

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte MICHAEL J. HEALEY and
RAYMOND JOHNSEN

Appeal 2008-2262
Application 10/466,673
Technology Center 1700

Decided: June 19, 2008

Before CHARLES F. WARREN, PETER F. KRATZ, and
CATHERINE Q. TIMM, *Administrative Patent Judges*.

TIMM, *Administrative Patent Judge*.

DECISION ON APPEAL

Appellants appeal under 35 U.S.C. § 134(a) from the Examiner's
decision rejecting claims 1-24. We have jurisdiction under 35 U.S.C. § 6(b).

Oral arguments were presented on May 22, 2008.

We affirm.

I. BACKGROUND

The invention relates to a method of draping a non-crimp fabric over a forming tool (Claim 1). Conventionally, such draping is performed during the forming of reinforced composite articles. These composites are conventionally formed by stitching together plies of fabric and curing resin within the fabric (Spec. 1:6-20). Normally, the stitching restricts the fabric from draping over the forming tool (Spec. 1:22-24). Appellants use a fusible stitching thread and, in the inventive method, the restriction to draping is overcome by heating the fabric so that the fusible thread softens or melts relieving tension within the thread allowing the fabric to move and thereby improve the drape of the fabric over the forming tool (Spec. 2:12-18; 3:24-28; 5:16-18). Claim 1 is illustrative of the subject matter on appeal:

1. A method of draping a non crimp fabric over a forming tool prior to curing of said non crimp fabric, the method including the steps of:

- providing a non crimp fabric comprising a layup of plies stitched together using a thread at least part of which is fusible;

- placing the non crimp fabric on the forming tool; and

- heating the non crimp fabric sufficiently to soften the fusible thread as the non crimp fabric drapes over the tool, thereby reducing the restriction to drape caused by the stitching.

Appellants request review of all the rejections maintained by the Examiner, namely,

1. the rejection of claims 1-24 as lacking written descriptive support under 35 U.S.C. § 112, ¶ 1,

2. the rejection of claims 1-24 under 35 U.S.C. § 102((b) as anticipated by either “Harpell” (US 4,623,574 issued Nov. 18, 1986) or “Vane” (EP 361 796 published Apr. 4, 1990), and
3. the rejection of claims 1-24 under 35 U.S.C. § 103(a) as unpatentable over either Harpell or Vane.

II. DISCUSSION

Written Descriptive Support

The 35 U.S.C. § 112, ¶ 1 rejection is based upon the Examiner’s conclusion that language within claims 1 and 8 lack written descriptive support in the originally filed Specification. Specifically, the Examiner rejects the claim language “prior to curing of said non crimp fabric” found in lines 1-2 of claim 1 and the language “said matrix resin when cured and said fusible thread both having a similar modulus of elasticity” in claim 8, lines 2-3.

We consider the “prior to curing” language of claim 1 first. With respect to this language, Appellants contend that one of ordinary skill in the art would understand that the Specification is describing draping of a non-cured, non-crimp fabric because cured fabric is stiff and will not drape (Br. 5-6).

The Examiner acknowledges that “a composite material which has been fully cured is very stiff and not capable of ‘drape’ over anything” (Ans. 7). However, the Examiner contends that a slightly or partially cured composite material is still flexible enough to drape and, therefore, “draping” is not necessarily limited to a non-crimp fabric which is not cured at all (Ans. 7). According to the Examiner, “the definition of drape (“the ability to

conform to changes in the shape of the component being made”; page 1, lines 22-23 of the specification) does not recite anything about the extent, or state, of cure.” (Ans. 7.)

Appellants’ and the Examiner’s contentions give rise to a question of claim interpretation, specifically: what is the meaning of “prior to curing” to one of ordinary skill in the composite forming art? Appellants seem to believe that this language excludes any and all curing reactions occurring either before or concurrent with draping. The Examiner’s rejection is based upon the absence of any disclosure in the Specification explicitly discussing the extent of curing relative to the timing of draping.

