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**Datasheet for the decision
of 31 January 2024**

Case Number: T 2330/19 - 3.4.01

Application Number: 12172329.0

Publication Number: 2546924

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B29C70/40, B29C70/86,
B29C70/88, B29C70/30

Language of the proceedings: EN

Title of invention:
Integrated antenna system

Patent Proprietor:
The Boeing Company

Opponents:
AIRBUS Operations GmbH/AIRBUS Operations S.A.S./
AIRBUS S.A.S./
AIRBUS Operations Ltd./
AIRBUS Operations S.L.

Headword:
Integrated antenna / Boeing

Relevant legal provisions:

EPC Art. 56

RPBA 2020 Art. 13

RPBA Art. 12(4)

Keyword:

Inventive step - (no)

Decisions cited:

T 1903/13



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Case Number: T 2330/19 - 3.4.01

D E C I S I O N
of Technical Board of Appeal 3.4.01
of 31 January 2024

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Decision under appeal:
Interlocutory decision of the Opposition
Division of the European Patent Office posted on
18 June 2019 concerning maintenance of the
European Patent No. 2546924 in amended form.

Composition of the Board:

Chairman P. Scriven
Members: B. Noll
 C. Almberg

Summary of Facts and Submissions

- I. The opposition was based on the grounds of lack of novelty and inventive step (Article 100(a) together with Articles 52(1), 54, and 56 EPC).
- II. The Opposition Division decided that the patent, in amended form according to an auxiliary request 6, met the requirements of the EPC.
- III. The opponents appealed that decision.
- IV. After receipt of the statement of grounds of appeal and the proprietor's reply, the Board set out its preliminary opinion on the case.
- V. Both parties made further submissions, in response to the preliminary opinion.
- VI. The parties' final requests, at the end of oral proceedings, were as follows.
- VII. The appellant requested that the decision under appeal be set aside and that the patent be revoked.

VIII. The respondent's main request was that the appeal be dismissed, i.e. that the patent be found to be maintainable on the basis of the request found allowable in the appealed decision or, in the alternative, on the basis of one of

- auxiliary requests 1 and 2, filed with the reply to the appeal;
- auxiliary request 2-1, filed at oral proceedings before the Board;
- auxiliary request 3, filed with the reply to the appeal.

IX. The sole claim of the main request reads (reference signs omitted):

*A method for forming an antenna system, the method comprising:
forming a number of conductive elements in a configuration on the surface of a resin layer, wherein the configuration of the number of conductive elements forms the antenna system;
positioning the resin layer with the number of conductive elements with respect to a number of layers of reinforcement material;
and
consolidating the resin layer with the number of layers of reinforcement material to form a composite structure, wherein the antenna system is integrated into the composite structure, wherein the consolidating step comprises:*

*consolidating the resin layer with the number of layers of reinforcement material to form a laminate in which the laminate has a substantially planar shape;
placing the laminate on a mold; and
changing a shape of the laminate on the mold into a desired shape of the composite structure to form the composite structure, characterized in that the desired shape of the composite structure is selected to have the shape from one of a wing, a horizontal stabilizer, a vertical stabilizer, a flap, an engine housing, and a fuselage of an aircraft, wherein the resin layer is selected from one of a thermoplastic resin layer and a thermoset resin layer.*

X. The claim of the auxiliary request 1 adds

*[... of a resin layer] by depositing the number of conductive elements directly onto the surface of the resin layer
[, wherein ...].*

XI. The claim of the auxiliary request 2 adds, to claim 1 of the main request,

*[... of a resin layer], wherein the forming uses silk screening, electroplating, chemical deposition, spraying, plasma spraying, chemical vapor deposition, physical vapor deposition, or applies conductive tape to the surface
[, wherein ...].*

XII. The claim of the auxiliary request 2-1 adds, to claim 1 of the main request,

[... of a resin layer], wherein the forming uses silk screening, spraying, plasma spraying, or applies conductive tape to the surface [, wherein ...].

XIII. The claim of the auxiliary request 3 adds to, claim 1 of the main request,

[... of reinforcement material] by placing the resin layer with the number of conductive elements onto the number of layers of reinforcement material [; and ...].

