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Datasheet for the decision of 30 January 2024

Case Number: T 1344/21 - 3.4.03

Application Number: 16171214.6

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Language of the proceedings: EN

Title of invention:
LIGHT-EMITTING DIODE LIGHT SOURCE AND LAMP

Patent Proprietor:
Liquidleds Lighting Corp.

Opponent:
Girard Sudron Deutschland GmbH

Headword:
Flexible LED string

Relevant legal provisions:
EPC Art. 54, 56, 111(1)
RPBA 2020 Art. 11, 12(2), 13(1), 13(2)

Keyword:

Novelty - (yes)
Inventive step - (no) - arbitrary choice of limit values - effect not made credible within the whole scope of claim
Amendment to appeal case - exercise of discretion - amendment overcomes issues raised (no)
Remittal - special reasons for remittal - exceptionally wide range of new issues - (yes)

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Case Number: T 1344/21 - 3.4.03

D E C I S I O N
of Technical Board of Appeal 3.4.03
of 30 January 2024

Appellant: (Opponent)	Girard Sudron Deutschland GmbH Südliche Münchner Str. 55 82031 Grünwald bei München (DE)
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Representative:	Karl, Christof Bardehle Pagenberg Partnerschaft mbB Patentanwälte, Rechtsanwälte Prinzregentenplatz 7 81675 München (DE)
Decision under appeal:	**Decision of the Opposition Division of the European Patent Office posted on 17 June 2021 rejecting the opposition filed against European patent No. 3188264 pursuant to Article 101(2) EPC.**

Composition of the Board:

Chairman	T. Häusser
Members:	M. Stenger
	T. Bokor

Summary of Facts and Submissions

I. The appeal of the opponent concerns the decision of the opposition division to reject its opposition against European patent no. EP 3 188 264 B1. The opposition division found in particular that the claimed subject-matter was new and involved an inventive step over the following document:

D8 US 2014/0268779 A1

II. Reference is also made to the following documents:

D5 CN 104952864 A (XIAMEN DACOL PHOTOELECTRONICS TECHNOLOGY) 30 September 2015
D6 WO 2015/135817 A 1 (KONINKL PHILIPS) 17 September 2015

III. At the end of the oral proceedings before the board, the appellant-opponent (henceforth: opponent) requested that the decision of the opposition division be set aside and that the patent be revoked in its entirety. They further requested that auxiliary request 0 not be admitted into the proceedings and that the case be remitted to the opposition division for examination of auxiliary requests I to XIX.

IV. At the end of the oral proceedings before the board, the respondent-proprietor (henceforth: proprietor) requested that the appeal be dismissed and that the patent be maintained as granted. On an auxiliary basis, they requested that the decision under appeal be set aside and the patent be maintained in amended form based on auxiliary request 0 filed with letter dated 2 January 2024 or based on one of auxiliary requests I

to XIX, filed originally on 17 January 2020 and filed again with the reply to the grounds of appeal. They agreed to the remittal as requested by the opponent.

V. Claim 1 as granted has the following wording (labeling **a**, **b**, **b1**, ... taken from the contested decision in line with the submissions of the parties)
A light-emitting diode (LED) light source (10), wherein the LED light source (10) comprises:

a *a plurality of LED dies (11); and*

b *a plurality of electricity-conducting holding elements (12) being metal sheets respectively;*

b1 *wherein adjacent two of the electricity-conducting holding elements (12) are respectively configured to jointly hold and electrically connect to a positive polarity and a negative polarity installed at two opposite sides of a bottom of one of the LED dies (11) to form a flexible LED light bar;*

b2 *wherein each one of the LED dies (11) is a double-sided light emission LED with a light-emitting surface on a bottom surface uncovered by the adjacent two of the electricity-conducting holding elements (12) of the LED die (11) and another light-emitting surface on a top surface of the LED die (11);*

b3 *wherein each LED die (11) is a flip-chip LED die or an OLED die; and*

c *wherein the electricity-conducting holding elements (12) and the LED dies (11) are alternately connected in series to form the flexible LED light bar;*
characterised in that

c1 *a first length (L1) of each electricity-conducting holding element (12) is greater than or equal to a second length (L2) of each LED die (11),*

c2 *and a first width (W1) of each electricity-conducting holding element (12) is greater than or equal to one-half of a second width (W2) of each LED die (11).*

The board notes that features **c1** and **c2** can also be expressed as L1/L2≥1 (**c1**) and W1/W2≥0.5 (**c2**).