We first look to the meaning of the terms as used in the Specification. *See U.S. v. Adams*, 383 U.S. 39, 49 (1966) (“[I]t is fundamental that claims are to be construed in the light of the specifications and both are to be read with a view to ascertaining the invention.”). According to the Specification, “preferably, *after curing*, the fusible thread should have a glass transition temperature (T_g) of greater than 120 °C for aerospace applications.” (Specification 2:33 to 3:2 (emphasis added)). Furthermore, “[t]he fusible thread may melt and remain as a separate phase from the matrix resin, dissolve in the matrix or precipitate out *later as the matrix is cured or allowed to set*.” These disclosures imply that the “curing” referred to is the “curing” step required to set the composite article, i.e., form the stiffened end product. These disclosures do not preclude draping such conventional resin impregnated fabrics such as “prepregs,” i.e., fabrics impregnated with partially-cured but still formable resin (cured to B-stage) (see, e.g., Vane,

col. 1, ll. 4-8).¹ One of ordinary skill in this art would not read the Specification as precluding the draping of “prepreg” material. *See In re Am. Acad. of Sci. Tech. Ctr.*, 367 F.3d 1359, 1364 (Fed. Cir. 2004) (“claim language should be read in light of the specification as it would be interpreted by one of ordinary skill in the art.”).

With the above claim interpretation in mind, we turn to the question of whether there is written descriptive support in the original Specification for the “prior to curing” language of claim 1. The question we must answer is: does the original disclosure of the application reasonably convey to one of ordinary skill in the art that Appellants had possession of a method of draping which occurs “prior to curing of said non crimp fabric” as now claimed?

The test for determining compliance with the written description requirement of 35 U.S.C. § 112, first paragraph, is whether the disclosure of the application as originally filed would have reasonably conveyed to one of ordinary skill in the art that the inventor had possession at that time of the later claimed subject matter. *Vas-Cath, Inc. v. Mahurkar*, 935 F.2d 1555, 1563 (Fed. Cir. 1991). The subject matter of the claims need not be described identically or literally for the application to satisfy the written description requirement of 35 U.S.C. § 112, first paragraph. *In re Kaslow*,

¹*See also* Manas Chanda and Salil K. Roy, *Plastics Technology Handbook* 2-52 (2006) (available by searching Google Book with terms “Plastics Technology Handbook” and “prepreg”) stating that in the prepreg molding process, “unidirectionally oriented layers of fibers are pre-impregnated with the matrix resin and cured to an intermediate stage of polymerization (B-stage). When desired, this pre-impregnated composite precursor, called a prepreg, can be laid up in the required directions in a mold for quick conversion into end components through the use of hot curing techniques.”

707 F.2d 1366, 1375 (Fed. Cir. 1983). However, the description of the invention must be sufficiently clear so that one of ordinary skill in the art would have recognized from the disclosure that the applicants invented the later claimed subject matter. *In re Wertheim*, 541 F.2d 257, 262 (CCPA 1976).

Our review of the Specification convinces us that the Specification reasonably conveys that Appellants had possession at the time the application was filed of a method of draping non-crimp fabric over a forming tool prior to curing the resin within the fabric.

As stated in the Specification:

The method may also include heating the plies as aforesaid to improve the drape of the fabric. In one embodiment, the plies are heated to a temperature not greater than the fusion temperature of the thread. However, in another embodiment, the plies are heated to a temperature at or above the fusion temperature of the fusible thread, so that the thread fuses and allows the fabric to move. *Where this occurs without the presence of a matrix resin*, cooling under pressure below the fusion temperature substantially maintains the shape formed creating a pre-form, due to the fusible stitch acting as an in-situ binder.

(Specification 3:24-31 (emphasis added).)