XIV. The following documents are relevant to this decision:

D1: FR 2665324 A1; and
E1: US2008/0218416 A1

XV. The parties' arguments and submissions, insofar as they are relevant to this decision, are dealt with in the reasons, below.

Reasons for the Decision

Background

1. In aviation technology, the weight and shape of components attached to the outside of an aircraft have a considerable influence on flight characteristics: fuel consumption, and range (patent specification, [0005]). Antennas, which in themselves are structures made of conductive material with specific geometry, are necessary for data and voice communication, or for radar systems. The patent deals with the manufacture of antennas as elements integrated with the surface of aircraft parts, without impairing the aircraft parts' aerodynamic shape.

Main request, claim 1, inventive step

2. E1 is concerned with the manufacture of structures which have a mechanical function as load-bearing elements and also carry electronic elements (E1: abstract). The areas of application of these structures include, in particular, a wing structure for an aircraft made of composite materials (E1: [0012]). The electronic device may be an antenna (E1, [0057]). E1 is, therefore, in the same technical field as the patent and is a suitable starting point for assessing inventive step.
3. E1 discloses a method of manufacturing a load-bearing antenna system by forming a number of conductive elements on the surface of a resin layer (E1: Fig. 1, ply 6; description at [0042]). In one example, the element is an RF antenna system [0020, 0048]. The resin

layer carrying the conductive elements is positioned relative to a number of layers of reinforcement material (E1: Fig. 1, plies 2, 4) and the stack is consolidated to form a composite structure, whereby the antenna system is integrated into the composite structure (E1: Fig. 1, bottom, [0048]).

4. E1 discloses this composition structure for substantially any external part of an aircraft, including fuselage, wing, flap ([0044]). E1 further gives examples of materials for the plies, including various resins, organic or inorganic fibres or combinations thereof, which have thermosetting properties and are included in the selection groups recited in claim 1. Further, E1 describes methods for direct patterning of high-conductivity metal patterns onto curved surfaces [0061]. Direct patterning is preferred to photolithography, which E1 says is expensive and not well-suited for curved surfaces, in particular because the pattern can easily be damaged by subsequent bending (E1: [0061]).
5. The method of claim 1 differs from the disclosure of E1 in that the laminate has a planar form; in that the laminate is placed on a mold; and in that the shape of the laminate is changed on the mold into a desired shape for the composite structure. Neither party disputes that these are the features which distinguish the method according to claim 1 from the disclosure of E1.
6. In the impugned decision, the technical problem, starting from E1, was formulated as enhancing the method of manufacturing so that less effort, cost, and processing time were required. This formulation is supported by the parties and explains in what respects

the claimed method should be advantageous, although the effort, cost, and processing time of the methods disclosed in E1 are unknown. Therefore, the Board is satisfied with this formulation of the technical problem.

7. When looking for a solution to this problem, the skilled person would have taken into consideration D1, which concerns the manufacture of a printed circuit on a non-developable surface, i.e. a surface such as a sphere or hyperboloid that cannot be created by simply folding or bending a flat surface (D1: page 1, lines 13 - 25). A specific application addressed in D1 is the manufacture of high frequency antennas for a radar detector in military aircraft (D1: page 1, line 27 to page 2, line 7). D1 describes that direct manufacture of the circuit on a portion of a sphere is difficult to implement and it can be expected to be even more difficult for more complex surfaces (D1: page 2, lines 8 - 19). D1 discloses the manufacture of an assembly of one or more printed circuits on a planar substrate of thermoplastic resin and reinforcing fabrics (D1: Figures 2 and 3; description, page 6, lines 16 - 30), which is then put into an autoclave at a sufficient temperature for deforming the layers of resin and reinforcing fabrics into the desired shape. Thus, when starting from E1 and further considering D1, the skilled person would have arrived at the method of claim 1.

8. The proprietor argued that E1 would have dissuaded the skilled person from producing an antenna on a flat substrate and then bending the substrate to produce a load-bearing part, as there would be a risk of damage during bending. E1 had thus ruled out the bending of a substrate as a realistic possibility for manufacturing

a load-bearing component with an aircraft antenna. D1 was not concerned with the manufacture of a structural component for an aircraft, but only with forming a substrate with an antenna into a desired shape. The examples in Figures 2 and 3 of D1 only had reinforcing fabric in areas that were not curved, or were at most slightly curved, and Figure 7 of D1, which related to a radome with an antenna, showed that, for an antenna of an aircraft, the non-developable mould with circuit elements had to be produced separately from the reinforcing structure and that both were only joined together after they had been individually formed into the desired shape.

