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**Datasheet for the decision
of 25 September 2019**

Case Number: T 1702/14 - 3.2.05

Application Number: 03077403.8

Publication Number: 1388409

IPC: B29C57/06, B29C57/00, F16L9/12,
B29C61/02

Language of the proceedings: EN

Title of invention:

Apparatus and method for post-forming thermoplastic ducts

Patent Proprietor:

The Boeing Company

Opponents:

Airbus SAS (FR) / Airbus Opérations SAS (FR) / Airbus
Operations Ltd (GB) / Airbus Operations GmbH (DE) /
Airbus Operations S.l. (ES)

Headword:

Relevant legal provisions:

EPC 1973 Art. 56
RPBA Art. 13(1), 13(3)

Keyword:

Late-filed request - admitted (yes)

Inventive step - main request (yes)

Decisions cited:

Catchword:



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Case Number: T 1702/14 - 3.2.05

D E C I S I O N
of Technical Board of Appeal 3.2.05
of 25 September 2019

Appellant: The Boeing Company
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Decision under appeal: **Decision of the Opposition Division of the
European Patent Office posted on 11 June 2014
revoking European patent No. 1388409 pursuant to
Article 101(3) (b) EPC.**

Composition of the Board:

Chairman O. Randl
Members: P. Lanz
T. Karamanli

Summary of Facts and Submissions

- I. The patent proprietor lodged an appeal against the decision of the opposition division to revoke European patent No. 1 388 409 ("the patent").
- II. During the opposition proceedings, the joint opponents had raised the grounds for opposition according to Article 100(a) EPC in conjunction with Article 54 or Article 56 EPC (lack of novelty and lack of inventive step), as well as Articles 100(b) and 100(c) EPC.
- III. Oral proceedings were held before the board of appeal on 25 September 2019.
- IV. The appellant (patent proprietor) requested that the decision under appeal be set aside and that the patent be maintained as amended on the basis of the claims of the main request filed by letter dated 15 February 2019, or of auxiliary request 1 or 2, filed as the main request and the first auxiliary request, respectively, with the statement setting out the grounds of appeal.
- The joint respondents (joint opponents) requested that the appeal be dismissed.
- V. The documents referred to in the appeal proceedings include the following:

D2: DE 27 32 492;

D3: US 3,982,871;

D4: DE 37 34 343;

D8: DE 1 704 240;

D12: WO 01/54887;

D14: DE 39 20 814.

VI. Claim 1 according to the main request reads as follows:

"An apparatus (10, 10a, 150, 200, 200a) for thermoplastically forming a contour in a thermoplastic duct (12) defining a passage (13), the apparatus comprising:

a collar (20) extending longitudinally from a first end (22) to a second end (24) and having an inner surface (26) extending at least partially between said first and second ends, said inner surface defining a cavity (28);

an inner support structure (90) extending longitudinally in said cavity of said collar and having an outer surface (92) opposing said inner surface of said collar;

wherein:

an expansion member (130,144) disposed between said inner and outer surfaces and extending at least partially around said inner support structure;

said collar defines a mold contour (34);

said expansion member is formed of an elastomeric material and said inner support structure defines a channel (142) for receiving said expansion member, a width of said channel being adjustable in the longitudinal direction of said collar to compress said expansion member in the longitudinal direction and urge said expansion member radially toward said mold contour such that said expansion member is configured to expand radially and urge the formation portion (16) of the duct radially outward against said mold contour;

the apparatus further comprises at least one heater (50, 120, 148,164) configured to heat the formation portion of the duct to at least a formation temperature;

said inner support structure comprises a first portion (94) and a second portion (96), said first portion defining a face (100) directed in the longitudinal direction and an aperture (102) in said face configured to at least partially and longitudinally receive said second portion, said second portion and said face defining said channel for receiving said expansion member, such that insertion of said second portion into said first portion adjusts the width of said channel; wherein said second portion and said face define the channel for receiving said expansion member, such that insertion of said second portion into said first portion adjusts the width of said channel and thereby expands said expansion member radially and urges the formation portion of the duct radially outward and said mold contour to thermoplastically form the duct; and said at least one heater comprises a plurality of heaters extending at least partially through said inner support structure."

VII. The arguments of the appellant can be summarised as follows:

Admission of the appellant's main request

The main request had been filed well before the oral proceedings in reaction to the board's communication under Article 15(1) RPBA. The amendments to the claims of this request consisted in the deletion of the method claims as granted and the combination of the granted apparatus claims 9, 10, 14, 19 and 21 in accordance with their dependencies. These amendments simplified

the case as they dealt with all formal objections raised under Articles 83, 84 and 123(2) EPC and did not raise any new issues. The only subject which remained to be discussed was the contested issue of inventive step in view of the inclusion of the heater within the support structure. This did not constitute a new line of defence so that the respondents' attacks still applied. For these reasons, the present main request was to be admitted into the proceedings.

