UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte HENKEL CORPORATION

Appeal 2007-2907
Application 10/644,791
Technology Center 1700

Decided: 7 August 2007

Before TORCZON, TIERNEY, and MOORE, *Administrative Patent Judges*.

TORCZON, *Administrative Patent Judge*.

DECISION ON APPEAL

The subject matter of the claims on appeal is flame-retardant molding compositions. All of the pending claims have been rejected. The appellant (Henkel) seeks review of the rejections. We affirm.

THE CLAIMS

Claims 1-15 and 25-27 are currently pending.[1] Henkel has not argued the separate patentability of any subgroups of the claims as provided by rule

---

[1] Appeal Brief (20 April 2007) (Br.) 2.

so we select claim 1 as representative.[2] Claim 1 defines the subject matter of the invention as follows:[3]

> 1. A flame retardant molding composition substantially free of halogen, phosphorous and antimony, comprising:
>
> an epoxy resin;
> melamine cyanurate; and
> a transition metal oxide of a Group VIA element.

A claim before the Office is given its broadest reasonable construction consistent with the specification.[4] The meaning of "substantially free" varies with context.[5] If an applicant wishes to be more restrictive, other terms of art are available such as "essentially free".[6] Indeed, Henkel describes the composition on appeal as "[t]ypically…essentially free of bromine and antimony compounds."[7] By contrast, Henkel teaches the use of small amounts of triphenylphosphine (TPP) as a catalyst.[8] This distinction makes sense in terms of the problem to be solved since halogens and antimony present safety hazards,[9] while phosphorous compounds—when used in

---

[2] 37 C.F.R. § 41.37(c)(1)(vii).
[3] Br. 12.
[4] *In re Icon Health & Fitness, Inc.*, App. No. 2006-1573, slip op. at 5 (Fed. Cir. 2007).
[5] *Biotec Biologische Naturverpackungen v. Biocorp., Inc.*, 249 F.3d 1341, 1346-47, 58 USPQ2d 1737, 1740-41 (Fed. Cir. 2001) (construing "substantially free" to include "less than 5%").
[6] *Glaxo Grp., Ltd. v. Ranbaxy Pharm., Inc.*, 262 F.3d 1333, 1336, 59 USPQ2d 1950, 1952 (Fed. Cir. 2001) (contrasting "substantially" in a parent claim with "essentially free" in a dependent claim).
[7] Specification (Spec.) ¶0015. We note that bromine is a halogen.
[8] Spec. ¶¶0028 and 0031; Tables **1A** and **2A**.
[9] Spec. ¶0004.

amounts sufficient as fire retardants—introduce undesirable properties in the molded product.[10]

In patent claims, "comprising" indicates that the listed items are essential, but that the claim is also open to the inclusion of other items as well.[11] The specification explains that suitable transition metal oxides include chromium oxides, molybdenum oxides, tungsten oxides, and mixtures of these oxides.[12]

We construe claim 1 to encompass fire-retardant compositions suitable for molding, in which very small amounts of phosphorous, halogen, and antimony compounds may be included, but in which phosphorous, halogen (especially bromine) and antimony compounds are to be avoided in any substantial amounts. The composition must include an epoxy resin, melamine cyanurate, and a chromium-family metal oxide, but may also include other components.

THE REJECTIONS

The examiner has rejected the claims under 35 U.S.C. 103, contending the subject matter of the claims was obvious in view of the Gallo patent[13] and Japanese published applications[14] of Fujii,[15] Saito,[16] and Yamaguchi.[17]

---

[10] Spec. ¶0005.
[11] *Genentech, Inc. v. Chiron Corp.*, 112 F.3d 495, 501, 42 USPQ2d 1608, 1613 (Fed. Cir. 1997).
[12] Spec. ¶0027. While "Group VIA" is ambiguous in isolation, these examples clarify that the chromium family group is intended.
[13] Anthony A. Gallo, *Flame retardant molding compositions*, US 6,432,540 B1 (issued 13 August 2002) (Gallo patent). Gallo is named as a co-inventor in the application on appeal.
[14] We rely on and cite to the translations in the record rather than the originals.

