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File Number: T 301/89 - 3.2.2

Application No.: 82 301 295.0

Publication No.: 0 061 273

Title of invention: Manufacture of springs of fibre reinforced composite material

Classification: B29C 43/20, F16F 1/18

D E C I S I O N
of 27 January 1992

Proprietor of the patent: GKN Technology Limited

Opponent: I BASF Aktiengesellschaft
II Metzeler GmbH

Headword:

EPC Article 56

Keyword: "Plurality of problems"
"Contribution of the problem to the inventive step"
"Inventive step (yes)"

Headnote



Case Number : T 301/89 - 3.2.2

D E C I S I O N
of the Technical Board of Appeal 3.2.2
of 27 January 1992

Appellant :
(Proprietor of the patent)

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Respondent II:
(Opponent 02)

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Decision under appeal :

**Decision of Opposition Division of the European
Patent Office dated 17 January 1989, notified on
27 February 1989, revoking European patent
No. 0 061 273 pursuant to Article 102(1) EPC.**

Composition of the Board :

Chairman : G. Szabo
Members : P. Dropmann
L. Mancini

Summary of Facts and Submissions

- I. European patent No. 0 061 273 comprising five claims was granted on 5 November 1986 on the basis of European patent application No. 82 301 295.0 filed on 15 March 1982.

Claim 1, the only independent claim, is worded as follows:

"A method of manufacturing leaf springs from a fibre reinforced resin composite material said springs comprising, at least on the outer surfaces opposite the neutral bending axis thereof, fibres (13) extending longitudinally of the springs, said method including the steps of forming a resin impregnated fibre assembly (13, 14) of a number of individual springs alongside one another, subjecting the assembly to a moulding process including treatment to cure the resin, and cutting the cured assembly along at least one longitudinal cutting line (15) into individual springs characterised in that the assembly is formed in the moulding process with depressions extending in said outer surfaces thereof along said line or lines (15) where the assembly is to be cut."

- II. Two oppositions were filed against this patent on the ground of lack of inventive step (Article 100(a) EPC).

The following documents were considered in the opposition proceedings:

(D1) US-A-3 900 357,

(D2) NL-A-7 901 625 (corresponding to US-A-4 351 788 published after the priority date of the patent in suit),

- (D3) DE-A-2 434 779,
- (D4) EP-A-0 054 208 (falling under Article 54(3) EPC),
- (D5) DE-A-519 482, and
- (D6) US-A-1 839 699.

III. By its decision taken at the oral proceedings on 17 January 1989 and notified on 27 February 1989, the Opposition Division revoked the patent. It was held that the method according to Claims 1 and 2 as granted did not involve an inventive step for the following reasons:

In view of the closest state of the art represented by document D1 the technical problem to be solved by the invention was to increase the long-term durability of the individual leaf springs. Since the skilled man knew that stresses in an article, which was subjected to bending, concentrated at sharp corners or edges, he would have applied his general knowledge to provide the leaf springs with edges which were not sharp. As the springs were moulded, the skilled man would obviously have provided the assembly in the moulding process with depressions where the cutting into individual springs was to take place. This would have provided the edges of the spring directly with unsharp contours and eliminated an additional step for shaping after the cutting had taken place.

IV. On 26 April 1989, a Notice of Appeal was filed against the decision of the Opposition Division. The appeal fee was paid on the same date. The Statement of Grounds was received on 6 July 1989.

In this statement, the Appellant (Proprietor of the patent) essentially argued that:

- (a) a substantial procedural violation had occurred in respect of the decision of the Opposition Division

taken at the oral proceedings without the opportunity being given to the Proprietor to counter the reasoning of the Opposition Division in reaching its decision to revoke the patent,

- (b) the technical problem should be seen in providing springs in which surface fibres were not severed and were maintained in the required density and alignment, in view of the discovery that the severed fibres were a source of cracks,
- (c) the problem perceived and overcome by the Proprietor had not been recognised hitherto, thus giving rise to patentable subject-matter in view of decision T 2/83, "Simethicone Tablet/RIDER", OJ EPO 1984, 265,
- (d) the disposition and orientation of fibres within a component made of fibre-reinforced resin material was an important factor, and
- (e) a technical prejudice had existed against the provision of depressions in the fibre-resin assembly of springs by moulding.

