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Datasheet for the decision of 6 May 2025

Case Number: T 0014/23 - 3.2.05

Application Number: 18192972.0

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Language of the proceedings: EN

Title of invention:
Impregnation section of die and method for impregnating fiber rovings

Applicant:
Ticona LLC

Relevant legal provisions:
EPC Art. 84

Keyword:
Claims - clarity - main request, first and second auxiliary requests (no)

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Case Number: T 0014/23 - 3.2.05

D E C I S I O N
of Technical Board of Appeal 3.2.05
of 6 May 2025

Appellant: (Applicant)	Ticona LLC 8040 Dixie Highway Florence, KY 41042 (US)
Representative:	Marks & Clerk LLP 15 Fetter Lane London EC4A 1BW (GB)
Decision under appeal:	**Decision of the Examining Division of the European Patent Office posted on 4 August 2022 refusing European patent application No. 18192972.0 pursuant to Article 97(2) EPC.**

Composition of the Board:

Chairman	M. Holz
Members:	T. Vermeulen
	B. Burm-Herregodts

Summary of Facts and Submissions

I. The applicant (appellant) filed an appeal against the decision of the examining division to refuse European patent application No. 18 192 972.0 ("the application").

II. In the decision under appeal, the examining division concluded, *inter alia*, that the subject-matter of claim 1 according to the main request and auxiliary request 1 was not novel in view of the document EP 0 712 716 A1 (D2) and that the subject-matter of claim 9 according to the main request and auxiliary request 1 did not involve an inventive step in view of document D2 when taken alone.

III. With the statement of grounds of appeal the appellant filed sets of claims according to a main request, a first auxiliary request and a second auxiliary request.

IV. The appellant was summoned to oral proceedings before the board scheduled for 6 May 2025.

V. In a communication under Article 15(1) RPBA issued on 26 March 2025, the board set out its preliminary opinion that claim 1 of the main request and the first and second auxiliary requests did not define the matter for which protection was sought in a clear manner and that, therefore, the clarity requirement of Article 84 EPC was not met. Reference was made, in particular, to features 1.5 and 1.6 (see point IX. below).

VI. By letter dated 2 May 2025, the appellant filed a new set of claims to replace its first auxiliary request.

VII. Oral proceedings before the board were held by videoconference on 6 May 2025.

VIII. The appellant requested that the decision under appeal be set aside and a patent be granted on the basis of the set of claims of the main request filed with the statement of grounds of appeal or, alternatively, on the basis of the set of claims of the first auxiliary request filed with the letter dated 2 May 2025 or on the basis of the set of claims of the second auxiliary request filed with the statement of grounds of appeal. In the event that the board found that the subject-matter of claim 1 of the main request, the first auxiliary request or the second auxiliary request met the requirements of Article 54(1) EPC, it was requested that the case be remitted to the examining division for examination of inventive step in respect of the subject-matter of claim 1.

IX. Claim 1 of the main request, which the appellant considers identical to claim 1 of the main request underlying the impugned decision, has the following wording (the feature numbering used by the board appears in square brackets):

"[**1.1**] An impregnation section of a die (150) for impregnating a plurality of fiber rovings (142) with a polymer resin (214), the impregnation section comprising: [**1.2**] an impregnation zone (250) configured to impregnate the plurality of rovings (142) with the resin (214), [**1.3**] the impregnation zone (250) comprising a plurality of contact surfaces (252), each of the plurality of contact surfaces (252) being a

curved lobe, [**1.4**] wherein the contact surfaces are defined alternately on first and second surfaces (257, 259) such that the rovings alternately impinge on contact surface [*sic*] on the first and second surface, [**1.5**] and wherein the rovings pass the contact surface [*sic*] in a sinusoidal-type pathway, [**1.6**] and wherein each of the plurality of contact surfaces (252) is configured such that the plurality of rovings (142) traverse the contact surface [*sic*] (252) at an angle (254) in the range between 1 degree and 30 degrees; [**1.7**] and a gate passage (270) in fluid communication with the impregnation zone (250) for flowing the resin (214) therethrough such that the resin (214) impinges on a surface (216) of each of the plurality of rovings (142) facing the gate passage (270) and substantially uniformly coats the plurality of rovings (142), [**1.8**] the gate passage (270) extending vertically to the impregnation zone (250), [**1.9**] having a decreasing cross-sectional profile in a flow direction (244) of the resin (214), [**1.10**] and positioned upstream in a run direction (282) of the plurality of rovings (142) of any contact surfaces (252) of the impregnation zone (250)."

