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Case Number: T 1935/14 - 3.3.09

Application Number: 06254833.4

Publication Number: 1767344

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Language of the proceedings: EN

Title of invention:
Wide area lightning diverter overlay

Patent Proprietor:
The Boeing Company

Opponent:
Airbus Operations Limited et al

Headword:

Relevant legal provisions:
EPC Art. 100(c), 123(2), 83, 56

Keyword:
Grounds for opposition - amendments
Sufficiency of disclosure
Inventive step

Decisions cited:

Catchword:

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Case Number: T 1935/14 - 3.3.09

D E C I S I O N
of Technical Board of Appeal 3.3.09
of 29 September 2017

Appellant: (Patent Proprietor)	The Boeing Company 100 North Riverside Plaza Chicago, IL 60606-1596 (US)
Representative:	Boult Wade Tennant Verulam Gardens 70 Gray's Inn Road London WC1X 8BT (GB)
Appellant: (Opponent)	Airbus Operations Limited et al Pegasus House Aerospace Avenue Filton Bristol BS34 7PA (GB)
Representative:	Worthington, Richard Easton Withers & Rogers LLP 4 More London Riverside London SE1 2AU (GB)
Decision under appeal:	**Interlocutory decision of the Opposition Division of the European Patent Office posted on 11 July 2014 concerning maintenance of the European Patent No. 1767344 in amended form.**

Composition of the Board:

Chairman	W. Sieber
Members:	M. O. Müller
	F. Blumer

Summary of Facts and Submissions

I. This decision concerns the appeals filed by both the joint opponents and the patent proprietor against the decision of the opposition division finding that European patent No. EP 1 767 344 as amended met the requirements of the EPC.

II. With the notice of opposition the joint opponents had requested revocation of the patent in its entirety on the grounds under Article 100(a) (lack of novelty and inventive step), 100(b) and 100(c) EPC.

The documents submitted during the opposition proceedings included:

D1: US 2005/0041362 A1;

D2: US 2005/0181203 A1;

D4: US 2005/0150596 A1;

D5: US 4,506,311 A; and

D6: US 4,796,153 A.

III. The opposition division's decision was based on the claims as granted (main request) and a first and second auxiliary request.

Claim 1 as granted read as follows:

"1. An overlay (710) comprising:
a patterned metal foil (718);
a polymer film (720) underlying the patterned metal foil (718); and

a polymer topcoat (712) overlying the patterned metal foil (718),

characterized in that the patterned metal foil (718) comprises a plurality of sections (750) of metal foil physically separate from one other by a plurality of areas (752), the plurality of areas (752) having a sheet resistance of 100 to 1,000,000 ohms per square or more."

Claim 1 of the first auxiliary request read as follows (amendments to claim 1 as granted highlighted)

"1. An overlay (710) comprising:

a patterned metal foil (718);

a polymer film (720) underlying the patterned metal foil (718); and

a polymer topcoat (712) overlying the patterned metal foil (718),

characterized in that the patterned metal foil (718) comprises a plurality of sections (750) of metal foil physically separate from ~~one~~ each other by a plurality of areas (752), the plurality of areas (752) having a sheet resistance of 100 to 1,000,000 ohms per square or more, wherein the plurality of sections (750) of the metal foil have a first non-zero thickness and the plurality of areas (752) have a second thickness that is less than the first thickness."

Claims 1 and 8 of the second auxiliary request read as follows (amendments to the claims as granted highlighted):

"1. An overlay (710) comprising:

a patterned metal foil (718);

a polymer film (720) underlying the patterned metal foil (718); and
a polymer topcoat (712) overlying the patterned metal foil (718),
characterized in that the patterned metal foil (718) comprises a plurality of sections (750) of metal foil physically separate from ~~one~~ each other by a plurality of areas (752), the plurality of areas (752) having a sheet resistance of 100 to 1,000,000 ohms per square or more, wherein the plurality of sections (750) of the metal foil have a first non-zero thickness and the plurality of areas (752) have a second thickness that is less than the first thickness, wherein the second thickness is greater than zero."

"8. A method of forming an overlay (710) for a substrate (22), the method comprising:
providing a metal foil (718);
providing a first polymer film (720) underlying the patterned metal foil (718); and
providing a polymer topcoat (712) overlying the patterned metal foil (718),
characterized in that the metal foil (718) is patterned to form a plurality of sections (750) of metal foil physically separate from ~~one~~ each other by a plurality of areas (752), the plurality of areas (752) having a sheet resistance of 100 to 1,000,000 ohms per square or more, wherein the plurality of sections (750) of the metal foil have a first non-zero thickness and the plurality of areas (752) have a second thickness that is less than the first thickness, wherein the second thickness is greater than zero."