The examiner has also rejected the claims relying on the Gallo patent and the Fujii and Yamaguchi publications.

SCOPE AND CONTENT OF THE PRIOR ART

The Gallo patent

The Gallo patent is directed to flame-retardant molding composition. It explains that epoxy resins are widely used for such compositions but that antimony oxides and bromine (a halogen) used in such compositions present safety concerns. Phosphorous containing compounds are noted to have undesirable properties such as a high moisture absorption rate.[18] The Gallo patent proposes a composition substantially free of halogen, phosphorus, and antimony that includes at least an epoxy resin and a transition metal oxide of a Group VIA element.[19]

The Saito publication

Saito discloses an epoxy resin molding compound that is fire retardant.[20] Although bromine and antimony oxide were commonly used in such compositions as fire retardants, Saito prefers to avoid halogens and

---

[15] Masanobu Fujii et al., *Epoxy resin composition for sealing semiconductor and semiconductor device using the composition*, JP H11-269347 A (pub'd 5 October 1999) (Fujii).
[16] Hiroyuki Saito et al., *Epoxy resin molding material for sealing electronic component and electronic part item sealed therewith*, JP H10-212396 A (pub'd 11 August 1998) (Saito).
[17] Yoshio Yamaguchi and Hiroko Yamamoto, *Resin composition for sealing semiconductor and semiconductor device using the same*, JP H11-100492 A (pub'd 13 April 1999).
[18] Gallo patent 1:5-35.
[19] Gallo patent 1:47-65.
[20] Saito ¶0001.

antimony as unsafe. Similarly, Saito notes that commonly used phosphoric acid compounds cause problems.[21] Saito solves the problem of replacing these materials by using molybdenum or tungsten oxides instead.[22] Saito also recommends the use of a compound of melamine and isocyanuric acid to assist in retarding flames.[23]

The Yamaguchi publication

Yamaguchi discloses a flame-retardant epoxy resin.[24] Yamaguchi too notes the disadvantages of using bromine and antimony as fire retardants,[25] and considers its resin to be safer because the resin is free of halogens and antimony.[26] The problem is solved using an organic flame retardant as the principal flame retardant.[27] Yamaguchi prefers nitrogen or phosphorous compounds, particularly heterocyclic compounds, specifically including melamine, cyanuric acid, isocyanuric acid, and melamine cyanurate.[28] Note that Yamaguchi illustrates melamine cyanurate as an ionic composition with a melamine moiety and an isocyanurate moiety. Other fire retardants, including metal oxides, may also be used.[29]

---

[21] Saito ¶¶0003-0005.
[22] Saito ¶0006.
[23] Saito ¶0014.
[24] Yamaguchi ¶0001.
[25] Yamaguchi ¶0002.
[26] Yamaguchi ¶0042.
[27] Yamaguchi ¶0005.
[28] Yamaguchi ¶¶0016-0020.
[29] Yamaguchi ¶0022.

The Fujii publication

Fujii discloses a fire-retardant sealing agent.[30] While epoxy resins work well, they are insufficiently fire-retardant. Bromine and antimony are commonly used fire-retardant additives, but they present safety concerns, and phosphorous-based alternatives are unsatisfactory.[31] Fujii's solution is a fire-retardant epoxy resin that is free of bromine and antimony.[32] Metal oxides and hydrates could be used instead although they adversely affect the material properties of the epoxy and the oxides might not be sufficiently fire retardant. Fujii specifically names molybdenum trioxide (MoO3) as one such metal oxide.[33] Fujii uses a blend including magnesium hydroxide and specific metal oxides.[34] The specific metal oxides include oxides of zinc, tin, molybdenum, and tungsten.[35]

DIFFERENCES BETWEEN THE PRIOR ART AND CLAIM 1

The Gallo patent does not teach or suggest the use of melamine cyanurate.

