Paper No. 45

UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

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Ex parte HORST HECKEL, DETLEF SKALETZ,
BRUNO WAGNER and JOACHIM HEYDWEILLER

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Appeal No. 1999-2601
Application 08/862,682

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ON BRIEF

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Before ABRAMS, MCQUADE, and NASE, Administrative Patent Judges.

MCQUADE, Administrative Patent Judge.

DECISION ON APPEAL

Horst Heckel et al. appeal from the final rejection of claims 2 and 5 through 12, all of the claims pending in the application.

THE INVENTION

The invention relates to a process for the production of fiber-reinforced composite material. Representative claim 5 reads as follows:

5. A process for the production of a fiber-reinforced composite material in an impregnation device, which, in order to form a filament band, comprises:

pulling a multiplicity of continuous filaments having single-filament diameters of 7 to 30 micrometers, which are arranged in parallel and tensioned, over heated spreader surfaces including a first spreader surface, the spreader surfaces and the filament band defining nips,

wherein the filament band upon entering the first spreader surface has a tension of from 5 N to 50 N per 4000 single filaments and a speed of at least 3 m/min, said tension and speed achieved by pulling the filament band,

feeding a thermoplastic polymer melt, having a viscosity of 105 to 2500 Pa·s, measured at a low shearing rate, through a feed opening in the device, wherein the feed opening for the melt is not in contact with the continuous filaments,

dragging the melt into the nips with the pulled filament band, which is brought into contact with the melt prior to the contact with the first spreader surface, wherein the tension and the speed of the band press melt through the band, thus effectively impregnating the filament band, and then

cooling the band to provide a solidifying melt impregnated filament band with a content of continuous filaments of from 5 to 70% by volume.

THE PRIOR ART

The references relied on by the examiner to support the final rejection are:

Hilakos	4,728,387	Mar. 1, 1988
Dyksterhouse et al. (Dyksterhouse)	4,894,105	Jan. 16, 1990
Glemet et al. (Glemet)	4,957,422	Sep. 18, 1990
Goldmann et al. (Goldmann)	5,002,712	Mar. 26, 1991
Montsinger	5,176,775	Jan. 5, 1993
Azari	5,268,050	Dec. 7, 1993
Marttila, European Patent Document	0 415 517 A1	Mar. 6, 1991

Bates, P. J. et al., "Pulling Tension Monitoring in Thermoplastic Pultrusion Prepregging/Compounding," Antec '91, 49th Annual Technical Conference In Search of Excellence, Society of Plastics Engineers & Plastics Engineering, Vol. 4, pp. 2047-2052 (May 5, 1991) (Bates).

THE REJECTIONS

Claims 2 and 5 through 12 stand rejected under 35 U.S.C. § 103 as being unpatentable over Azari in view of either Goldmann or Marttila, and further in view of Hilakos, Bates and Dyksterhouse.

Claims 2, 5, 7 through 9, 11 and 12 stand rejected under 35 U.S.C. § 103 as being unpatentable over Glemet in view of either Goldmann or Marttila, and further in view of Hilakos, Bates, Dyksterhouse and optionally Montsinger.

Claims 6 and 10 stand rejected under 35 U.S.C. § 103 as being unpatentable over Glemet in view of either Goldmann or Marttila, and further in view of Hilakos, Bates, Dyksterhouse, optionally Montsinger, and Azari.

Attention is directed to the appellants' main and reply briefs (Paper Nos. 38 and 40) and to the examiner's answer (Paper No. 39) for the respective positions of the appellants and the examiner with regard to the merits of these rejections.[1]

[1] The explanation of the first rejection in the answer (see pages 5 through 11) refers to Glemet even though Glemet is not included in the statement of the rejection. Where a reference is relied on to support a rejection, whether or not in a minor capacity, there is no excuse for not positively including the reference in the statement of the rejection. See In re Hoch, 428 F.2d 1341, 1342 n.3, 166 USPQ 406, 407 n.3 (CCPA 1970) and MPEP § 706.02(j). Accordingly, we have not considered Glemet in assessing the merits of the first rejection.