X. Claim 1 of the first auxiliary request, which the appellant considers identical to claim 1 of auxiliary request 1 underlying the impugned decision, differs from claim 1 of the main request in that feature 1.6 has been amended as follows:

"[**1.6'**] and wherein each of the plurality of contact surfaces (252) is configured such that the plurality of rovings (142) traverse the contact surface [*sic*] (252) at an angle (254) in the range between ~~1~~—5 degree<u>s</u> and 30 degrees;"

XI. Claim 1 of the second auxiliary request differs from claim 1 of the first auxiliary request in that feature 1.3 has been amended as follows:

"[**1.3'**] the impregnation zone (250) ~~comprising~~ consisting of a plurality of contact surfaces (252), each of the plurality of contact surfaces (252) being a curved lobe,"

XII. The appellant's submissions may be summarised as follows.

Main request

In the impugned decision, the examining division incorrectly concluded that the fibre rovings of document D2 followed a sinusoidal-type pathway. A sinusoidal wave required a constant amplitude and wavelength. However,the rovings of document D2 passed the contact surfaces in a pathway with an oscillation of decreasing amplitude. Such a damped sine wave did not conform with a sine wave and was not therefore sinusoidal. The person skilled in the art reading paragraph [0062] of the application as filed was taught that the reason for the pathway being sinusoidal was to enhance shear. Figures 4 and 13 of the application as filed clearly showed that the rovings impinged on the contact surfaces 252 due to the sinusoidal pathway and this enhanced impregnation of the resin into the roving. This would not occur in a pathway having a damped sine-wave form, where the rovings would follow a straight path by the end of the channel. Moreover, the suffix "type" in the term "sinusoidal-type" of feature 1.5 of claim 1 of the main request did not broaden the meaning of the term "sinusoidal" to the extent suggested by the examining division in the

impugned decision. It would be clear to the skilled person that the suffix "type" was used simply on account of the potential effect of the contact surfaces 252 on the pathway. As a result of the curved shape of the contact surfaces 252, some slight deviations from a pure sine-wave form were possible. This explained why the rovings shown in Figures 15 to 17 of the application as filed had straight sections and circular arcs. A "sinusoidal-type" pathway was thus an essentially sinusoidal pathway, as also shown in Figures 15 to 17 of the application as filed. It must also be considered that the term "sinusoidal" described the pathway in which the rovings moved and not the rovings or their trajectory *per se*. The pathway was the path or channel formed between the first and second surfaces 257, 259 of the impregnation zone. It was clear, for example from Figure 4 of the application as filed, that this pathway was sinusoidal. In the embodiment of Figures 15 to 17 of the application as filed, the pathway referred to the shape of the channel formed between the pins 260.

Regarding feature 1.6 of claim 1 of the main request, it was clear to the skilled person who was aware of the alternating arrangement of the contact surfaces on first and second surfaces (see feature 1.4) that the angle was measured with respect to a horizontal plane, as shown, for example, by the horizontal line in the cross-sectional view of Figure 4 of the application as filed. Further support for this understanding could be found in paragraphs [0060] and [0063] of the application as filed. Figure 4 of the application as filed illustrated that the angle was measured at the point where the horizontal line crossed the contact surface. The tension in the fibre rovings should be such that the angle requirement was met.

In sum, features 1.5 and 1.6 of claim 1 of the main request were clear and the requirements of Article 84 EPC were met.

First and second auxiliary requests

The same arguments applied in respect of claim 1 of the first and second auxiliary requests, both of which therefore complied with Article 84 EPC.

Reasons for the Decision

1. The invention is concerned with the impregnation of fibre rovings with a polymer resin. It seeks to improve existing solutions by providing the strength, durability and temperature performance demanded by a particular application (paragraph [0005] of the application as filed). To this end, the fibre rovings are supplied to a die having an impregnation zone of a particular geometry that forces the polymer resin generally transversely through the rovings by shear and pressure. As a result, the degree of impregnation is significantly enhanced (paragraph [0044] of the application as filed).

Main request - lack of clarity (Article 84 EPC)

2. Claim 1 of the main request defines an impregnation section of a die comprising an impregnation zone configured to impregnate a plurality of fibre rovings with a polymer resin (features 1.1 and 1.2). The geometry of the impregnation zone is restricted by features 1.3 to 1.6.

3. The impregnation zone comprises a plurality of contact surfaces, each being a curved lobe (feature 1.3). These contact surfaces are arranged alternately on first and second surfaces such that the rovings passing through the impregnation zone alternately "impinge on contact surface [*sic*] on the first and second surface" (feature 1.4). This is understood to mean that, as a consequence of the arrangement of the curved lobes, fibre rovings make contact with lobes on the first surface and lobes on the second surface in an alternating manner.

