UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte AIRBUS FRANCE

Appeal 2007-4307
Application 10/173,095
Technology Center 1700

Decided: September 28, 2007

Before RICHARD E. SCHAFER, RICHARD TORCZON, and MICHAEL P. TIERNEY, *Administrative Patent Judges*.

TORCZON, *Administrative Patent Judge*.

DECISION ON APPEAL

The claims on appeal relate to a process for making a reinforced acoustically resistive layer. The examiner has rejected all pending claims. The appellant (Airbus) seeks review. We affirm.

THE CLAIMS

Claims 18-38 are pending. Airbus has not argued the patentability of the claims separately so for the contested rejections we treat the claims as standing or falling together based on representative claim 18.[1] Although

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[1] 37 C.F.R. § 41.37(c)(1)(vii).

claims 22, 24, and 34 are separately mentioned in the reply brief,[2] we will not consider arguments first raised in the reply brief.[3]

Claim 18 defines the invention as follows:[4]

> 18. A process for the production of a reinforced acoustically resistive layer comprising the steps of:
> - producing a layer of structural reinforcement from fibers pre-impregnated with a thermosetting or thermoplastic resin, said layer having a given quantity of open surface relative to the acoustic waves to be handled,
> - emplacing on said layer a metallic acoustic cloth whose mesh is adapted to the quantity of open surface of said structural layer, and
> - polymerizing or consolidating said resin under suitable pressure and temperature,
> said process further comprising the step of:
> - interposing before polymerizing and consolidating, between said resin and said metallic cloth, a component adapted for macromolecular interpenetration with said resin during polymerization or consolidation and that increases the mechanical and adhesive properties of the connection between the fibers of said structural reinforcement and said metallic cloth.

We are obliged to construe claims as broadly as reasonable. The method steps are listed using the transitional term "comprising", which opens the method to the inclusion of other steps, including steps adding other materials, consistent with the steps listed.

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[2] Reply Brief 6.
[3] *Cf. Carbino v. West*, 168 F.3d 32, 34 (Fed. Cir. 1999) (a late argument, even on a question of law, need not and ordinarily should not be considered).
[4] Claim 18 is reproduced from the claim appendix of the Appeal Brief (Br.), including the hyphenation of the indentations.

From the specification, we understand "quantity of open surface" to refer to the number of openings in the structural reinforcement, which face the direction of acoustic waves. Similarly, "mesh…adapted to the quantity of open surface" means a mesh selected to avoid closing off the underlying openings.[5] The open surface limitation encompasses honeycomb structures known to be suitable in the prior art for dissipating acoustic energy, but the claim is not limited to such structures.[6] Indeed, this limitation does not require acoustic damping at all. The examiner has read this limitation to be met by other structural layers involving fibers impregnated with resin, which are used as face sheets.[7] The examiner's reading is reasonable in view of the breadth of this limitation. Airbus has not amended its claim to avoid this broad reading so we analyze the rejections with this breadth in mind.[8]

We construe broadly "polymerizing or consolidating said resin under suitable pressure and temperature" to mean that polymerization or consolidation or both may be used, particularly in view of the comprising language also used. In the absence of an express definition in the specification, we ascribe to "consolidation" its ordinary meaning of:

> The act or process of consolidating, making firm, or uniting; the state of being consolidated; solidification; combination.[9]

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[5] Specification (Spec.) 2:1-7 and 3:10-14.
[6] Spec. 1:16-18.
[7] Examiner's Answer (Ans.) 3-4 (discussing "a fiber reinforced plastic layer").
[8] *In re Morris*, 127 F.3d 1048, 1056-57, 44 USPQ2d 1023, 1029-30 (Fed. Cir. 1997).
[9] http://en.wiktionary.org/wiki/consolidation, def. 1 (visited 27 September 2007).

In this construction, uniting two resin structures together is a consolidation of the resin. Claim 18 does not require a specific resin, but Airbus has indicated that suitable resins include polyetherimides (PEI) and polyetheretherketones (PEEK), although PEEK is said to be expensive.[10]

In construing the claim we focus on the contested limitations. Airbus focuses its argument on appeal on the last recited step of the method.[11] Had Airbus complied with (and the examiner enforced compliance with) 37 C.F.R. § 1.75(e) (requiring the use of "improvement" format for claims whenever possible) the briefing on appeal would have been much simpler. For simplicity, we focus on the contested last step:

> said process further comprising the step of:
> - interposing before polymerizing and consolidating, between said resin and said metallic cloth, a component adapted for macromolecular interpenetration with said resin during polymerization or consolidation and that increases the mechanical and adhesive properties of the connection between the fibers of said structural reinforcement and said metallic cloth.