This portion of the Specification describes several embodiments of the method including an embodiment in which the matrix resin, the portion of the “non crimp fabric” that undergoes curing, is not present when heating the plies to improve drape. This conveys to one of ordinary skill in the art that Appellants were in possession of at least one embodiment in which draping occurs before curing.

Moreover, even in the embodiments in which the matrix resin is present during draping, the Specification reasonably conveys that Appellants were in possession of methods of draping prior to the full cure of the resin. As Appellants and the Examiner both acknowledge, those of ordinary skill in the art reading the Specification would have understood that draping must occur before the resin impregnated fabric was fully cured because once fully cured the composite material is stiff and not capable of draping (Br. 6; Ans. 7).

We conclude that the original disclosure of the application reasonably conveys to one of ordinary skill in the art that Appellants had possession of a method of draping which occurs “prior to curing of said non crimp fabric” as required by claim 1.

Turning to claim 8, the question is: does the original Specification provide written descriptive support for the words “of elasticity” in the phrase “similar modulus of elasticity”?

We answer this question in the affirmative.

Original claim 8 uses the word “modulus” in reference to a mechanical property possessed by each of the matrix resin and fusible thread. In this context, the modulus is generally known as a measure of the stiffness or elasticity of a material.² The Examiner provides no evidence or reasoning tending to show that there is some other meaning for modulus

² Modulus of elasticity is defined as the “ratio of the increment of some specified form of strain, such as Young’s modulus, the bulk modulus, or the shear modulus. Also known as coefficient of elasticity; elasticity modulus; elastic modulus.” McGraw-Hill Dictionary of Scientific and Technical Terms, 5th ed. (1994).

when measuring material properties other than “modulus of elasticity.” It would appear that those of ordinary skill in the art of composite article forming would understand that “modulus” as used in Appellants’ Specification and claims refers to “modulus of elasticity,” and would, therefore, understand Appellants to be in possession of what is claimed.

The rejections over Harpell and Vane

Turning to the prior art rejections for anticipation and obviousness over either Harpell or Vane, Appellants argue all the claims as a group focusing on claim 1. We, therefore, select claim 1 as representative of the issues on appeal.

Specifically, Appellants contend that neither Harpell nor Vane teaches any of the three steps of claim 1, nor provides any suggestion for performing those steps (Br. 4-11) because these references do not “bear any relationship to a method of draping a non-crimp fabric” (Br. 9), and neither reference teaches “fusible” threads or the softening of those threads to reduce restriction to drape (Br. 10-11 and 15-16; Reply Br. 4-11).

The Examiner contends that each reference teaches each and every limitation of claim 1, the reduction of restriction claimed being either inherently present in the heating step taught in the references or it would have been obvious to one of ordinary skill in the art to heat to soften the thread and thereby reduce restriction to drape (Ans. 4-11).

Under 35 U.S.C. § 102, the critical question is: does claim 1 read on or encompass a method of draping that was already known in the prior art as shown by the disclosure of either Vane or Harpell; and under 35 U.S.C. § 103, the critical question is: are the differences, if any, between the draping

method of claim 1 and the method of either Vane or Harpell such that the claimed method as a whole would have been obvious to one of ordinary skill in the composite article forming art?

“The law of anticipation does not require that the reference ‘teach’ what the subject patent teaches. Assuming that a reference is properly ‘prior art,’ it is only necessary that the claims under attack, as construed by the court, ‘read on’ something disclosed in the reference, i.e., all limitations of the claim are found in the reference, or ‘fully met’ by it.” *Kalman v. Kimberly-Clark Corp.*, 713 F.2d 760, 772 (Fed. Cir. 1983). Moreover, a limitation need not be expressly described in the reference, “a prior art reference without express reference to a claim limitation may nonetheless anticipate by inherency.” *In re Omeprazole Patent Litigation*, 483 F.3d 1364, 1373 (Fed. Cir. 2007).