4. The impregnation zone is further defined by the requirement that "the rovings pass the contact surface [*sic*] in a sinusoidal-type pathway" (feature 1.5). Similarly to the case of feature 1.4, this is understood to be a consequence of the arrangement of the contact surfaces or curved lobes. Through the contact with the different lobes, fibre rovings pass the lobes along a path that has a sinusoidal-type shape.

5. It is this latter requirement that forms the basis of the appellant's grievance with the decision under appeal. The appellant essentially disputes the examining division's broad understanding of the term "sinusoidal-type", which led to the conclusion of lack of novelty over document D2 (see point 14 of the reasons for the impugned decision).

6. The appellant essentially argues that the pathway of the fibre rovings passing through the die of document D2 has an oscillation of decreasing amplitude and non-

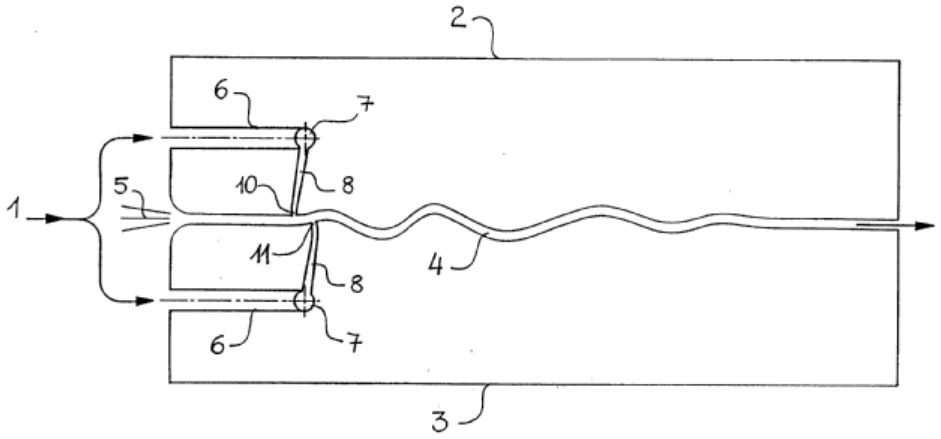

Figure 1 of document D2

constant wavelength, which does not conform to a sine wave and is not therefore sinusoidal.

7. In the board's view, the term "sinusoid" has a well-established meaning in mathematics: it is a curve with the general form $f(x) = A.\sin(\omega.x + \varphi)$, i.e. which is similar to the sine function, but is possibly shifted in phase, period, amplitude, or any combination thereof. As a consequence, the appellant is correct when arguing that a damped sine wave is not a sinusoidal function.

8. However, feature 1.5 of claim 1 does not use the term "sinusoidal" but "sinusoidal-type" to define the pathway of the fibre rovings. The examining division held, in point 14 of the reasons for the impugned decision, that the expression "sinusoidal-type waveform" was broader than "sinusoidal waveform", and included, *inter alia*, waveforms with varying amplitude. The appellant disagrees and submits that the suffix "-type" is only used to account for slight deviations from the pure sine-wave form due to contact of the fibre rovings with the curved lobes.

9. By arguing that deviations are possible, the appellant acknowledges that the expression "sinusoidal-type waveform" is broader than "sinusoidal waveform". The question at issue is: how much broader is it?

10. The wording of claim 1 of the main request does not provide an answer to this question. Nor has the appellant convincingly demonstrated that the skilled person would have understood what limitations were imposed on the claimed subject-matter by use of the term "sinusoidal-type". Moreover, the term "sinusoidal-type" only appears once in the description of the application as filed, namely in paragraph [0062], in the context of the embodiments of Figures 4, 13 and 15 to 17 and as part of a list of three possible pathway forms ("waveform, tortuous, sinusoidal-type"). No definition or explanation of the term "sinusoidal-type" is given in this context.

11. In the absence of any answer to the above question, it must be concluded that the appellant's argument that the deviations from a pure sine-wave form are to be restricted to the region of contact with the curved lobes is speculative and therefore without merit. The embodiments of Figures 15 to 17 of the application as