IV. The opposition division's view can be summarised as follows:

The sheet resistance of 100 to 1 000 000 ohms per square or more, as required by claim 1 of the main request, was disclosed in the application as filed only in combination with areas with a non-zero thickness. Since claim 1 was not restricted to such areas, it was not based on the application as filed. The main request was thus not allowable either.

For essentially the same reasons, the first auxiliary request was not allowable.

The second auxiliary request met the requirements of Rule 80 EPC and Article 123(2) and (3) EPC. The invention as defined in this request was sufficiently disclosed, since the skilled person would be able to determine the sheet resistance. No novelty objections had been raised by the joint opponents, and the claimed subject-matter was novel. Lastly, the second auxiliary request was also inventive. The subject-matter of claim 1 differed from closest-prior-art document D2 *inter alia* in that the metal foil was patterned and in terms of the sheet resistance of the areas between the metal sections. The objective technical problem was the provision of more efficient wide-area surface protection against lightning strike for aircraft. The claimed solution was not obvious when starting from D2 and taking D6 into account; D6 taught away from the subject-matter claimed, because it aimed at conducting a lightning strike through metal rather than through an ionisation path. Furthermore, in view of the complex structure of the overlay of D6, the skilled person would not know how to modify the overlay disclosed in

D2 and so would not arrive at the claimed subject-matter.

V. This decision was appealed by both the proprietor and the joint opponents. As the two parties are thus respectively appellant and respondent in these proceedings, for simplicity the board will continue to refer to them as the proprietor and the opponent.

The proprietor's statement of grounds of appeal included a main request and first and second auxiliary requests.

The opponent's statement of grounds of appeal contained

D9: "A Method Of Measuring The Resistivity And Hall Coefficient On Lamellae Of Arbitrary Shape", Philips Technical Review, volume 20(8), 1958/59, pages 220 to 224.

VI. In its response to the opponent's statement of grounds of appeal, the proprietor filed:

D10: Excerpt from Wikipedia "Cape Breton Island", 7 pages;

D11: New York Times article "Bus Lanes to Quicken Commute on East Side", 2 pages; and

D12: M. Green et al., Thin Solid Films, volume 467, 2004, pages 308 to 312.

VII. With its letter dated 11 June 2015, the opponent requested that D10 to D12 not be admitted into the proceedings and submitted

D13: Excerpt from the National Institute of Standards and Technology (NIST), US Department of Commerce, 2011, "II. The Hall Effect", 3 pages.

VIII. With its communication dated 24 May 2017, the board communicated its preliminary opinion to the parties.

IX. The opponent filed a response to this communication with letter dated 29 August 2017.

X. The proprietor's response filed with letter dated 16 August 2017 contained a main request and first to fifth auxiliary requests, replacing the requests previously filed, and requested *inter alia* that should D12 not be admitted into the proceedings, the admissibility of D13 be discussed.

XI. In response thereto, the opponent requested that the first, third and fifth auxiliary requests not be admitted.

XII. On 29 September 2017, oral proceedings took place before the board. During the oral proceedings, the proprietor no longer relied on D10 and D11. The opponent withdrew its request that D12 not be admitted, so the proprietor's conditional request relating to D13 became moot. The opponent furthermore did not maintain its inventive-step attacks, submitted in writing, based on D2 in combination with D5 and on D4.

Claim 1 of the main request and the first auxiliary request is identical to claim 1 as granted (see point III above).

Claim 1 of the second and third auxiliary requests reads as follows (amendments to claim 1 of the main request highlighted):

"1. An overlay (710) comprising:
a patterned metal foil (718);
a polymer film (720) underlying the patterned metal foil (718); and
a polymer topcoat (712) overlying the patterned metal foil (718),
characterized in that the overlay is a two-dimensional lightning diverter overlay that can transport the energy of a lightning strike over a wide area via multiple pathways on a surface; and in that the patterned metal foil (718) comprises a ~~plurality~~ two-dimensional array of sections (750) of metal foil physically separate from one other by a plurality of areas (752), the plurality of areas (752) having a sheet resistance of 100 to 1,000,000 ohms per square or more."