Saito would anticipate the subject matter of claim 1 if Saito's melamine/isocyanuric acid compound were melamine cyanurate as seems likely in view of Yamaguchi's disclosure; otherwise, Saito lacks a teaching of the use of melamine cyanurate.

Yamaguchi does not teach the use of a chromium-family metal oxide.

Fujii does not teach the use of melamine cyanurate.

---

[30] Fujii ¶0001.
[31] Fujii ¶0002.
[32] Fujii ¶¶0004 and 0013.
[33] Fujii ¶0004.
[34] Fujii ¶¶0005 and 0019.
[35] Fujii ¶0011.

ORDINARY LEVEL OF SKILL IN THE ART

We look to the evidence of record—the applicant's disclosure, the cited references, and any declaration testimony—in resolving the ordinary level of skill in the art.[36] From Henkel's Background of the Invention[37] and the four cited reference, we have an unusually clear view of what a person having ordinary skill in the art knew and could do. Those skilled in the fire-retardant epoxy resin art knew how to make and use epoxy resins with a broad range of fire-retardant additives, including melamine cyanurate and chromium-family metal oxides. They understood the need to eliminate bromine and antimony for safety reasons. They understood that alternative additives presented various advantages and disadvantages. They understood and made various combinations of known additives to maximize the advantages while minimizing the disadvantages. Combinations included using molybdenum and tungsten oxides with melamine/isocyanuric acid compositions. One skilled in the art would have expected chromium-family metal oxides to work with melamine cyanurate as substitute fire retardants in place of bromine, antimony, and phosphorous compositions.

SECONDARY CONSIDERATIONS: UNEXPECTED RESULTS

Henkel relies on the declaration of Dr. Anthony A. Gallo, one of the inventors named for the application on appeal, to provide evidence of

---

[36] *Ex parte Jud*, 2006 WL 4080053 at *2 (BPAI) (rehearing with expanded panel). Dr. Gallo, a named inventor for the application on appeal, filed a declaration, but it does not directly address the question of the level of skill in the art.
[37] Spec. ¶¶0003-0006.

unexpectedly good results.[38] When the prior art teaches away from combining certain known elements, discovery of a successful means of combining them is more likely to be nonobvious. The fact that the elements worked together in an unexpected and fruitful manner supports a conclusion of nonobviousness.[39] Expected results, on the other hand, support a conclusion of obviousness.[40]

Unexpected results must be based on comparison with the closest prior art and must represent a difference in kind rather than a difference of degree.[41] Dr. Gallo compared three samples: (A) a composition with both tungsten trioxide and melamine cyanurate, (B) a composition with tungsten trioxide but no melamine cyanurate, and (C) a composition with melamine cyanurate but no tungsten trioxide.[42] According to Dr. Gallo, Sample B totally burned in a flame test, while Sample C was unworkable and could not be used. Consequently, Sample A, which only burned for 3-7 seconds, was clearly better.[43] Dr. Gallo states that the results of his test could not have been predicted from the prior art.

We accord little weight to Dr. Gallo's testimony. His comparative samples of only tungsten oxide and only melamine cyanurate are not

---

[38] Br. 8 and Evidence Appendix item 1.
[39] *KSR Int'l v. Teleflex Inc.*, 127 S. Ct. 1727, 1739-40, 82 USPQ2d 1385, 1395 (2007).
[40] *In re Skoll*, 523 F.2d 1392, 1397, 187 USPQ 481, 484 (CCPA 1975).
[41] *In re Harris*, 409 F.3d 1339, 1344, 74 USPQ2d 1951, 1955 (Fed. Cir. 2005).
[42] Declaration Under 37 C.F.R. §1.132 (Gallo decl.) ¶4 and Table 1.
[43] Gallo decl. ¶5. Totally burned in this test meant burned for more than 20 seconds. The relevant standard is said to require both an average and maximum burn time of no more than 10 seconds. ¶6.