VI. Claim 1 of auxiliary request 0 differs from claim 1 as granted in that it comprises at its end the following additional feature **d** (labeling **d** added by the board):

d *each electricity-conducting holding element (12) is made of a bendable and electrically conductive material.*

VII. The opponent essentially argued that the subject-matter of claim 1 as granted was not new over D8, or at least not inventive in view of D8 combined with the skilled person's common general knowledge. Auxiliary request 0 was filed late and should not be admitted into the proceedings under Article 13(2) RPBA.

VIII. The proprietor essentially argued that D8 neither disclosed nor suggested features **b1**, **b2**, **c1** and **c2**. Auxiliary request 0 was filed in reply to an issue first raised in the board's communication preparing the oral proceedings and should thus be admitted.

Reasons for the Decision

1. The appeal is admissible.

2. The contested patent

The objective of the contested patent is to provide an LED light source in the form of a flexible light bar formed of LED dies and electrically conductive holding elements, with increased connection strength between the electrically conductive holding element and the LED dies, such that the light bar can be bent into a multi-turn helical shape providing illumination in all directions (see in particular paragraphs [0011] and [0029] of the granted patent). Such LED light bars may then be used in LED lamps to avoid "dead zones" (see paragraphs [0012] and [0013]).

3. Prior art D8

D8 aims at providing a light bulb/lamp (see Figure 1) with, e.g. the aesthetic appearance of an incandescent light bulb and having the advantages associated with LEDs (see paragraph [0008]). For this purpose, a plurality of LED light sources is disclosed which all consist of a string of LED dies having electrically conductive support elements between adjacently disposed LED dies (paragraphs [0011] and [0012]. The LED strings of some of the LED sources are twisted or bent (see e.g. Figures 5 and 7). The LED string shown in Figure 7 is explicitly described to have a helical configuration (see paragraphs [0062] and [0063]).

4. Features of claim 1 as granted undisputedly disclosed in D8

None of the parties disputed that D8 discloses features **a**, **b**, **b3** and **c**.

The board concurs with the parties, since, in the terminology of the contested patent, D8 discloses the following features of claim 1 as granted (references in brackets referring to D8):

A light-emitting diode (LED) light source (string 170, Figure 7), wherein the LED light source (170) comprises:
a a plurality of LED dies (LED die chips 122); and
b a plurality of electricity-conducting holding elements (conductive supports 124) being metal sheets respectively (see paragraph [0092]: "*Additionally, there are a number of ways that electrical connectors or electrical conductive supports 124, including metal wires and ribbons, may be joined.*" The board notes that this part of paragraph [0092] is formulated in a general manner and thus does not only apply to Figure 26 mentioned at the beginning and the end of paragraph [0092]);
b3 wherein each LED die (122) is a flip-chip LED die (as shown at least in Figures 2 to 8 of D8) or an OLED die; and
c wherein the electricity-conducting holding elements (124) and the LED dies (122) are alternately connected in series to form the flexible LED light bar (figures and paragraphs [0011] and [0012]);

It was further not disputed that D8 discloses the part of feature **b1** that
b1' adjacent two of the electricity-conducting holding elements (124) are respectively configured to jointly hold and electrically connect to a positive polarity

and a negative polarity installed at two opposite sides of a bottom of one of the LED dies (122) to form a LED light bar (figures and paragraphs [0011] and [0012]).

5. Features of claim 1 as granted the disclosure of which in D8 was disputed

The opponent submitted that D8 disclosed all features of claim 1 as granted.
The proprietor contested that D8 disclosed that part of feature **b1** which specifies that the LED light bar is flexible, as well as features **b2**, **c1** and **c2**.

5.1 Relevant arguments of the opponent

The opponent submitted that the contested patent did not teach or explain the degree of flexibility of the LED filament, for example by indicating a force that had to be applied to achieve a certain distortion. No helical structure was defined in claim 1 and bendability was not mentioned therein, either. Thereby, any flexibility had to be sufficient to anticipate the feature that the light bar was flexible. D8 thus disclosed feature **b1** as a whole.