The fourth auxiliary request is identical to the second auxiliary request found allowable by the opposition division (for the exact wording of independent claims 1 and 8, see point III above).

XIII. So far as relevant to the present decision, the opponent's arguments can be summarised as follows:

The ground under Article 100(c) EPC prejudiced the maintenance of the patent in the form of the main request. The application as filed did not provide a basis for overlays with a plurality of sections of metal foil that were separated by a plurality of voids, the sheet resistance of which was 100 to 1 000 000 ohms per square or more.

The physical separation of metal foil sections by areas of non-zero thickness required by claim 1 of the fourth auxiliary request was not based on the application as filed. Furthermore, the feature of claim 6 of areas of dielectric polymer having a sheet resistance of 100 to 1 000 000 ohms per square or more lacked a basis in the application as filed.

The invention as defined in the fourth auxiliary request was insufficiently disclosed, since the skilled person would not be able to measure the sheet resistance of the plurality of areas.

The subject-matter of claim 1 of the fourth auxiliary request lacked inventive step in view of D2 in combination with D6. The subject-matter of this claim differed from D2 in that the metal foil was patterned such that it comprised a plurality of sections of metal foil physically separated from one another by a plurality of areas having a sheet resistance of 100 to 1 000 000 ohms per square or more. The skilled person looking for a means to create coronas for energy dissipation would have found the claimed solution in D6.

XIV. So far as relevant to the present decision, the proprietor's arguments can be summarised as follows:

The ground under Article 100(c) EPC did not prejudice the maintenance of the patent in the form of the main request. The first full paragraph of page 26 of the application as filed provided a basis for overlays with a plurality of sections of metal foil that were separated by a plurality of voids with a sheet resistance as claimed.

As to the term "physical separation" in claim 1 of the fourth auxiliary request, it was a matter of plain English that a physical separation of metal foil sections was the same as a separation of these sections as disclosed in the second paragraph of page 7 of the application as filed. The feature of claim 6 of areas of dielectric polymer having a sheet resistance of 100 to 1 000 000 ohms per square or more was based on the last full paragraph of page 25 and the paragraph bridging pages 25 and 26 of the application as filed.

Contrary to the opponent's assertion, the sheet resistance of the plurality of areas could be measured, and the invention as defined in the fourth auxiliary request was sufficiently disclosed.

The subject-matter of claim 1 of the fourth auxiliary request was inventive in view of D2 in combination with D6. The subject-matter of this claim differed from D2 in that the metal foil was patterned such that it comprised a plurality of sections of metal foil physically separated from one another by a plurality of areas having a sheet resistance of 100 to 1 000 000 ohms per square or more. The problem to be solved was the provision of an overlay that allowed dissipation of energy from lightning strike. D2 taught away from the claimed solution in that it aimed at energy diversion rather than dissipation. The same applied to D6.

XV. The proprietor requested that the decision under appeal be set aside and that the patent be maintained on the basis of the main request or of any of the first to fifth auxiliary requests, all requests as filed with letter dated 16 August 2017, the fourth auxiliary

request implying that the opponent's appeal be dismissed.

XVI. The opponent requested that the decision under appeal be set aside and that the patent be revoked.

It also requested that the proprietor's first, third and fifth auxiliary requests not be admitted into the proceedings.

Reasons for the Decision

Main request

1. Amendments - Article 100(c) EPC

1.1 Claim 1 refers to an overlay comprising *inter alia* a patterned metal foil which comprises a plurality of sections (750) physically separated from each other by a plurality of areas (752). The plurality of areas has a sheet resistance of 100 to 1 000 000 ohms per square or more. The thickness of the areas is not defined. It can therefore be zero, implying that the areas are voids. In fact, this is one embodiment envisaged by the patent in suit (e.g. claim 2 as granted). Claim 1 hence covers overlays with a plurality of sections of metal foil that are separated by a plurality of voids, the sheet resistance of which is 100 to 1 000 000 ohms per square or more.

1.2 First of all, voids cannot form a sheet. It therefore does not make technical sense to define a "sheet resistance" of voids. Furthermore, a sheet resistance of voids is not disclosed in the application as filed. The only place where the application as filed mentions a sheet resistance with values as defined by claim 1 is

the paragraph bridging pages 25 and 26, which however refers only to overlays where the areas 752 have a finite, non-zero thickness, i.e. are not voids.

1.3 The proprietor argued that a basis was provided by the first full paragraph of page 26 of the application as filed, which disclosed areas that were voids and that had a sheet resistance of more than 1 000 000 ohms per square.