The law of obviousness allows for some differences between what is claimed and what is described in the prior art. “Section 103 forbids issuance of a patent when ‘the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains.’” *KSR Int'l Co. v. Teleflex Inc.*, 127 S. Ct. 1727, 1734 (2007). The question of obviousness is resolved on the basis of underlying factual determinations including (1) the scope and content of the prior art, (2) any differences between the claimed subject matter and the prior art, (3) the level of skill in the art, and (4) where in evidence, so-called secondary considerations. *Graham v. John Deere Co.*, 383 U.S. 1, 17-18 (1966). *See also KSR*, 127 S. Ct. at 1734 (“While the sequence of these questions might be reordered in

any particular case, the [*Graham*] factors continue to define the inquiry that controls.”).

Vane describes a method of producing formable composite materials (Vane, col. 1, ll. 1-3). According to Vane, it was known in the prior art to produce such composites from prepregs comprising woven or nonwoven fiber mats impregnated with resin matrix material, but these formable composites suffered disadvantages in strength and shelf life due to unpredictable fiber distribution in the nonwovens and crimps created by the weave in the woven mats (Vane, col. 1, ll. 4-17). Vane describes a method of producing formable composite material that overcomes these problems (Vane, col. 1, ll. 18-23). Vane describes stitching together superimposed layers (a layup of plies) impregnated with matrix material (Vane, col. 1, ll. 24-33). During subsequent forming of the composite material, e.g., under heat and pressure, the matrix material consolidates (Vane, col. 1, ll. 38-43). Moreover, the yarn or thread used in the stitching may be a thermoplastic material that becomes part of the matrix during the heat and pressure application (Vane, col. 3, ll. 37-44). Because the fabric layers are firmly held by the stitching, “the composite material by the method of [Vane] can be formed to complex shapes without creasing or wrinkling.” (Vane, col. 4, l. to col. 5, l. 3).

Appellants have not convinced us that the Examiner reversibly erred in finding that Vane teaches each and every limitation of claim 1.

We find that Vane describes providing a non crimp fabric (it can be formed into complex shapes without creasing or wrinkling) which is a lay up of plies stitched together with a fusible thread as claimed. The stitches are “fusible” as claimed because they are formed of thermoplastic that “will

become part of the matrix when the composite material is formed,” i.e., when heat and pressure fuse the thermoplastic stitches with the matrix material.

Appellants contend that the thread of Vane is not fusible because “fusible thread” is defined in their Specification as a thread “melting at a temperature of between 40 °C and 150 °C.” (Reply Br. 5). We cannot agree that such a definition exists in the Specification. The Specification merely states a preference for threads that melt in this temperature range (Spec. 2:30-31). In fact, “fusible” is defined more broadly in the Specification to mean “that the thread not only melts by itself when heated, but may also dissolve into a resin during processing at temperature.” (Specification 2:15-16). The stitching of Vane meets this definition because the stitching is thermoplastic. Thermoplastic, by definition, melts when heated past its melting temperature. Moreover, the thread of Vane becomes “a part of the matrix” during the heating and pressurizing of the composite consolidation. The stitching is fusible as claimed.

We further find that one of ordinary skill in the art would understand Vane as describing placing the non crimp fabric on a forming tool. By describing the composite shaping method as one of forming complex shapes under heat and pressure, Vane describes to one of ordinary skill in the composite forming art the use of a forming tool to supply the heat and pressure and do the shaping.

We further find that Vane describes heating the non crimp fabric as claimed. To one of ordinary in the composite forming art, Vane describes placing or draping the non crimp fabric on a forming tool and heating the fabric while pressure is applied so that the fabric conforms to the complex

shape of the tool. During this process, according to Vane, the stitching becomes part of the matrix, i.e., it softens and/or melts. This softening and/or melting would necessarily result in “reducing the restriction to drape caused by the stitching” as claimed. While Vane does not use the same words to describe the method step as the claim, the method reasonably appears to inherently be the same or substantially the same as that claimed. This substantial identity shifts the burden to Appellants to show that, in fact, the claimed process is different than that of the prior art. *In re Best*, 562 F.2d 1252, 1254-55 (CCPA 1977).