Inventive step

Document D3 formed the closest prior art. The forming apparatus of document D3 as shown in Figures 3 and 4 did not comprise an inner support structure having a two-part design. Moreover, there were no integrated heaters. Rather, the tube end to be deformed and the mandrel were pre-heated before the deformation (see D3, column 3, lines 36 to 38). The subject-matter of claim 1 differed from document D3 *inter alia* in the feature of the at least one heater comprising a plurality of heaters extending at least partially through the inner support structure.

As disclosed at the beginning of paragraph [0028] of the patent, the technical effect of this difference was to enable a heating of the formation portion of the duct concurrently with its expansion.

Starting from document D3, the objective technical problem to be solved was how to provide heat to the formation portion of the duct during the formation of the bead.

The present invention solved this problem in accordance with claim 1 by providing a plurality of heaters

extending at least partially through the inner support structure. The claimed heaters were configured to heat the forming portion of the duct during the forming operation. This was particularly advantageous for fibre-reinforced thermoplastic ducts since the stress induced by the deformation was reduced. Document D14 could not render obvious the claimed solution. According to this prior art document (see in particular Figures 3a and 3b), the heater 7 was placed within the tube end. Then the heater was withdrawn before the moulding was completed. Since this known arrangement required the heater to be withdrawn from the formation portion before the forming step, it did not allow for a heating during the deformation of the duct. The term "inner support structure" of claim 1 had a technical meaning. According to the invention, the inner support structure served as a reaction surface during the deformation of the duct. By contrast, the heater 7 of document D14 did not support the pipe during the deformation (as it was already retracted at this stage). It could therefore not be considered an inner support structure in the sense of the contested claim. For these reasons, document D14 could not provide any incentive for having a plurality of heaters extending at least partially through the inner support structure. The teaching of document D14 was to take away the heaters during the step of forming the contour. In view of this, a combination of documents D3 and D14 could not render obvious the subject-matter of claim 1. As regards document D8, this prior art showed in Figure 1 that the heating was positioned in the outer part and not in the inner part of the apparatus. Additionally, the inner part did not have the two-part structure as in the present claim. A combination of document D3 with document D8 would have motivated the skilled person to provide the heating in the collar portion since this

was less complex than having the heaters extending through the inner structure, as required in the present claim. Hence, a combination of documents D3 and D8 could not render obvious the subject-matter of claim 1. Document D12 (see Figures 1 and 2) was directed to a further alternative, according to which a heating fluid was circulated in the outer mould part; the inner mould part did not have the two-part design and the heaters as defined in the contested claim. The subject-matter of claim 1 was therefore inventive over a combination of documents D3 and D12.

Similar to document D3, the tube end of document D2 was pre-heated before the deformation (see D2, column 3, lines 17 to 22 and claim 1). The subject-matter of claim 1 therefore differed from document D2 in the feature of the at least one heater comprising a plurality of heaters extending at least partially through the inner support structure. In view of the similarities of the disclosure of documents D2 and D3, the reasoning set out above for a combination of document D3 with any of documents D14, D8 or D12 equally applied if document D2 was used as starting point and combined with any of documents D14, D8 or D12. The subject-matter of claim 1 was thus not obvious in view of a combination of document D2 with documents D14, D8 or D12.

Document D4 was a less promising starting point as it related to the forming of a wet-laid pipe of thermosetting polyester resin to be cured (see D4, column 3, lines 13 to 19 and lines 37 to 45) and not to the deformation of a thermoplastic pipe as in the contested claim. The curing of the pipe of document D4 was done in an autoclave and not by heating the pipe in the forming apparatus. There was no indication that the

heaters of document D14 were suitable for curing the resin of document D4. There was thus no reason why the skilled person should have provided the inner support structure with a plurality of heaters. The subject-matter of claim 1 was thus inventive in view of a combination of document D4 with any of documents D14, D8 or D12.

Finally, document D14 was even more remote from the claimed subject-matter since it did not disclose an inner support structure having two parts movable relative to each other, an expansion member formed of an elastomeric material (see Figures 6a to 6c of D14 for the design of the expansion member) and the heaters extending through the inner support structure. Furthermore, the apparatus of Figure 3b of document D14 was directed to the formation of a flange and not suitable for pushing the duct into a mould contour. A combination of documents D14 with any of documents D2, D3 or D4 could not render obvious the subject-matter of claim 1.