The faceted side 123 of the LED dies of D8 emitted more light than the other sides according to paragraph [0054] of D8. Further, the provision of a reflective material at the rearward side of the LED dies was mentioned as increasing the light emission perpendicular to side 123 (paragraph [0056]). In the patent the double-sided light emission was defined only by the presence of an uncovered surface at the rear of the LED dies. Such an uncovered surface had to be present in D8 as well to avoid electrical short

circuits. D8 thus disclosed feature **b2** in the sense of the patent.

Concerning feature **c1**, the parts of the electrically conductive supports 124 in the form of a ribbon of D8 that overlapped with the LED dies 122 as shown in particular in Figure 3B (and mentioned in paragraph [0055]) had to be taken into account for the overall length L1 of the supports 124. The supports 124 of Figures 3A and 3B were shown cut off, otherwise the next LED die would have been shown in these figures as well. Figures 2 to 4 thus unambiguously disclosed a length L1 of the supports 124 that was greater than the length L2, in the same direction, of the LED dies 122 and therefore feature **c1**.

The width ratio defined in feature **c2** had the purposes of providing sufficient strength for the connection of the LED dies and the holding elements and of providing a sufficient heat dissipating capability (patent specification, column 6, lines 45 to 50). The same purposes were fulfilled by the supports 124 of D8, which therefore disclosed feature **c2** not only in Figures 2 to 8, but also at least implicitly in the description.

5.2 Relevant arguments of the proprietor

In the absence of any explicit definition of the term "flexible" in the contested patent, the proprietor interpreted this term used in feature **b1** in the context of the patent (e.g. Figures 2 and 3 and paragraph [0029]) as meaning that the LED filament/LED light bar must be able to be bent into a (multi-turn) helical shape and possibly into other shapes as well.

The board notes that this interpretation corresponds to a part of the interpretation for the term "flexible" given by the board in its communication preparing the oral proceedings.

The proprietor further submitted that D8 explicitly mentioned bending of the electrically conductive supports only with respect to Figures 9 to 25. In these figures, the electrically conductive support elements were wires and thus, even in the form of ribbons with a rectangular cross-section as suggested in paragraph [0124], had a width that was small with respect to the width of the LED dies. The condition of feature **c2** could thus never be fulfilled in these embodiments. Such wires could be bent or formed either before or after attachment to the LEDs as set out in paragraph [0129] and the corresponding LED strings were thus flexible in the sense of the patent. However, the LED dies in these embodiments were wire bonded and no flip chips as defined in feature **b3** of claim 1. The embodiments of Figures 9 to 25 of D8 could thus not be used for a feature analysis of claim 1 as granted.

Only Figures 2 to 8 seemed to show flip chips and could thus be used for such a feature analysis. However, flip chip LEDs could not emit light on two sides, as set out with respect to the figures submitted on page 12 of the proprietor's reply to the grounds of appeal. The proprietor was the first to instruct manufacturers of LED dies to make double-sided emitting flip-chip LED dies. The LED dies of Figures 2 to 8 of D8 thus did not show feature **b2**.

Further, D8 did not mention that the planar support elements 124 shown in Figures 2 to 8 could be bent. On the contrary, they had to be relatively thick to be

able to sufficiently dissipate heat as required by D8 and as mentioned by the opponent. Thus, the twisted and the helical configurations mentioned with respect to Figures 5 and 7 had to be created by bending the electrically conductive supports 124 before assembly of the LED string, not by bending the already assembled LED string. At most, the shape of these configurations could be fine-tuned when being fixed to support elements for mounting into the bulb. This possibly generated a small torque or tension as mentioned in D8 with respect to these configurations.
The LED strings of Figures 2 to 8 of D8 were thus not flexible as required by feature **b1**.

In addition, the dimensions defined in features **c1** and **c2** could not be derived directly and unambiguously from D8, certainly not from Figures 2 to 8 of this document which were only schematic and explicitly not to scale according to paragraph [0013]. If there had been any suggestion concerning the lengths of the supports taken from the drawings at all, Figure 3B disclosed a length L1 shorter than the length L2. D8 simply left the dimensions of the dies 122 and of the supports 124, including their lengths and widths as well as the distance between two adjacent dies, completely open.