9. The Board is not persuaded by these arguments. E1 mentions the bending of a substrate as a risky but realistic way of producing a curved surface with an antenna. Therefore, the skilled person would not have left D1 unconsidered. D1 points out that a reinforcing fabric can be laid out over the entire surface of the circuit if it will not be too deformed (D1: page 7, lines 27 - 29). Consequently, the skilled person, starting from E1 would, as an obvious step, have used the teaching of D1 to manufacture an antenna structure from a planar laminate layer and bent it into a mildly curved load-bearing structure of an aircraft such as a wing or flap, and would thus have arrived at the claimed method.

10. In conclusion, the method as defined with the main request lacks an inventive step. The patent cannot be maintained on the basis of the main request.

Auxiliary request 1, inventive step

11. Depositing conductive elements directly onto the surface is suggested in E1 (E1: abstract: ... *forming an electronic element directly on at least one ply...*), in the sense that the conductive element lies directly on the surface but not, for example, on an intermediate layer. The amendment to claim 1 does not, therefore, further distinguish the method from what is disclosed in E1. The claimed method lacks an inventive step for substantially the same reasons as for the main request.

12. The proprietor argued that the amendment did further distinguish the method from D1, which suggested a photolithographic process which was not compatible with directly depositing the conductive elements. Therefore, the skilled person would not have considered D1 in combination with E1.

13. However, this argument is unpersuasive, since the feature in question does not further distinguish over the disclosure of E1 and nothing would have prevented the skilled person from considering D1 for the bending of the substrate (see point 9., above). Therefore, this feature does not change the conclusion that bending the substrate would have been obvious from D1.

Auxiliary request 2, inventive step

14. E1 discloses various fabrication methods for forming a metallic layer on a substrate, including vacuum deposition, plating, etching and lamination (E1, [0010]), which anticipate some of the alternatives

defined in the claim of the auxiliary request 2. The method of this request, therefore, is not further distinguished from the disclosure of E1 than that of the main request. The claim lacks an inventive step for substantially the same reasons as for the main request.

Auxiliary request 2-1, admission

15. The admission of this request, submitted only at oral proceedings, lies within the discretion of the Board under Article 13 RPBA. The criteria considered by the Board are whether there are exceptional circumstances, justified by cogent reasons, and whether the amendment prima facie overcomes the issues in question.
16. The proprietor argued that the options for depositing the electronic elements, to which the auxiliary request 2-1 was limited, did not use photolithography, and that the amendment was straightforward.
17. There are no exceptional circumstances, and the proprietor has not presented any justifying, cogent reasons (Article 13(2) RPBA). Furthermore, excluding photolithography is not clearly and prima facie sufficient to overcome the objection of lack of inventive step, as E1, paragraph [0023], discloses further options including (non-photolithographic) screen printing. It is not prima facie apparent that silk printing, defined in the claim, is different from screen printing disclosed in E1 (Article 13(1) RPBA).
18. Therefore, the Board decided to not admit auxiliary request 2-1 into appeal proceedings.

Auxiliary request 3, admission

19. The respondent filed this request in due time, with its reply to the appeal in 2019. Its admission is at the Board's discretion under Article 12(4) RPBA 2007 (see Article 25(2) RPBA).

20. The amended claim puts the focus onto a step of putting the resin layer and layers of enforcement material together. This is a shift in away from the higher-ranking auxiliary requests, which focus on the manufacture of the electronic elements. This divergence does not "relate[] to the case under appeal" (see decision in T 1903/13, Reasons 3.3). The amendment also appears, prima facie, unable to overcome the inventive step objection to the higher-ranking requests (see Case Law of the Boards of Appeal, Tenth Edition, V.A.5.12.3 a)). Therefore, the Board decided not to admit auxiliary request 3 into the appeal proceedings.

Conclusion

21. With no allowable request on file, the patent must be revoked.

Order

For these reasons it is decided that:

The decision under appeal is set aside.

The patent is revoked.

The Registrar:

The Chair:



D. Meyfarth

P. Scriven

Decision electronically authenticated