In summary, the subject-matter of claim 1 was based on an inventive step.

VIII. The respondents' submissions may be summarised as follows:

Admission of the appellant's main request

The amended main request could have been submitted together with the statement setting out the grounds of appeal. The fact that the amendments consisted in the combination of granted claims demonstrated that this request could have been filed earlier. Instead, the appellant had initially defended the patent by adding

the aspects of the rod heaters. The new main request changed the appellant's case at an advanced stage of the appeal proceedings. Moreover, the new main request was not considered a direct reaction to the board's communication. For these reasons, the present main request should be not admitted into the proceedings.

Inventive step

Any of documents D2, D3, D4 or D14 were possible starting points for challenging the inventive merits of the subject-matter of claim 1. It was noted that the mandrel of document D3 had two parts (reference signs 2 and 3+4; see Figures 1 and 2). Although not shown in the schematic drawings, according to the embodiment of Figures 3 and 4 of document D3 these two parts were inserted into each other to adjust the width of the cavity. Thus, the claimed two-part design of the inner support structure was known from Figures 3 and 4 of document D3. In document D3 the forming mandrel was heated, however without the explicit mention of heaters (see D3, column 3, lines 36 to 38), in order to avoid a premature solidification of the pre-heated tube end. The subject-matter of claim 1 therefore differed from document D3 only in the feature of the at least one heater comprising a plurality of heaters extending at least partially through said inner support structure. The formulation of the objective technical problem suggested by the appellant had no basis in the patent, which was silent on the exact arrangement. Moreover, the claim did not refer to simultaneous heating. It was the respondents' view that, when starting from document D3, the objective technical problem was to find a construction for heating the mandrel of document D3. In order to solve the problem, the skilled person would have turned to document D14 which disclosed a plurality

of heating rods. There were no difficulties in transferring this teaching to the apparatus of document D3, in particular since the heater 7 of document D14 served as inner support structure. From a technical point of view, it was possible to exchange the positions of the heater and the expansion device on the mandrel shown in Figure 3b of document D14. It had to be taken into account that the disclosure in the claims of document D14 was broader and not limited to the three-step process of the embodiments of Figures 3a and 3b. Alternatively, the skilled person could have consulted document D8 for a solution to the technical problem. This prior art disclosed a plurality of heating rods in the outer collar for heating the tube end during the forming step. If the mandrel of document D3 had to be heated it was obvious to provide the heating rods of document D8 in the mandrel of document D3. Also, document D12 disclosed a heater in the outer collar, which the skilled person could have integrated into the mandrel of document D3. Therefore, a combination of document D3 with any of documents D14, D8 or D12 rendered the subject-matter of claim 1 obvious.

According to alternative lines of attack, documents D2 or D4 could be used as starting points. The subject-matter of claim 1 differed from these documents in the feature of the at least one heater comprising a plurality of heaters extending at least partially through said inner support structure. In this case, the objective technical problem was to find a way to ensure that the formation portion was at the formation temperature. The skilled person would have consulted documents D14, D8 or D12 for a solution to this problem. As explained above, each of these disclosures comprised a plurality of heaters which could be

integrated into the inner support structures of documents D2 or D4 without any difficulties. The appellant's argument that the polyester of document D4 necessarily was a thermosetting resin was incorrect since polyesters were thermoplastic materials.

Finally, document D14 could be considered a reasonable starting point. This document did not disclose an inner support structure having an expansion member formed of an elastomeric material. As the patent was silent regarding the advantages of this feature, the objective technical problem was to find an alternative expansion member. However, the use of elastomeric rings as expansion members was well known from documents D2, D3 or D4. In view of this, the subject-matter of claim 1 was rendered obvious by a combination of document D14 with documents D2, D3 or D4.

For these reasons, the subject-matter of claim 1 was not based on an inventive step.

Reasons for the Decision

1. Admission of the appellant's main request

1.1 With its submission dated 15 February 2019, the appellant filed amended claims of a new main request, the admission of which is contested by the respondents.

1.2 According to Article 13(1) RPBA, any amendment to a party's case after it has filed its grounds of appeal or reply may be admitted and considered at the board's discretion. The discretion shall be exercised in view of *inter alia* the complexity of the new subject matter submitted, the current state of the proceedings and the need for procedural economy. Article 13(3) RPBA further

stipulates that amendments sought to be made after oral proceedings have been arranged shall not be admitted if they raise issues which the board or the other parties cannot reasonably be expected to deal with without adjournment of the oral proceedings.