DISCUSSION

The appellants' specification indicates that the process set forth in the appealed claims is designed to produce fiber-reinforced composite materials made of thermoplastics having high molecular weight, which thermoplastics characteristically have high melt viscosity. According to the appellants, "[h]igh molecular weight improves recycling behavior because repeated melting results in a melt which, despite its oxidative and thermal degradation, is still in the high-molecular-weight region" (specification, page 2). In discussing the background art (see pages 1 through 4 in the specification), the appellants note that the use of highly viscous thermoplastics in the subject environment is problematic for reasons such as inadequate wetting of the fibers and low impregnation speeds. Regarding the asserted capacity of their invention to overcome these problems, the appellants explain that

> [i]t is surprising that such a good wetting of the fiber material, which was not believed to be possible, can be achieved at all using melts of high viscosity. It is particularly surprising that this effect is achieved at impregnation speeds which are substantially higher than those of EP 056703 for material of low viscosity.
>
> The principle underlying the invention is still unclear. Perhaps, as a result of the increased tension, the drag flow accompanying the filaments leads to the formation, in the vicinity of the curvatures of

> the spreader surfaces, of hydrodynamic wedges which generate a forced flow through the filament bundle. This is because it is favorable for the geometry of the spreader surfaces to be such that the nips defined by the spreader surfaces and the incoming band to be filled with melt and for the fiber bundles not to be brought into direct contact with the feed opening for the melt. The melt can be fed in at any desired point of the impregnating device of preferably undulatory design, provided the fibers do not come into contact with this point. . . .
>
> The process according to the invention is surprising in that it could not be expected that such high tensions on the fibers and the absence of contact between the fibers and the feed opening for the melt would permit the use of such highly viscous polymers and hence the achievement of such a high impregnation quality. What is particularly surprising is that the impregnation speeds achieved by this method are very much higher [specification, pages 3 and 4].

In accordance with the foregoing explanation, process claims 5 and 7, the two independent claims on appeal, require a thermoplastic polymer melt having a viscosity of 105 to 2500 PA·s measured at a low shearing rate, a filament tension upon entering the first spreader surface of from 5N to 50N per 4000 single filaments, a filament speed of at least 3 m/min, and a feed opening for the melt which is not in contact with the filaments. As conceded by the examiner (see pages 7 through 9 and 12 through 16 in the answer), Azari and Glemet, the primary references respectively applied to support the appealed rejections, fail to respond to at least the tension limitations. The examiner's

reliance on Bates to overcome this particular deficiency is not well taken.

Bates pertains to a study which monitored the force or tension required to pull a composite strand from the impregnation chamber and sizing die of a cross-head/thermoplastic pultrusion compounding system. According to the study, pulling tension may play a significant role in controlling fiber damage and resin impregnation, and may be indicative of what is occurring inside the impregnation chamber (see page 2047). The graphs illustrated in Figures 3 through 6 (see pages 2050 and 2051) depict experimental results showing the effects of various spreader pin quantities, spreader pin diameters and melt temperatures (i.e., viscosities) on the relationship between pulling force (tension) and speed. Of note is that the various experiments involve a common, constant entrance tension (see page 2048).

In the examiner's view (see pages 8, 9, 14, 15, 26 and 27 in the answer), Bates demonstrates that entrance tension as recited in claims 5 and 7 is an art-recognized, result-effective variable. From this, the examiner concludes that the specific entrance tension parameters set forth in these claims would have been obvious optimizations of this variable. Bates, however, demonstrates nothing of the sort. To the contrary, Bates'

teaching that the various experimental results reported therein stem from the same entrance tension belies the examiner's position.

The examiner's conclusion of obviousness also suffers from a lack of factual support for the determination (see page 27 in the answer) that Azari, and by implication Glemet, respond to the limitations in claims 5 and 7 requiring a feed opening for the melt which is not in contact with the filaments.

The foregoing flaws in the examiner's evidentiary showing find no cure in the further application of Goldmann or Marttila for their disclosures of specific filament diameters, Hilakos for its disclosure of a heated spreader surface, Dyksterhouse for its disclosure of the shear-thinning of high viscosity melts, and Montsinger for its disclosure of filament spreading prior to impregnation.

Accordingly, we shall not sustain the standing 35 U.S.C. § 103 rejection of claims 5 and 7, and dependent claims 2, 6 and 8 through 12, as being unpatentable over Azari in view of either Goldmann or Marttila, and further in view of Hilakos, Bates and Dyksterhouse, the standing 35 U.S.C. § 103 rejection of claims 5 and 7, and dependent claims 2, 8, 9, 11 and 12, as being unpatentable over Glemet in view of either Goldmann or Marttila,

and further in view of Hilakos, Bates, Dyksterhouse and optionally Montsinger, and the standing 35 U.S.C. § 103 rejection of dependent claims 6 and 10 as being unpatentable over Glemet in view of either Goldmann or Marttila, and further in view of Hilakos, Bates, Dyksterhouse, optionally Montsinger, and Azari.

SUMMARY

The decision of the examiner to reject claims 2 and 5 through 12 is reversed.

REVERSED

NEAL E. ABRAMS Administrative Patent Judge	)	
	)	BOARD OF PATENT
JOHN P. MCQUADE Administrative Patent Judge	)	APPEALS AND INTERFERENCES
JEFFREY V. NASE Administrative Patent Judge	)	

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