Appellants further contend that Vane does not describe draping, does not suggest that there is any “drape” problem, nor suggest a solution to such a problem (Br. 9-10). As stated in the Specification “drape” is the “ability to conform to changes in shape of the component being made.” (Specification 1:22-23.) Vane describes using the fabric to form complex surfaces and this necessarily requires the fabric have the ability to conform to changes in shape, i.e., “drape.” The fact that Vane does not expressly state any problems occurring with “drape” or solutions to such problems is of no moment where, as here, the reference teaches each and every limitation of the claim either expressly or inherently. *In re Self*, 671 F.2d 1344, 1350-51 (CCPA 1982) (arguments that a reference is taken from a non-analogous art, that it teaches away from appellant's invention, or that the reference was not recognized as containing a solution to the long-standing problems in the art found not germane to a §102 rejection).

We find that claim 1 reads on or encompasses a method of draping that was already known in the prior art as shown by the disclosure of Vane. We conclude as well that the differences, if any, between the draping

method of claim 1 and the method of Vane was such that the claimed method as a whole would have been obvious to one of ordinary skill in the composite article forming art. As anticipation is the epitome of obviousness, we also agree that Vane supports an obviousness rejection. *In re Fracalossi*, 681 F.2d 792, 794 (CCPA 1982) (“[L]ack of novelty is the ultimate of obviousness.”).

Turning to Harpell, we agree with Appellants that the examples of Harpell are directed to forming flat sample targets and , therefore, do not describe a step of draping fabric as claimed. Thus, we reverse the anticipation rejection over Harpell.

However, we conclude that the Harpell disclosure as a whole supports the Examiner’s conclusion of obviousness. Harpell’s disclosure is not limited to the forming of target samples, Harpell suggests forming more complex articles such as helmets using the composite forming method described in the reference. One of ordinary skill in the art would have recognized that forming such complex articles requires draping over a forming tool and applying heat and pressure to shape the impregnated fabric. Harpell further describes using thermoplastic (polyethylene terephthalate (PET)) stitching which thermoplastic is known to be “fusible.” Thus, restriction to drape would be expected to occur during the formation of the suggested complex articles because it is reasonable to conclude that the low denier PET yarn stitching, which would have been obvious to employ in a multi-ply fabric (see Example 6), would soften during molding of the complex articles. Indeed, Harpell discloses a 130 °C composite molding temperature in Example 6 for the formation of a flat target. This disclosure is reasonably suggestive to one of ordinary skill in the art that such molding

temperatures or perhaps somewhat higher molding temperatures, would have been reasonable to employ in forming more complex articles.

Appellants contend that PET melts at 270 °C, but provides no support for this statement. *See In re Greenfield*, 571 F.2d 1185, 1189 (CCPA 1978) (arguments of counsel cannot take the place of evidence). Moreover, the melting point alone is not enough to show that restriction to drape would not be reduced upon softening of the PET low denier yarn. Softening often occurs at temperatures lower than the melting point. We cannot say Appellants have not established reversible error in the Examiner's obviousness rejection over Harpell.

III. CONCLUSION

We sustain the rejection of claims 1-24 under 35 U.S.C. § 102(b) as anticipated by Vane and the rejection of claims 1-24 under 35 U.S.C. § 103(a) as unpatentable over either Vane or Harpell. We do not sustain the rejection of claims 1-24 under 35 U.S.C. § 102(b) as anticipated by Harpell or the rejection of claims 1-24 under 35 U.S.C. § 112, ¶1.

IV. DECISION

The decision of the Examiner is affirmed.

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V. TIME PERIOD FOR RESPONSE

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

AFFIRMED

tf/lr

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