- 1.3 Applying these criteria to the case in hand, the board notes that the sole independent claim of the present main request, which was filed more than seven months in advance of the oral proceedings, is a combination of granted claims in accordance with their dependencies. The amended request deals with all objections raised under Articles 84 and 100(b) EPC 1973 as well as Article 123(2) EPC and does not raise any new issues. The only subject which remains to be discussed is the contested issue of inventive step, in particular in view of the heater extending at least partially through the inner support structure. Moreover, the amendments to the claims do not constitute a new line of defence so that the respondents' inventive step attacks still apply. Although the present main request possibly could have been filed already at the outset of the appeal proceedings, it simplifies the procedure, is in line with the need for procedural economy and does not add any complexity to the appellant's case. Furthermore, the present main request was filed well in advance of the oral proceedings and does not raise issues which the board or the other parties could not reasonably be expected to deal with without adjournment of the oral proceedings.

For these reasons, the board exercised its discretion in accordance with Article 13(1) and (3) RPBA and admitted the main request into the appeal proceedings.

2. *Inventive step*

2.1 Starting from document D3

2.1.1 The parties are in agreement that document D3 forms a reasonable starting point for assessing inventive step of the subject-matter of claim 1. Document D3 discloses an apparatus for thermoplastically forming a contour in a thermoplastic tube end. It states that the inner forming mandrel may be heated before the tube is pushed thereon to prevent premature solidification of the tube end (see D3, column 3, lines 36 to 38), however without giving any further details on how the heating is accomplished. It is undisputed between the parties that document D3 does not directly and unambiguously disclose the last feature of claim 1, i.e. that the at least one heater comprises a plurality of heaters extending at least partially through the inner support structure.

2.1.2 Concerning the technical effect achieved by this difference, the appellant relies on paragraph [0028] of the patent and sees the technical effect in enabling a heating of the formation portion of the duct concurrently with its expansion. Accordingly, the appellant is of the view that the objective technical problem is how to provide heat to the formation portion of the duct during the formation of the bead.

The respondents argue that the objective technical problem is to find a construction for heating the mandrel of document D3.

2.1.3 Established case law (see Case Law of the Boards of Appeal of the European Patent Office, 9th edition,

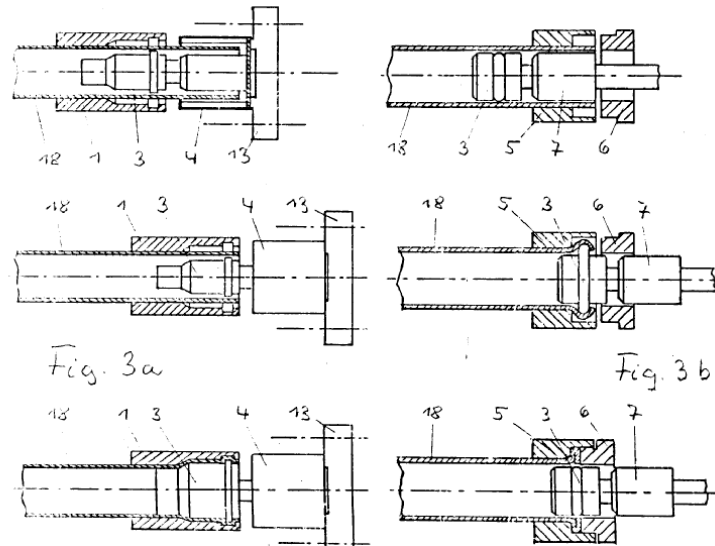
2019, I.D.4.1.) requires that in the application of the problem and solution approach objective criteria must be used to determine the technical problem. In order to assess the potential technical contribution made in the claimed subject-matter, the objective technical problem has to be based on the technical effects achieved by the differing features in the claimed subject-matter against the state of the art.

Applying these principles to the case at issue, the board observes that the formulation of the technical problem as suggested by the respondents is not based on the specific advantages of the plurality of heaters extending at least partially through the inner support structure but relates to heating the mandrel in general. By contrast, the objective technical problem proposed by the appellant takes into account the technical effect of the difference in the claimed apparatus over the prior art: Having a plurality of heaters extending at least partially through the inner support structure allows for heating the forming portion during the formation of the contour in the thermoplastic duct (see paragraph [0028] of the patent). The board thus adopts the objective technical problem suggested by the appellant for the assessment of the inventive merits of the subject-matter of claim 1.

Therefore, the objective technical problem in view of document D3 is how to provide heat to the formation portion of the duct during the formation of the bead.