Although the claim requires this interposing step to occur "before polymerizing and consolidating", the specification contemplates a pre-polymerization step within the scope of the invention.[12] In view of the comprising language in the claim and the teachings in the specification, we construe the claim to be open to a pre-polymerizing step for the resin of the structural reinforcement layer.

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[10] Spec. 5:1-14.
[11] Br. 5-9.
[12] Spec. 7:8-14.

Moreover, the phrase "before polymerizing *and* consolidating" is ambiguous since the claim also says "polymerizing *or* consolidating" both before and afterward (emphasis added). This difference raises the question of whether the interposing step must occur (1) before *some* polymerization or consolidation of the resin occurs, (2) before *all* polymerization and consolidation occurs, or (3) something in between. Ultimately, the applicant has the burden of drafting the claim to define the scope intended, while we must give the claim as drafted its broadest reasonable construction.[13] The broadest reasonable construction of "before polymerizing and consolidating" is that additional polymerization or consolidations of the resin may occur before or after the interposing step as long as at least one polymerization or consolidation of the resin occurs after the interposing step. Note that this construction is consistent with the pre-polymerization of the resin contemplated in the specification.

From the specification, we understand "component adapted for macromolecular interpenetration with said resin" to encompass an adhesive with elastic properties or a resin selected to interact with the resin of the structural layer.[14] Although the "component" may itself be a resin, we understand "said resin" in the claim to refer to the resin of the structural reinforcement layer.

The phrase "macromolecular interpenetration" is not defined in the specification. Airbus gives an example, however, in which interpenetration is said to be accomplished by polymerization with a fiber-reinforced resin

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[13] *Morris*, 127 F.3d at 1056-57, 44 USPQ2d at 1029-30.
[14] Spec. 6:24-32.

composite material.[15] We thus understand macromolecular interpenetration to include not only mechanical or attractive coupling, but also covalent bonding.

THE REJECTIONS

Claim 36 stands rejected for failing to comply with the first and second paragraphs of 35 U.S.C. 112.[16] Airbus has elected not to contest these rejections.[17] Consequently, the rejection of claim 36 is affirmed pro forma.

Claims 18-20, 23, 25, 27, 28, 31, 32, and 37 stand rejected[18] under 35 U.S.C. 103 for having been obvious in view of United States patents to Riel,[19] Stephens,[20] and Chee,[21] and of a Japanese published application of Nakanishi.[22] Our understanding of the Nakanishi publication rests entirely on the translation of record on appeal.

Claims 18, 21, 22, 24, 26, 29, 30, 33-35, and 38 stand rejected[23] under § 103 for having been obvious in view of United States patents to Scanlon,[24]

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[15] Spec. 10:15-20.
[16] Official Action Summary mailed 3 May 2005 (Final Rejection) 2-3.
[17] Br. 1.
[18] Final Rejection 3.
[19] Frank J. Riel, *Noise suppression panel*, US 4,465,725 (issued 1984).
[20] Gerald E. Stephens, *Method of making an acoustic panel with a triaxial open-weave face sheet*, US 4,671,841 (issued 1987).
[21] Wan T. Chee & George W. Quigley, *Continuously wound filament structure for use in noise attenuation element*, US 4,600,619 (issued 1986).
[22] Toshio Nakanishi & Hideo Kawamura, *Epoxy resin composition*, JP 53-101501 A (pub'd 1978).
[23] Final Rejection 3, as clarified with respect to claim 29 in the Office communication mailed 22 April 2006.

Andre,[25] and Rostami,[26] and of Airbus representations regarding the prior art. Airbus has not contested the availability of these references as evidence of obviousness in this appeal.

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. One function of such secondary considerations is to guard against the employment of impermissible hindsight.[27]

Scope and content of the prior art

Riel is directed to a noise suppression panel for use in extreme conditions, including noise suppression for aircraft engines.[28] An embodiment is illustrated in Riel FIG. 1 (below).