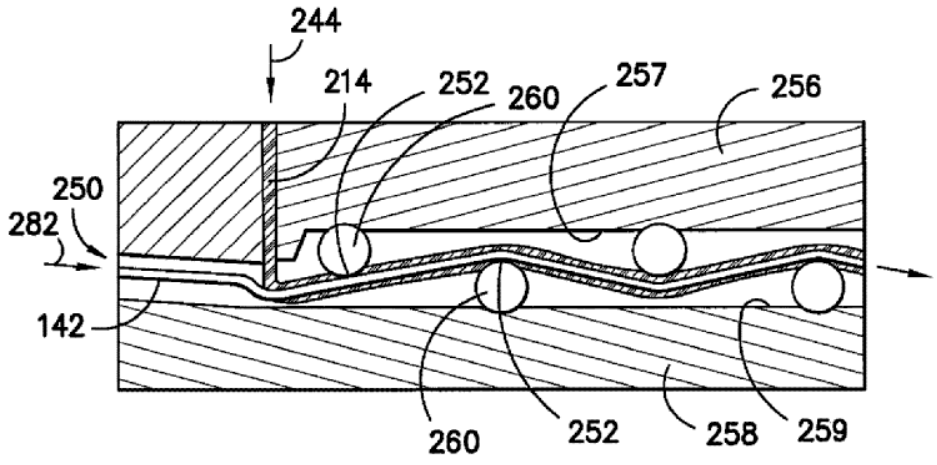

Figure 15 of the application

filed, which - according to the appellant - show essentially sinusoidal pathways, illustrate fibre rovings 142 following a pathway with straight sections between the contact surfaces of cylindrical pins 260. This goes against the premise that only slight deviations at the contact surfaces are permitted by the claim wording. Even if, as the appellant argues, a sinusoidal-type pathway is to be understood as an essentially sinusoidal pathway, the limitations resulting from the use of "essentially" are unclear.

12. In a further line of argument, the appellant refers to Figure 4 of the application as filed to corroborate its position that feature 1.5 applies to the pathway in which the rovings move and not to the rovings or their trajectory *per se*. However, this still does not explain how the term "sinusoidal-type" is to be understood. Moreover, Figures 15 to 17 of the application as filed, for example, show a substantially straight channel formed by the surfaces 257, 259, which is unrelated to the actual pathway of the fibre rovings. The understanding of "pathway" as the path or channel formed between the first and second surfaces of the impregnation zone also contradicts the appellant's argument that it is the contact of the fibre rovings with the curved lobes that produces possible deviations from the pure sine-wave form of the pathway.

13. It follows from the above that the skilled person would be left in doubt when considering which limitations the expression "sinusoidal-type pathway" of feature 1.5 imposes on the impregnation section of a die of claim 1 of the main request.

14. The uncertainties regarding the pathway of the fibre rovings and the difficulties they present for understanding the claimed subject-matter are reinforced by the requirement of feature 1.6 that each of the plurality of contact surfaces is to be configured such that the plurality of rovings traverse the contact surface at an angle in the range between 1 degree and 30 degrees. Claim 1 of the main request does not provide any information on how this angle should be measured. Even if, as the appellant argues, a horizontal plane running through the impregnation zone were to be used as a reference, the skilled person would be left to guess the point of the pathway at which the angle should be within the claimed range. The appellant suggests that the angle is measured at the point where the horizontal line crosses the contact surface in Figure 4 of the application as filed. However, such information is not actually apparent from the schematic figure or from its detailed description, let alone from the claim wording. Furthermore, other factors, such as the tension applied to the fibre rovings, may affect the angle at which the fibre rovings traverse the contact surfaces, thus raising further doubt as to how the contact surfaces must be configured to comply with the requirement of feature 1.6.

15. In sum, as neither feature 1.5 nor feature 1.6 is clear, claim 1 of the main request does not define the matter for which protection is sought in a clear manner, contrary to the requirements of Article 84 EPC.

First and second auxiliary requests - lack of clarity (Article 84 EPC)

16. The only difference between claim 1 of the first auxiliary request and claim 1 of the main request lies in the change of the lower limit of the range of feature 1.6 from 1 degree to 5 degrees (see point X. above). Feature 1.5 remains unamended in claim 1 of the first auxiliary request. As a consequence, the lack of clarity discussed in points 8. to 13. above persists in claim 1 of the first auxiliary request. Moreover, the amendment to feature 1.6 does not remedy the clarity issue discussed in point 14. above.

17. Claim 1 of the second auxiliary request has, furthermore, been amended by replacing the term "comprising" in feature 1.3 by "consisting of" (see pointXI. above). The clarity issues discussed in the context of the main request have thus not been overcome in claim 1 of the second auxiliary request either.

18. Therefore, the requirements of Article 84 EPC are not met for claim 1 of the first and second auxiliary requests.

Conclusion

19. Since none of the requests on file is allowable, the appeal must be dismissed.

Order

For these reasons it is decided that:

The appeal is dismissed

The Registrar: The Chairman:

N. Schneider M. Holz

Decision electronically authenticated