This argument is not convincing. The cited passage does not refer to a sheet resistance of a plurality of voids but to the electrical resistance of voids. It can thus not provide a basis for a plurality of voids having a sheet resistance as required by claim 1.

1.4 Therefore, claim 1 contains added matter. The ground under Article 100(c) EPC consequently prejudices the maintenance of the patent in the form of the main request.

First to third auxiliary requests

2. Amendments - Article 100(c) EPC

2.1 Claim 1 of each of the first to third auxiliary requests suffers from the same deficiency as set out in point 1 above for claim 1 of the main request. Therefore, these auxiliary requests are not allowable. This was in fact not disputed by the proprietor during the oral proceedings.

2.2 In view of this there was no need for the board to decide on the opponent's request that the first and third auxiliary requests not be admitted into the proceedings.

Fourth auxiliary request

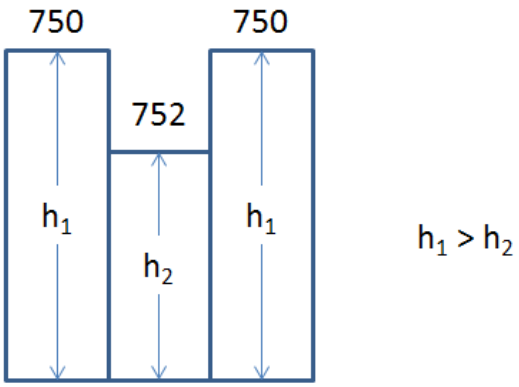
3. Amendments - Articles 100(c) and 123(2) EPC

3.1 At the end of claim 1, the features "wherein the plurality of sections (750) of the metal foil have a first non-zero thickness and the plurality of areas (752) have a second thickness that is less than the first thickness, wherein the second thickness is greater than zero" have been added. This amendment is based on claim 3 of the application as filed.

Claim 1 thus no longer covers embodiments in which the areas (752) have a thickness of zero, i.e. are voids. The objection raised against claim 1 of the main request as regards the sheet resistance of voids therefore no longer applies. Nor was any such objection raised by the opponent.

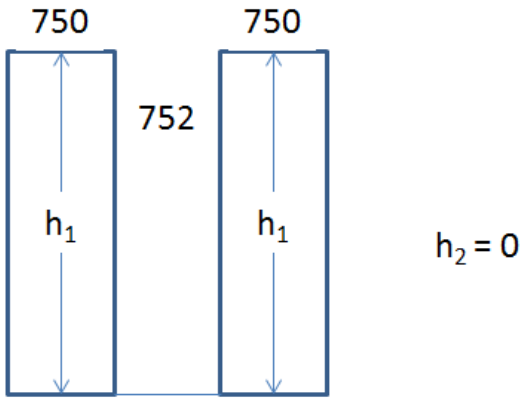
3.2 The opponent raised an added-matter objection against the feature of claim 1 that the plurality of metal foil sections (750) are physically separated from one another by a plurality of areas (752), the thickness of which is greater than zero but smaller than that of the metal foil sections.

3.2.1 The second paragraph of page 7 of the application as filed discloses a patterned metal foil that includes a plurality of sections having a first non-zero thickness and being separated from each other by a plurality of areas having a second non-zero thickness that is smaller than the first thickness. This can be illustrated graphically as follows (h_1 being the first thickness of metal sections and h_2 being the second thickness of areas):



As not disputed by the opponent, this passage of the application as filed provides a basis for the feature that the sections of metal foil 750 are separated from each other by a plurality of areas 752, the thickness of which is greater than zero but smaller than that of the metal foil sections.

3.2.2 The opponent argued however that the term "physically separate" in claim 1 was not the same as "separate" as used in this passage of the application as filed. In the opponent's view this term implied that the sections of metal foil were totally separate, i.e. were separated by voids rather than by areas of non-zero thickness. So, physical separation as required by claim 1 is understood by the opponent as follows:



3.2.3 The board does not share the opponent's view. It is a matter of plain English that physical separation does not require complete separation. For instance, Great Britain is considered to be physically separate from continental Europe even though the land masses are joined beneath the English Channel.

Therefore, the board is convinced that the definition in claim 1 that the separation of metal foil sections and areas is a physical one does not add anything over the separation of metal foil sections and areas as disclosed in the above passage of the application as filed. Claim 1 therefore does not extend beyond the content of the application as filed.