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[24] John F. Scanlon & David M. Moorehouse, *One step molded continuous fiber reinforced perforated composite panels*, US 5,246,520 (issued 1993).
[25] Robert Andre, Alain Porte & Eric Rambaud, *Process for the production of an acoustically resistive layer, resistive layer thus obtained, and wall using such layer*, US 6,607,625 B2 (issued 2003).
[26] Shamsedin Rostami, *Polymer compositions*, US 5,071,925 (issued 1991).
[27] *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).
[28] Riel 1:5-35

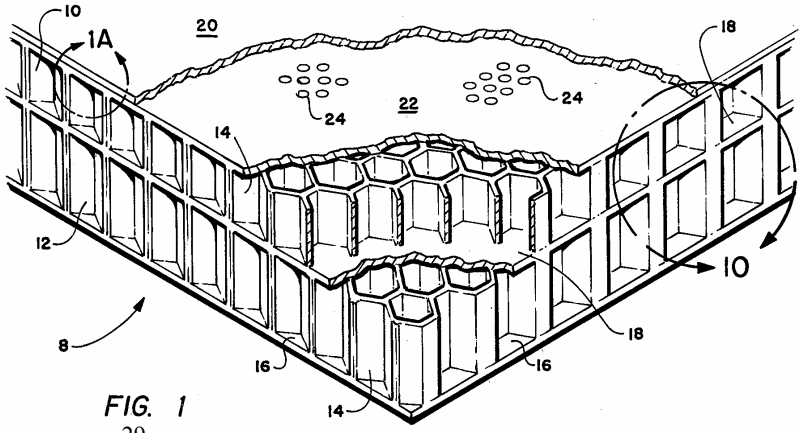

FIG. 1

The examiner notes[29] that a microporous sheet **20** (which may be woven stainless steel) is bonded to a perforate sheet **22** (which may be graphite fiber reinforced plastic). The bonding may be achieved with an adhesive, which may be in the form of a reticulated film.[30] Riel provides a similar disclosure for bonding between honeycombed cores **10**, **12** (which may be fiberglass-reinforced phenolic resin) and an inner microporous layer **18** (which may also be woven stainless steel). This adhesive may also be a reticulated film and is said to provide a mechanical interlock between the layers.[31]

Stephens relates to acoustic energy absorbing structures, including ones for use with aircraft engines, and their manufacture.[32] Stephens FIG. **3** (below) illustrates a typical acoustic panel **50** with a honeycomb body section **54**, an open triaxial-weave face sheet **56**, and a microporous layer **58** that is preferably woven stainless steel.[33] The face sheet 56 is woven carbon

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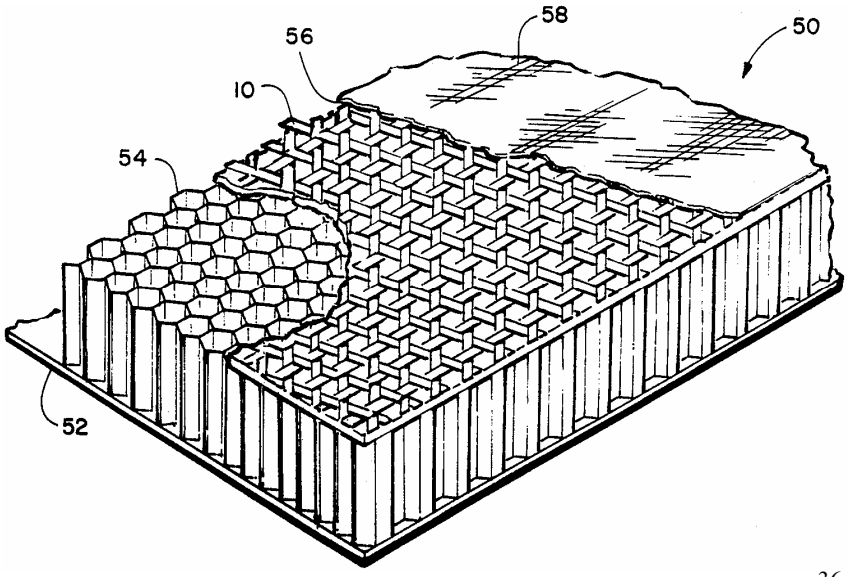
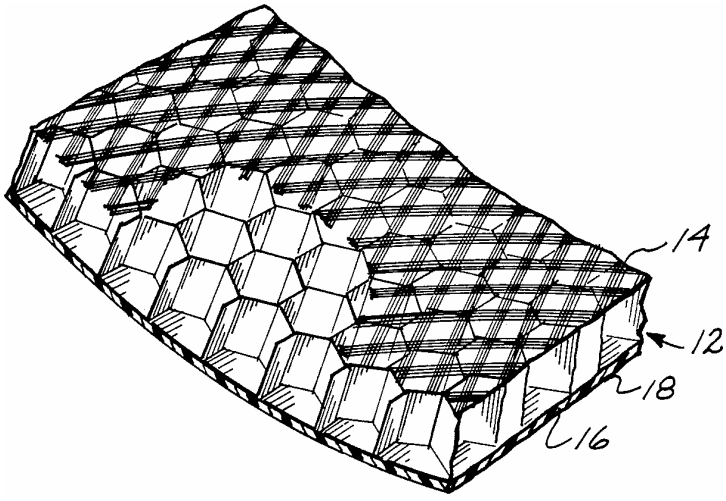
[29] Ans. 5.
[30] Riel 3:14-22, 3:58-66, and 4:5-9.
[31] Riel 2:65-3:15, 3:29-36, and 5:57-6:5.
[32] Stephens 1:7-21.
[33] Stephens 4:13-26.