V. In contesting these arguments, Respondent I (Opponent 01) submitted that:

- (a) the problem of avoiding the severance of the surface fibres as stated by the Appellant appeared to be artificial and it was more obvious to formulate the problem on the basis of a need to facilitate the sawing of the cured assembly,

- (b) it was obvious in the light of document D2 or D6 to solve the problem of facilitating the sawing by providing depressions in the surface layers during moulding of the assembly,
- (c) the problem considered by the Opposition Division in the decision under appeal could be overcome in an obvious manner as set out in this decision,
- (d) the subject-matter of Claim 1 could not be considered as a "problem invention" since the requirement set out in paragraph 6 of decision T 2/83 (no "one-way-street" situation) was not met,
- (e) it was not surprising that by providing said depressions the problem stated by the Appellant was also simultaneously, solved, and
- (f) no real technical prejudice, which was generally known and well accepted in the art, existed against the provision of depressions.

Opponent 02 did not file any submissions during the appeal proceedings.

VI. The Appellant requests that the decision under appeal be set aside and the patent be maintained on the basis of Claims 1 to 5 as granted or on the basis of the conditional submission filed with the Statement of Grounds. In addition, refund of the appeal fee is requested if the appeal is successful.

The Respondent requests that the appeal be dismissed.

Reasons for the Decision

1. The appeal is admissible.
2. The Board is satisfied that the method according to Claim 1 as granted is novel with regard to each document cited in the proceedings. Since novelty was not disputed, detailed arguments need not be given.
3. Closest state of the art

Following the finding of the Opposition Division and in line with the parties, the Board accepts that document D1 represents the closest state of the art.

This document is concerned with a method of manufacturing leaf springs of composite fibre-reinforced resin material, wherein the springs may have, at least in surface layers spaced apart from one another about the neutral bending axis of the spring, fibres which extend substantially longitudinally of the springs. The method includes the step of forming a resin impregnated fibre assembly which is of a size corresponding to a number of individual springs disposed alongside one another. The impregnated fibre assembly is subjected to a moulding process including treatment to cure the resin, and is then cut into individual springs along longitudinal cutting lines (cf. in particular Figure 13).

4. Problem and solution

The Appellant is of the opinion that the technical problem should be seen in providing springs in which surface fibres are not severed and are maintained in the required density and alignment, in view of the discovery that otherwise cracks appear in the material on prolonged use sooner than without severed fibres.

In contrast to this, the Respondent is of the opinion that a technical problem was already apparent in a need to facilitate the sawing operation, i.e. to saw the cured assembly into individual springs in an expedient manner.

The Opposition Division, on the other hand, considered in the decision under appeal that the technical problem was to increase the long-term durability of the individual leaf spring.

The Board is not convinced that the skilled person would have formulated the particular problem set out by the Respondent without the benefit of hindsight. The slicing of the cured assembly mentioned in document D1 neither appears to cause any difficulty or calls for any modification, nor does the solution, i.e. the depressions, influence the sawing action to any significant degree.

Nevertheless, all of these problems will be considered by the Board when dealing with the question of inventive step.

The problems are solved in accordance with Claim 1 as granted by forming the spring assembly in the moulding process with depressions extending in the outer surfaces along the lines where the assembly is to be cut.

5. Inventive Step

- 5.1 The Board is of the opinion that the prior art does not give any indication as to the problem discovered and formulated by the Appellant, in particular that of avoiding the severance of the surface fibres. It is true that the skilled man might carry out micrographic examinations when noticing failures of the springs in service. However, even if he discovered that severed

fibres provide a starting point for failure of the spring, this would not necessarily mean that such failure was due to the severance of the surface fibres during cutting of the cured resin impregnated fibre assembly at the manufacturing stage. There may be other reasons, e.g. a lack of adherence of the fibres to the matrix. The Board, therefore, considers that the problem could not have been posed by the average person skilled in the art.

Hence, the perception of the problem already represents a contribution to the inventive step.

The Respondent's argument that, in view of paragraph 6 of the decision T 2/83 (ibid.), the patent in suit was no "problem invention" cannot be accepted. The modification of the prior art method was not, as will be reasoned in paragraphs 5.2 and 5.3 below, necessarily achieved in a "one-way-street" manner as the obvious solution of some other problems, e.g. the above two problems formulated by the Respondent and the Opposition Division, respectively.

In addition to the relevance of the discovery of the problem stated by the Appellant, its solution also contributes to the inventive step. Faced with this problem, the person skilled in the art would, first of all, have thought of avoiding altogether the cutting step of the method known from document D1 by manufacturing the leaf springs individually and not via an assembly of a number of springs alongside one another. Even if this is not very attractive for economic reasons, it should be borne in mind that none of the state of the art documents mentioned in the proceedings is concerned with the severance of fibres of a composite material (document D4 falling under Article 54(3) EPC cannot be considered when assessing inventive step). With the exception of

documents D1 and D3, the documents have nothing to do with fibre reinforced material. Even document D3 is silent as to any cutting step or longitudinal fibre orientation. Thus, none of the revealed prior art documents gives any indication as to how the problem could be solved even if the problem were known.