3.3 The same applies for the physical separation of metal foil sections and areas required by claim 8.

3.4 Claim 6 defines the plurality of areas as areas of dielectric polymer. Claim 6 in conjunction with claim 1 thus requires areas of dielectric polymer having a sheet resistance of 100 to 1 000 000 ohms per square or more. The opponent argued that this was not based on the application as filed.

3.4.1 The last full paragraph of page 25 of the application as filed discloses areas of dielectric polymer or metal foil modified to have a high sheet resistance. In the subsequent paragraph bridging pages 25 and 26 it is disclosed that the areas desirably have a high sheet resistance, and that, for example, the sheet resistance of the areas may be in the order of around 100 to 1 000 000 ohms per square or more.

3.4.2 The opponent argued that there was no correlation between the dielectric polymer as disclosed in the last full paragraph of page 25 and the sheet resistance as disclosed in the next paragraph bridging pages 25 and 26.

The board does not agree. The last full paragraph on page 25 discloses areas of a dielectric polymer having a high sheet resistance and it is exactly this term "high sheet resistance" that is taken up again in the next paragraph bridging pages 25 and 26 and that is then exemplified as 100 to 1 000 000 ohms per square or more. Contrary to the opponent's assertion, there is thus a clear correlation between the dielectric polymer disclosed in the last paragraph on page 25 and the sheet resistance disclosed in the subsequent paragraph bridging pages 25 and 26.

Claim 6 therefore does not contain any subject-matter which extends beyond the content of the application as filed.

3.5 In the absence of any further objections from the opponent, the claims of the fourth auxiliary request are based on the application as filed.

4. Sufficiency of disclosure

4.1 As set out above, claim 1 requires the plurality of areas to have a sheet resistance of 100 to 1 000 000 ohms per square or more. The discussion of sufficiency of disclosure turned on the question of how this sheet resistance could be measured.

4.2 The proprietor argued that the sheet resistance of the plurality of areas was the sheet resistance of the grid formed by the plurality of areas. This grid could for example be created by removing the metal foil sections by etching or similar processes. Its sheet resistance could then be measured, e.g. using the van der Pauw technique.

4.3 In a first line of argument, the opponent contended that the skilled person would not be able to remove the metal foil section such as to obtain the required grid of areas whose sheet resistance was to be measured.

The board does not agree. As set out by the proprietor, commonly known techniques - such as edging - exist for removing metal sections, and the opponent has not provided any evidence that the skilled person would not be able to successfully apply such a technique.

4.4 In a second line of argument, the opponent contended that even if the skilled person could obtain the required grid of areas, he would not be able to measure its sheet resistance.

The opponent argued in particular that the grid of areas represented a sheet with holes and that it was confirmed by D13 that for sheets having holes the sheet resistance could not be measured with the van der Pauw

technique. However, all that D13 discloses is that it was originally devised by van der Pauw for using a sample with no holes (first paragraph of the section "The van der Pauw Technique"). As argued by the proprietor, the van der Pauw technique is rather old - it dates back to 1958/1959 (D9). The fact that van der Pauw originally advised using samples without holes does not necessarily mean that the resistance of sheets with holes could still not be measured much later on, at the priority date of the patent (19 September 2005). In fact D12, which dates from 2004, confirms that this had become possible in the meantime. More specifically, D12 states that the sheet resistance of perforated samples could be measured by a van der Pauw arrangement (first paragraph of "2.3 Electrical measurements"). The opponent in this respect argued that the size of holes in the grid of areas whose sheet resistance had to be measured was much larger than that of the perforations in D12, and that for sheets with such large holes the sheet resistance could not be measured. However, in the absence of any proof from the opponent this argument is entirely unsubstantiated and thus must fail.

4.5 The invention as defined in the claims of the fourth auxiliary request is thus sufficiently disclosed.

5. Novelty

5.1 The opponent had no objections and the board saw no reason to raise any of its own.

6. Inventive step

6.1 According to the opponent, the subject-matter of claim 1 lacked inventive step over D2 in combination with D6.

6.1.1 D2 is directed to appliqués for protection against lightning strike. It thus concerns the same technical field and has the same objective as the opposed patent, and can therefore be considered to represent the closest prior art.

6.1.2 D2 discloses an appliqué coating including a metal foil and a first polymer film underlying the metal foil, and optionally a top coat overlying the metal foil (paragraph [0018]). The appliqué coating may include e.g. a polymer film, a thin aluminium foil as vapour barrier, a polymer film and a pressure-sensitive adhesive (PSA) (paragraph [0074]).