5.3 Opinion of the board

5.3.1 Figures 9 to 25

The LED dies shown in Figures 9 to 25 are drawn in the same (schematic) manner as the LED dies shown in Figures 2 to 8 (see in particular Figures 10 and 25). In addition, there is no explicit suggestion in the description of D8 that they are of a different type.

The board thus has doubts that the skilled person would read D8 such that the LED dies shown in Figures 9 to 25 differed in any way from the LED dies shown in Figures 2 to 8, in particular that the LED dies shown in Figures 9 to 25 were no flip-chip dies, contrary to the submissions of the proprietor.

Nevertheless, the use of the term "wires" with respect to the supports 124 shown in Figures 9 to 25 suggests indeed that these supports are relatively narrow and thin, as submitted by the proprietor. The board will therefore concentrate in the following on the embodiments shown in Figures 2 to 8.

5.3.2 Meaning of the term "flexible"

The board sees no reason to change its interpretation of the term "flexible" in the context of the contested patent as expressed in its communication. As set out there, the skilled person would understand the term "flexible" as meaning that the LED bar must be able to be bent into a (multi-turn) helical shape and possibly into other shapes as well, as submitted by the proprietor. However, as also set out in the communication, bending the LED bar may involve an elastic and/or a plastic deformation, and the patent does not give any indication of the force required to bend the light bar, as submitted by the opponent.

5.3.3 Feature **b1**

As acknowledged by the parties, D8 mentions with respect to the embodiment shown in Figure 7 a helical configuration of the LED string 170 (paragraphs [0062] and [0063]). In that configuration, the electrically

conductive supports 124 may be under longitudinal torque or compression (see paragraph [0063]).
It is the understanding of the board that, in order to generate such a torque or compression, an elastic deformation or distortion of the supports 124 must be present. That is, an LED string 170 held in a specific final shape in which the supports 124 are under longitudinal torque or compression must have been bent and twisted into that final shape as a whole after having been assembled, such that the supports 124 are elastically deformed. In the embodiment shown in Figure 7, this final shape is a helical configuration. The board thus holds that D8 discloses a "flexible" light bar in the sense of the contested patent, in line with the submissions of the opponent.

The board notes that an interpretation of the LED strings of D8 as having a pre-formed helical configuration the shape of which is then fine-tuned for fixing it to supporting elements, as suggested by the proprietor, would also be considered to be "flexible" according to the interpretation of that term by the board as set out above. The only difference would be that the elastic deformation would be smaller.

Irrespective thereof, and contrary to the submissions of the proprietor, the board does not believe that the skilled person would interpret the embodiment shown in Figure 7 of D8 such that the connections between the supports 124 and the LED dies 122 can be made only after the supports have been brought (e.g. bent) individually (at least roughly) into the required shape. Manufacturing the LED string 170 in that manner would require to make some of the connections while the LED dies and the supports to be connected are not positioned flat on a working surface, but are arranged

such they extend at an angle therefrom. This would be much more complicated than assembling the LED string in a flat form first and bringing it into the desired shape after all the connections between the LED dies and the supports have been made.

This equally applies to the alternative also mentioned in paragraph [0063] that the supports 124 may have a configuration for supporting and suspending LED die chips without stress. In the opinion of the board, the skilled person would not understand that in this alternative, the LED string is assembled after the supports have been bent individually into their required shapes, either. Instead, the skilled person would understand this alternative as meaning that the deformation of the supports 124 induced by bending the assembled LED string is plastic rather than elastic. Such configuration would still fall under the interpretation of the term "flexible" by the board as set out above (see section 5.3.2).

The board accepts that the skilled person would design the supports 124 such that they provide a desired heat transfer rate, as submitted by both the opponent and the proprietor. In the context of the embodiments shown in Figures 2 to 7, in particular in Figures 5 and 7, the skilled person would do so, however, while respecting that the LED strings would have to flexible (or bendable, or to be bent) enough to obtain the desired shapes.

It follows from the above that the LED strings shown in Figures 2 to 7 of D8 are "flexible" in the sense of the contested patent, that is according to the interpretation of the board as set out above. D8 thus discloses feature **b1** in its entirety.