fiber.[34] The fiber is impregnated with an epoxy resin to produce a "prepreg".[35]



Chee relates to noise attenuation structures for jet engines.[36] Chee illustrates a section of a typical acoustic treatment panel **12** in FIG. 2 (right). A perforated outer skin **14** covers a honeycombed core **16**.[37] The core 16 may be made from a variety of materials, including NOMEX®, an aramid fiber. The panel may have more than one core layer arranged in a stack.[38] In one embodiment, Chee employs an outer

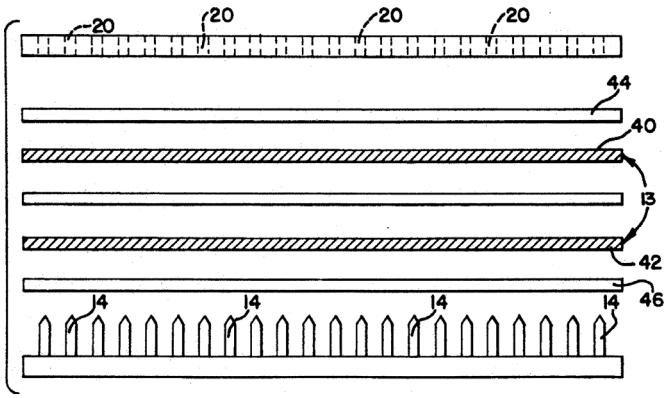


[34] Stephens 2:43-45.
[35] Stephens 3:1-2.
[36] Chee 1:8-20.
[37] Chee 2:28-42.
[38] Chee 2:42-54.

and inner skin, made of graphite and KEVLAR® aramid fibers, respectively, each wound with an epoxy resin. The inner skin was cured at 250°F then attached to an aluminum core using a reticulated adhesive film. The outer skin was then applied and co-cured with the core and inner skin. Chee notes that the fibers could also be pre-impregnated with resin, but teaches that using such fibers is more costly.[39]

Nakanishi relates to epoxy resin compositions containing an epoxy compound, a nitrile rubber, and a novolac phenol resin.[40] For some applications, the composition may be pre-cured.[41] The composition may be used as the resin for fiberglass-reinforced plastic.[42] It adheres strongly to metal and, once cured, has superior heat, impact, and chemical resistance.[43]

Scanlon relates to face sheets for use in acoustic abatement, commonly for gas turbine engines.[44] Scanlon FIG. 5 (right) illustrates an embodiment of the invention, in which the face sheet is formed as a laminate of two dry-woven mattes **40**, **42**. The



[39] Chee 3:54-4:18.
[40] Nakanishi 3:1-3.
[41] Nakanishi 5:13-17.
[42] Nakanishi 5:24-6:7.
[43] Nakanishi 6:8-11.
[44] Scanlon 1:8-15.

mattes **40**, **42** are commingled fibers of graphite and a thermoplastic resin (e.g., PEEK), interleaved with films **44**, **46**. The layers are heated under pressure in a mold until the material is cured.[45]

The examiner relies on Andre and admitted prior art to teach the claimed process apart from the interposing step. As previously discussed in the claim construction, we do not understand Airbus to be contesting that the other steps are in the prior art. Had the examiner enforced § 1.75(e), his burden in making the rejection would have been much simpler.

Rostami relates to polymer compositions, particularly those containing polysulphones.[46] According to Rostami, polysulphones and polyketones do not make good polymer blends, but adding a polyimide unexpectedly provides improved properties.[47] Such compositions may be used as the resin for making fiber-reinforced products, where the eligible fibers include fiberglass and graphite.[48] The compositions and fiber-reinforced products are good for applications where heat- and chemical-resistance are needed.[49] Rostami's EXAMPLE 1 involves blending a polysulphone with PEEK (a polyketone) and PEI (a polyimide).