The appliqué coating of D2 corresponds to the overlay of claim 1. The two polymer films of D2 correspond to the polymer film and polymer topcoat of claim 1. The aluminium foil corresponds to the metal foil of claim 1.

6.1.3 As was common ground between both parties, the subject-matter of claim 1 differs from D2 in that the metal foil is patterned such that it comprises a plurality of sections of metal foil physically separated from one another by a plurality of areas having a sheet resistance of 100 to 1 000 000 ohms per square or more.

6.1.4 It needs to be examined what problem is solved by this distinguishing feature.

According to the patent (column 20, line 56 to column 21, line 1), the purpose of having high sheet resistance in the areas between the metal foil sections is to force the generation of coronas rather than conducting the energy electrically within the material of the metal foil sections. According to column 19, line 57 to column 20, line 9 of the patent, corners at the ends of sides of adjacent metal foil sections (separated by the areas) act as radiators that create localised coronas of plasma in the event of a lightning strike, so that the lightning expends energy in vaporising the metal foil and ionising air molecules. Every time the lightning energy creates plasma in the form of localised coronas at the corners at the ends of sides of adjacent sections of metal foil, further lightning energy is consumed. The patent goes on to say that the total energy travelling on the surface is reduced because the lightning energy is consumed by the formation of localised coronas (column 20, lines 17 to 20).

Accordingly, the separation of metal foil sections by areas with a sheet resistance as defined in claim 1 results in the dissipation of energy from lightning strikes.

Since D2 lacks any sections of metal foil separated from each other by areas, the metal foil of D2 will merely conduct away any large electrical currents created by lightning strikes. No coronas will be formed between adjacent sections of metal foil, so there will be no advantageous energy dissipation as provided by the teaching of the patent in suit.

The problem solved by the distinguishing feature over D2 is thus the dissipation of energy from lightning

strikes. This was not contested by the opponent during the oral proceedings.

6.1.5 It needs to be decided whether the skilled person starting from D2 and confronted with this problem would arrive at the claimed solution.

D2 teaches away from the claimed solution. In paragraph [0043], it states that unpatterned metal foils provide increased integrity, conductivity and uniformity compared e.g. to expanded meshes (which are discussed in D2 as representing the prior art). In paragraph [0053], D2 explains that the unpatterned metal foil ("vapor barrier") makes it possible to disperse electrical charges throughout the foil and that, as a result, energy stays on the overlay and is dispersed substantially uniformly. So, the aim in D2 is exactly the opposite of that in the patent, namely energy diversion instead of dissipation.

Therefore, the skilled person would not arrive at the claimed solution on the basis of D2.

6.1.6 The opponent argued that the claimed solution would however be obvious in view of a combination of D2 and D6.

The board does not agree.

Firstly, contrary to the opponent's assertion, D6 - like D2 - discloses overlays for energy diversion rather than dissipation. This is clear from the very first sentences of D6, which state that the invention disclosed in D6 relates to lightning diversion strips (column 1, lines 10 to 11). The same follows from claim 1 of D6, which refers to a "lightning diversion

strip". Lastly, D6 discloses that this lightning diversion strip is generally similar to the lightning diversion strips known from the prior art (column 11, lines 7 to 10 with reference to figures 2 to 4, which refer to the prior art, see figure captions). These lightning diversion strips of the prior art prevent corona discharge and sparking between metallic segments (column 1, lines 63 to 64 and column 7, lines 7 to 9). The skilled person looking for an overlay that permits dissipation of energy from lightning strikes would thus not turn to D6.

Secondly, even if, as argued by the opponent, D6 disclosed a patterned metal foil for energy dissipation, the skilled person would not use it in the overlay of D2, since that document teaches away from such a patterned metal foil.

Therefore, the skilled person trying to solve the problem of providing an overlay that permits dissipation of energy from lightning strikes would not have been inclined to replace the metal foil of D2 with that of D6. The subject-matter of claim 1, and by the same token of all remaining claims, is thus inventive over D2 in combination with D6.

7. The patent can thus be maintained on the basis of the claims of the fourth auxiliary request, which is identical to the second auxiliary request found allowable by the opposition division.

Order

For these reasons it is decided that:

The appeals are dismissed.

The Registrar: The Chairman:

M. Cañueto Carbajo W. Sieber

Decision electronically authenticated