2.1.4 Turning to the obviousness of the claimed solution, the respondents rely on document D14. This document is directed to forming a contour in the end part of a

thermoplastic duct (see in particular Figures 3a and 3b):



It specifically discloses that heater 7 is inserted into the duct in order to heat the duct end (see topmost drawing in Figure 3b). Heater 7 is then withdrawn before the moulding is completed by radially forcing a section of the tube end outwardly against an outer mould contour (see middle drawing in Figure 3b). The apparatus of document D14 is designed for sequentially carrying out the process steps of heating and moulding. In view of the axially spaced arrangement of the expansion device and the heater on the mandrel in Figure 3b, this device is not suitable for heating the formation portion of the duct during the formation of the bead. It does therefore not provide a solution to the objective technical problem stated above. The fact that the claims of document D14 are worded in more general terms does neither alter the disclosure of the embodiment of Figure 3b (or 3a) nor constitute a teaching of an alternative embodiment. Moreover, according to Figure 3b (and 3a) the functions of heating the duct and then expanding it are separated

and performed by two distinct units (Rohrwärmegerät 7 (or 4) and Spreizdorn 3). In view of this distinction, the skilled person would have associated "Spreizdorn 3" with the inner support structure of contested claim 1 and not "Rohrwärmegerät 7 or 4". In summary, there is nothing in document D14 which could have pointed the skilled person to a concurrent heating and forming of the duct or to providing a plurality of heaters extending at least partially through the inner support structure. For these reasons, the subject-matter of claim 1 is not rendered obvious by a combination of documents D3 and D14.

2.1.5 Alternatively, the respondents refer to documents D8 or D12 regarding the obviousness of the claimed solution. However, in both documents the heaters extend at least partially through the outer collar (see Figure 1 of document D8 and Figures 1 to 4 of document D12) and not through the inner support structure, as defined in the contested claim. Starting from document D3, documents D8 and D12 thereby propose a structurally different solution for the technical problem of providing heat to the formation portion of the duct during the formation of the bead. This would have led the skilled person away from the subject-matter of claim 1.

2.2 Starting from documents D2 or D4

Similar to document D3, the tube end of document D2 is pre-heated before the deformation (see D2, column 3, lines 17 to 22 and claim 1). Document D4 relates to the forming of a wet-laid polyester pipe to be hardened (see D4, column 3, lines 13 to 19 and lines 37 to 45) and does not make any reference to heaters.

The subject-matter of claim 1 therefore differs from documents D2 or D4 in the feature of the at least one heater comprising a plurality of heaters extending at least partially through said inner support structure.

In view of the uncontested fact that the subject-matter of claim 1 differs from documents D2, D3 or D4 in the same claim feature, the considerations set out above in the context of document D3 regarding the formulation objective technical problem and the obviousness of the claimed solution in view of any of documents D14, D8 or D12 equally apply if documents D2 or D4 are used as starting points for the inventive step assessment instead of document D3.

The subject-matter of claim 1 is thus not obvious in view of a combination of document D2 or D4 with any of documents D14, D8 or D12.

2.3 Starting from document D14

Document D14 does not disclose an inner support structure having two parts movable relative to each other, and an expansion member formed of an elastomeric material (see Figures 6a to 6c of D14 for the design of the expansion member). Moreover, as discussed in point 2.1.4 above, document D14 fails to disclose a plurality of heaters extending at least partially through the inner support structure. Thus, this prior art is more remote from the claimed subject-matter than document D3. Even if the skilled person had started from document D14 and considered to replace the expansion member of document D14 by an elastomeric element, as suggested by the respondents, there would still not have been any pointer in any of documents D2, D3 or D4 to provide the device of document D14 with a plurality

of heaters extending at least partially through the inner support structure.

In view of this, the subject-matter of claim 1 is not rendered obvious by a combination of document D14 with any of documents D2, D3 or D4.

- 2.4 Based on the considerations set out above, the subject-matter of claim 1 according to the main request involves an inventive step within the meaning of Article 56 EPC 1973. This finding equally applies to dependent claims 2 to 11 which include the inventive feature combination of independent claim 1.

3. *Conclusion*

The board concludes that the claims as amended according to the appellant's main request meet the requirements of the EPC.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The case is remitted to the department of first instance with the order to maintain the patent as amended with the following claims and a description to be adapted thereto:

Claims: Nos. 1 to 11 of the main request filed by letter dated 15 February 2019.

The Registrar:

The Chairman:



N. Schneider

O. Randl

Decision electronically authenticated