5.3.4 Feature **b2**

The disposition of a reflective material on the rearward side 121 of LED die chips 122 mentioned in paragraph [0056] technically makes only sense if, without such a material, the chip would emit light via the rearward side, as submitted by the opponent. Thus, in the sentence in this paragraph indicating that "*the frontal side 123 of each LED die chip 122 may be configured to emit a greater amount of light than other sides of LED die chip 122*" the term "other sides" have to be considered to include also the rearward side 121, contrary to the submission of the proprietor.

The board notes that the description mentions the feature that the frontal/faceted side 123 of the LED dies may emit a greater amount of light than other sides of the LED die chip 122 with respect to all LED strings shown in Figures 2 to 7 (see paragraphs [0054], [0056], [0058], [0060] and [0062]). The board is thus convinced that at least the individual LED dies shown in these figures are of the same type emitting light also via their rearward sides and that the assembled LED strings shown therein differ only in the overall geometric shape of the LED strings. D8 therefore discloses double-sided light emission LED dies with a light-emitting surface on a bottom surface and another light emitting surface on a top surface as defined in feature **b2** at least with respect to Figures 2 to 7.

Since the supports 124 in D8 may not touch each other to avoid electrical short circuits as submitted by the opponent, the board holds that D8 also discloses a bottom surface uncovered by the two adjacent two of the

electricity-conducting holding elements of the LED die as also defined in feature **b2**.

D8 therefore discloses feature **b2** in its entirety, at least with respect to Figures 2 to 7.

As a side remark, the board notes that the figures submitted on page 12 of the proprietor's reply to the grounds of appeal may show a flip-chip LED die emitting in only one direction. This does not imply, however, that flip-chip LED dies emitting in two directions did not exist. The proprietor did not present any evidence that they were the first to use flip-chip LED dies emitting in two directions. In any case, this is not apparent from the contested patent.

5.3.5 Feature **c1**

The board accepts that for example the proportions shown in Figure 4 of D8 seem to suggest that the length of the supports 124, taking into account the part overlapping the LED dies, is longer than the length of the LED dies themselves, as submitted by the opponent. However, Figure 3B seems to suggest a shorter length of the supports, as submitted by the proprietor, and the board is not convinced that figures 3A and 3B necessarily show a cut-off version of the supports, contrary to the submission of the opponent.
In any case, the description of D8 does not refer to such a cut-off; instead, paragraph [0013] explicitly states that the figures are not to scale, as submitted by the proprietor.
As also submitted by the proprietor, D8 does not specify the length of the supports nor the distance between two adjacent LED dies in a string.

The board thus holds that D8 does not disclose feature **c1** in a direct and unambiguous manner, contrary to the submissions of the opponent.

5.3.6 Feature **c2**

The board accepts that the holding elements defined in claim 1 fulfill the same purposes as the supports 124 of D8, as submitted by the opponent. However, this does not necessarily mean that the dimensions, or dimension ratios, of the holding elements on the one hand and of the supports 124 on the other hand are equal.

In a similar manner as for the lengths, D8 does not specify the width of the LED dies or of the supports, as submitted by the proprietor. In Figures 2 to 6, the width of the supports is drawn as being very close to half the width of the LED dies. The board believes that the skilled person would also consider the supports of Figure 7 to correspond to the supports shown in figures 2 to 6.
As set out in paragraph [0013] of D8 mentioned already above, however, the figures are not to scale. The supports shown in Figures 2 to 6 could therefore as well have a width that is slightly below 50% of the width of the LED dies. The board therefore holds that D8 does not, neither explicitly nor implicitly, disclose feature **c2** in a direct and unambiguous manner.

6. Conclusion of the board concerning the disclosure in D8 of the features of claim 1 as granted

It follows from the above that D8 discloses, with respect to Figures 2 to 7, features **b1** and **b2**, contrary to the submissions of the proprietor. However, D8 does not disclose directly and unambiguously features **c1** and

c2 with respect to the same figures, contrary to the submissions of the opponent.

The subject-matter of claim 1 as granted is therefore novel over D8 within the meaning of Article 54 EPC.