Differences between the prior art and the claimed subject matter

Riel, Andre, and the admitted prior art do not teach the interposing step. Stephens, Chee, and Scanlon are concerned with making resin-fiber face sheets rather than improved bonding between the metal cloth and the

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[45] Scanlon 4:26-46.
[46] Rostami 1:8-14.
[47] Rostami 1:58-2:5.
[48] Rostami 7:10-23 and 7:60-8:4.
[49] Rostami 8:49-53.

face sheets. Nakanishi and Rostami are concerned with making resins for general applications without reference to acoustic panels.

The ordinary level of skill

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. We focus on what those of skill in the art know and can do.[50]

The specification, along with Riel and Andre, indicate that those in the art were conversant with the basic structure of acoustic panels used with jet engines. They knew that such panels must work in fairly extreme environments and thus need good physical properties, including resistance to mechanical stress and chemical corrosion. They knew that a variety of materials may be used for the different layers, with each material presenting advantages and disadvantages, both intrinsically and in its interaction with other materials.

Stephens, Chee, and Scanlon show that those in the art knew how to work with fiber-resin combinations for layers other than just the Helmholtz-cell layer. Indeed, it was known to make reinforcing face sheets that were themselves layers bonded together. Those in the art also knew that they could partially cure one component before co-curing it with another component.

Those in the art were familiar with the use of resins both as a component of fiber-resin materials and as adhesives. Chee and Scanlon

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[50] *Ex parte Jud*, 2006 WL 4080053 at *2 (BPAI) (rehearing with expanded panel). Airbus has not provided testimony regarding the level of skill.

show they knew to use resins cured together to perform both functions. Resin already on the fibers or additional resin could be used.

Nakanishi shows that those in the art could make and use epoxy-nitrile rubber-phenolic resin compositions. They would know that such resins could be used in making fiber-reinforced plastics or as superior metal adhesives.

Overall, the references and the background of the specification reveal considerable sophistication in the construction of acoustic panels for jet engines and in the use of resins in their construction.

Objective evidence of secondary considerations

Airbus does not rely on any objective evidence of secondary considerations.[51] We acknowledge the statement[52] in the specification that—

> It thus was discovered, in an unexpected manner, that when acoustic damping panels of the type mentioned above, are made with a honeycomb core flanked, on the one side, by a total reflector and, on the other side, by an acoustically resistive layer with two components according to the invention, that the presence of elastomer in the composition of the coating bath 1 leads to an elastic damping effect permitting absorbing the forces generated by shocks on the panel or during the use of these latter (torsion, flexure, etc . . .), these forces being absorbed in a manner that could not be achieved by the thermosetting resin because of its fragility. This is as much the properties of adherence of the nitrile-phenolic cement which are enjoyed, as its elastic properties.

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[51] Br. 12.
[52] Spec. 10:21-11:2.

There is no indication that the inventors took into consideration teachings in the art, such as those of Nakanishi, suggesting the use of a nitrile-phenolic cement as an adhesive for use with metal substrates. Moreover, the scope of the statement is narrower than claim 18, which is not limited to a honeycomb core or a nitrile-phenolic cement. Thus, although we credit the inventors' statement that the result was unexpected to them, we cannot give it much weight in view of its failure to account for pertinent teachings in the art and the broader scope of what is claimed versus what was discovered.

CONCLUSION

Obviousness is not limited to a literal combination of prior-art elements.[53] Rather the question is what a person having ordinary skill in the art would have expected in view of the combination of references. A person with skill in an art can reasonably be expected to apply techniques that work in one context to a problem in a related context.[54]

Those in the art knew how to co-cure resin-fiber face sheets with metal cloth. Such face sheets with openings literally meet the reinforcing structure limitation. Even if the reinforcing structure must be read to apply to the honeycomb cell layer, those skilled in art would have been able to cross apply the lessons of co-curing a face sheet and the metal cloth with the cell layer. The interposed component could itself be a resin-fiber face sheet.

The examiner has argued that the molecular interpenetration would be the inherent result of using the same resins that Airbus uses.[55] Airbus

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[53] *In re Etter*, 756 F.2d 852, 859, 225 USPQ 1, 6 (Fed. Cir. 1985) (en banc).
[54] *KSR Int'l*, 127 S. Ct. at 1731, 82 USPQ2d at 1389.
[55] E.g., Ans. 8.

counters that its broadest claims do not require those resins.[56] The short answer is that a claim is met if the claim encompasses those resins, as some dependent claims do. More significantly, however, since "molecular interpenetration" includes polymerization, no inherency theory is needed. Co-curing two resin compositions together such that they consolidate, even if one is partially cured already as in Chee, meets this limitation as well.

HOLDING

The final rejection of claims 18-38 is—

AFFIRMED

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[56] Reply 6.