- 5.2 As to the argument presented by the Respondent that the requirement to facilitate the sawing operation leads to the claimed subject-matter, the following observations can be made in addition to those which were already made above concerning the raising of the problem itself (cf. Point 4):

The Respondent suggests that it is obvious in the light of document D6 or D2 to solve this problem by forming, during the moulding process, depressions extending in the outer surfaces of the spring assembly, along the lines where the assembly is subsequently to be cut into individual springs.

Document D6 describes a method of making toothbrush handles in which a blank of pyroxylin material is moulded to provide a group of handles separated by very small and exceedingly thin fins, the handles being readily separable from each other by breaking the fins preferably by a slight pressure of the fingers. This document thus shows that an assembly made of a material having no fibre reinforcement is provided during moulding with lines of, advantageously, extremely reduced thickness where it is to be broken into individual parts. However, it does not give any hint in the direction of facilitating sawing or cutting of a fibre reinforced resin composite material. Indeed, such a reduction of the thickness as suggested in document D6 would necessarily lead to changes of the disposition of fibres in the vicinity of the depressions

formed in the spring assembly, which disposition and orientation of fibres are an important factor in fibre reinforced leaf springs as pointed out by the Appellant during the opposition and appeal proceedings. Such changes might have represented a risk in respect of the expected performance of the springs.

Similarly, document D2 does not suggest to the skilled person that he could solve the problem of facilitating the sawing operation by the provision of depressions in the spring assembly. This document relates to the manufacture of tiles by cutting mouldings of the desired tile size from a continuous extrusion of ceramic material. Before hardening, the extruded material is provided with shaped vertical surfaces defining two of the tiles sides. The extrusion is severed by wire cutters along a vertical groove formed when the vertical surfaces are formed. Again, this document is not concerned with fibre-reinforced material. The skilled person knowing the importance of fibre orientation and disposition in composite materials would not look to materials for which such considerations do not arise.

Thus, the Board cannot accept the Respondent's submission that, in view of the problem of facilitating the sawing operation of the method known from document D1, the formation of depressions in a spring assembly made from fibre reinforced material is obvious.

- 5.3 In the decision under appeal, the Opposition Division considered that the technical problem was to increase the long-term durability of the individual leaf springs and argued in the way set out in paragraph III above.

If it can be assumed on the basis of common general knowledge that flexing stresses concentrate at sharp

corners and edges and that unsharp edges are therefore desirable for leaf springs the skilled person would, as suggested by the Appellant, probably first of all think of providing the curved or otherwise chamfered edges on the springs by a mechanical operation, e.g. milling, after the individual springs have been cut from the cured assembly. The question whether or not the skilled man would, in an obvious manner and for economical reasons as suggested by the Opposition Division, also consider to provide the assembly, which is to be cut into individual springs, with depressions at the cutting lines already during the moulding process, cannot be answered in the affirmative by the Board. The disposition of fibres in springs made of fibre-reinforced resin material is at least as important as the shape of the springs. Thus the skilled person would not, as a necessity, choose this way to shape the edges. The selection of this particular manner was not obvious in the absence of knowledge about the real advantage and in view of risks already mentioned.

In view of the great importance of the fibre disposition and orientation, it was not a "one-way-street" to modify the moulding process in the suggested manner, in particular since such depressions would necessarily influence the disposition of the fibres near the depressions in an unpredictable manner.

- 5.4 For the reasons set out above, the method according to Claim 1 as granted involves an inventive step having regard to Article 56 EPC, irrespective of which of the stated technical problems is used as a starting point when assessing inventive step.

6. Request for reimbursement of the appeal fee

The Appellant requests refund of the appeal fee on the ground that a substantial procedural violation occurred in respect of the decision of the Opposition Division given at the oral proceedings since no opportunity was provided for him to argue against the line of reasoning by which the Opposition Division reached its decision to revoke the patent.

The Board is not convinced that the Appellant did not have the opportunity to counter the line of reasoning during the oral proceedings before the Opposition Division. It is normal practice to have arguments and counterarguments in turn. If the Appellant is surprised by a line of reasoning or a statement, he could request the Board for time to consider the point and even for a short adjournment to consult members of his team or his client. At least the Appellant could have expressed his views on this point. In the absence of such moves, there is no reason for the assumption that a substantial procedural violation occurred during those proceedings.

Hence, there is no basis for reimbursement of the appeal fee in accordance with Rule 67 EPC.

For these reasons, it is decided that:

1. The decision under appeal is set aside.
2. The patent is maintained as granted.

3. The request for reimbursement of the appeal fee is rejected.

The Registrar:

The Chairman:



S. Fabiani


G. Szabo