The board notes that these conclusions are in line with the finding of the opposition division (see section 2.2.2.4 of the contested decision).

7. Inventive step of claim 1 as granted, starting from D8

7.1 Closest state of the art

As set out above, D8 aims at the same objective (providing a bent LED string) and shares the most relevant technical features with the claimed invention (see sections 4. to 6. above). D8 can thus be considered to represent the closest prior art. This was not disputed by the parties.

7.2 Relevant arguments of the opponent

The opponent submitted that features **c1** and **c2** only defined lower limits for L1 and W1 with respect to the dimensions of the LED die. Every length/width ratio above these limits would fall under these definitions, even extremely high values.
The limits themselves were chosen arbitrarily; the contested patent did not give any reason why exactly these lower limits achieved a particular technical effect. For instance, paragraphs [0021] and [0022] of the patent specification only indicated the general purpose of features **c1** and **c2** to provide sufficient length and width to prevent disconnection of the LED

dies and the holding elements, but gave no indication of the forces involved.

In the absence of a problem mentioned in the patent, the objective technical problem could be formulated as how to provide an alternative solution.

When trying to put into practice the teaching of D8 and to find a value for the width ratio, the skilled person would take into account that the supports 124 should provide a desired heat transfer as explicitly mentioned in paragraph [0053] of document D8. It would also take into account that the LED strings of D8 could be bent, for instance into a multi-turn helix as disclosed with respect to Figure 7 and would therefore provide connections of sufficient strength, similar to what is mentioned in the contested patent. It would further find a hint in paragraph [0055] of D8 stating that a substantial portion of the rearward side 121 might be covered by the supports 124. All this suggested a higher rather than a lower width W1 of the supports with $W1/W2 \geq 0.5$.

Concerning the length ratio, the skilled person would also take into account that the LED strings of D8 were to be bent or twisted and would therefore consider a certain minimal gap or distance between adjacent LED dies because the longer this distance the easier a ribbon support 124 could be bent. A long distance between LED dies required a long length of the support 124. This suggested a high value of L1/L2, well above the claimed lower limit.

Thus, in the absence of any particular technical effect the skilled person would arrive at ratios falling into

the claimed ranges, i.e. above the respective claimed lower limits by routine trial and error.

7.3 Relevant arguments of the proprietor

The proprietor submitted that the technical effect of feature **c1** was to reduce bending stress. The longer the holding elements the smaller the shear stresses on the holding elements and on the connections would be and the easier the holding elements could be bent, as set out in paragraph [0021] of the contested patent.

The technical effect of feature **c2** was to provide a stronger connection between the LED dies and the holding elements to avoid the separation of the holding elements from the LED dies when the light bar was bent, as set out in paragraph [0022] of the patent. This also increased the (effective) flexibility of the light bar.

Both features **c1** and **c2** thus increased the flexibility of the holding element, with all other things held equal, i.e. compared to a holding element without these features. In that respect, it was not relevant that the flexibility of the holding element was also influenced by other parameters like the thickness and the elasticity coefficient of the metal elements.

D8 did not refer to the connection strength between the LED dies and the supports 124 at all. This issue was recognised only in the patent. The torque mentioned in D8 could not be very high since they involved at best a fine tuning of the shapes of the LED strings. To enable bending of the LED string according to the patent required a much higher connection strength.

Concerning heat dissipation, D8 only taught the problem, but offered no solution.

If the LED strings of D8 were considered to be bendable, the objective technical problem could be defined as how to manufacture them such that they could be bent.

In any case, and irrespective of the formulation of the objective technical problem, even if the skilled person *could* possibly have arrived at values falling within the ranges defined by features c1 and c2, there was no reason why the skilled person *would* have done so.

The arguments of the opponent why the skilled person would arrive at high ratios of L1/L2 and W1/W2 were based on hindsight. Covering a substantial portion of the rearward side of the LED dies as mentioned in D8 could be achieved by increasing the overlap of the LED dies and the supports in the length direction and did not require an increased width of the supports. Moreover, starting from D8 the skilled person would not increase the length ratio. Instead, it would rather try to reduce the gap or distance between adjacent LED dies to avoid that the individual LEDs became visible (dot appearance). This would lead to small L1/L2 values.

