, 1329 (Fed. Cir. 2003) (“even a slight

overlap in range establishes a *prima facie* case of obviousness”). The Appellant has failed to establish otherwise. *See* Br. 15–16.

Claims 38 and 44 also recite that “the first resin composition and the second resin composition are melt-mixed at a weight ratio of from 90:10 to 10:90.” Br. 21, 22.

The Examiner finds Tsou does not disclose the claimed ratio. Final Act. 4.⁹ The Examiner, however, concludes that “it would have been obvious for one of ordinary skill in the art to select a mixing ratio by routine optimization, depending on the desired resistance.” Final Act. 4.

The Appellant argues:

[A] particular parameter or claimed feature must first be recognized by the prior art as a result-effective one, i.e., a variable which achieves a recognized result, before the determination of the optimum or workable ranges of such feature might be characterized as routine experimentation or an obvious choice of expedients or design choice.

Br. 16.

In response, the Examiner finds that “because the rubber taught by Hoch et al provides improved impact resistance, the impact resistance of the mixture would be dependent on [the] amount of the rubber taught by Hoch et al that is contained in the mixture with Tsou et al.” Ans. 7. The Appellant does not direct us to any error in the Examiner’s finding.

For the reasons set forth above, the obviousness rejection of claims 38, 44, and 51 is sustained.

2. Rejection (2)

The Appellant does not direct us to any error in the Examiner’s findings of fact or conclusions of law as to Laucius. Rather, the Appellant argues that Laucius

⁹ Final Office Action dated April 9, 2018.

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does not overcome the previously identified deficiencies of Tsou and Hoch in the rejection of claims 33, 38, and 44. Br. 17.

For the reasons discussed above, there are no deficiencies in the rejection of claims 33, 38, and 44. Therefore, the obviousness rejection of claims 55–57 is sustained.

C. DECISION

The Examiner's decision is affirmed.

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a)(1)(iv).

AFFIRMED