representative of the closest prior art.[44] As discussed above, Fujii explained that metal oxides alone are insufficient as fire retardants (which is why Fujii combines them with magnesium hydroxide). Yamaguchi, which recommended the use of melamine cyanurate, also recommended adding metal oxides. Finally, Saito recommended using molybdenum or tungsten oxides with a melamine/isocyanuric acid composition. Fujii predicted the failure of Sample B, while Sample C does not represent the closest embodiment of either Yamaguchi or Saito.

Dr. Gallo's test falls well short of a comparison with the closest prior art. Moreover, the results are not unexpected. They are consistent with the teachings of Fujii, Yamaguchi, and Saito, all of whom would have counseled combining the metal oxides with another retardant. The test does not establish unexpected results. If anything, the results are consistent with the teachings of the prior art to prefer blends of fire retardants, including blends of metal oxides and melamine-related retardants.

ANALYSIS

In analyzing obviousness, the scope and content of the prior art must be determined, the differences between the prior art and the claims ascertained, and the ordinary level of skill in the art resolved. Objective evidence of the circumstances surrounding the origin of the claimed subject matter (so-called secondary considerations) may also be relevant. Such

[44] *Cf. Harris*, 409 F.3d at 1344, 74 USPQ2d at 1955 (selection of comparative example can severely affect the weight accorded to test).

secondary considerations guard against the employment of impermissible hindsight.[45] Anticipation is the epitome of obviousness.[46]

Saito alone teaches the use of molybdenum or tungsten trioxide with a melamine/isocyanuric acid composition that appears to be melamine cyanurate. Saito is pursuing the same goal as the present inventors of eliminating halogens and antimony from the epoxy resin. Saito also recognizes the problems of using phosphoric acid compounds as fire retardants. Even if Saito does not teach melamine cyanurate, one skilled in the art would readily apprehend that melamine cyanurate could be used in place of Saito's mystery composition after reading Yamaguchi. Fujii reinforces the desirability of using blends of fire retardants and counsels against using metal oxides alone.

The claimed composition combines familiar elements of the prior art according to known methods to yield predictable results, which is sufficient to establish obviousness.[47] Blending an oxide of chromium, molybdenum, or tungsten with melamine cyanurate as fire retardants for an epoxy resin substantially free of halogens, antimony, and phosphorous is well within the scope of what the cited references would have taught or suggested to a person having ordinary skill in the art.

---

[45] *Graham v. John Deere Co.*, 383 U.S. 1, 17, 36 (1966), *cited with approval in KSR Int'l v. Teleflex Inc.*, 127 S. Ct. 1727, 82 USPQ2d 1385 (2007). The record on appeal does not contain objective evidence of secondary considerations.

[46] *In re Paulsen*, 30 F.3d 1475, 1481, 31 USPQ2d 1671, 1675 (Fed. Cir. 1994)

[47] *Leapfrog Enter., Inc. v. Fisher-Price, Inc.*, 485 F.3d 1157, 1161, 82 USPQ2d 1687, 1690-91 (Fed. Cir. 2007), *citing KSR Int'l*, 127 S. Ct. at 1739, 82 USPQ2d at 1395.

CONCLUSION

The subject matter of claim 1 was obvious when the application was filed and is thus unpatentable under § 103. The examiner's rejection of claim 1 is affirmed. The rejections of claims 2-15 and 25-27 have not been separately challenged, so these rejections are also affirmed.

AFFIRMED

Julie W. Meder
WEBB ZIESENHEIM LODSDON ORKIN & HANSON, P.C.
700 KOPPERS BUILDING
436 SEVENTH AVENUE
PITTSBURGH, PA 15219-1818