7.4 Opinion of the board

7.4.1 Technical effects

The board accepts the argument of the proprietor referring to paragraph [0021] of the patent that, all other parameters held equal, a light bar with $L1/L2 \geq 1$ is more flexible than a light bar with $L1/L2 < 1$. Similarly, the board also accepts the argument of the

proprietor referring to paragraph [0022] that, all other parameters held equal, in a light bar with a W1/W2≥0.5, the connection strength is higher than in a light bar with W1/W2<0.5. In that sense, both features **c1** and **c2** contribute to a higher effective flexibility of the LED strings, as submitted by the proprietor.

However, neither paragraphs [0021] and [0022] nor any other part of the contested patent mentions any particular technical effect that would occur exactly when the particular limit values defined in features **c1** and **c2** are exceeded. Nor is there any such effect to be expected. Instead, the flexibility of the holding elements increases gradually and in a predictable manner with the ratio L1/L2 (all other parameters kept equal) and the strength of the connections increases gradually and in a predictable manner with the ratio W1/W2 (all other parameters kept equal).

In addition, the flexibility of the holding elements depends on other parameters as well, like their thicknesses and the material they are made of. Likewise, the strength of the connections also depends on other parameters as well, like the length of the overlap between the LED dies and the holding elements. None of these other parameters is defined in claim 1 as granted. For example, for a given length ratio of, for instance, L1/L2=1.1 with a relatively small gap between two consecutive LED dies, it is expected that there is a thickness of the holding elements above which the light bar is too rigid for it to be bent into a multi-turn helical shape in the sense of the patent. Therefore, contrary to the argument of the proprietor, it is relevant that the flexibility of the LED strings is influenced also by other parameters, because the

effects mentioned in paragraphs [0021] and [0022] are not achieved over the whole range claimed.

In sum, there is no particular, unpredictable technical effect occurring exactly when the lower limit values defined in features **c1** and **c2** are exceeded if all other parameters are held equal. In addition, the (predictable) variation of the flexibility of the light bar and the strength of the connections depends on other parameters as well, such that features **c1** and **c2** do not achieve any technical effect over the whole range claimed.

Therefore, the board concurs with the submission of the opponent that the exact limit values defined in features **c1** and **c2** are selected in an arbitrary manner.

7.4.2 Objective technical problem

As set out above, features **c1** and **c2** achieve no technical effect over the whole range claimed. Instead, they define arbitrary limits for certain dimensions of the holding elements, as submitted by the opponent, while D8 does not specify any values for the lengths and the widths of the supports and the LED dies at all, as submitted by the proprietor.

Starting from D8, the objective technical problem could thus be formulated as "how to implement the LED string of the embodiments shown in Figures 2 to 7 of D8". This objective technical problem essentially corresponds to the suggestion of the proprietor "how to manufacture the LED strings" of D8 such that they can be bent.

The board notes that the proposal of the opponent to formulate the objective technical problem as "how to provide an alternative" does not seem to be appropriate in the present case, given that D8 does not specify any values for the lengths and widths at all. Thus, there are no values in D8 for which an alternative could be found.

7.4.3 Obviousness

When trying to solve the objective technical problem defined above, the skilled person would take into account circumstances like the intended purpose of the LED strings of D8, namely, that they should provide a desired heat transfer and that they are to be bent or twisted, as submitted by the opponent, into a desired shape. This will even involve a particular desired radius of a helix according to the desired overall design.
It would also take into account that the supports may be under mechanical stress when the LED strings are bent or twisted as set out above (see section 5.3.3).
The board notes that the patent does not give any indication of the forces involved in bending the LED light bars, as submitted by the opponent. Thus, the board does not accept the argument of the proprietor that bending of the LED string according to the contested patent required a much higher connection strength than necessary in D8.

Thus, the skilled person starting from D8 would consider the connection strength between LED dies and supports as well, even though the connection strength is not explicitly mentioned in D8, as submitted by the proprietor.

The skilled person would further take into account that substantial portions of the rearward sides may be covered by the supports, as submitted by the opponent, and therefore would not refrain from providing a large width of the supports. It might also want to avoid that individual LED dies are visible ("dot appearance"), as submitted by the proprietor; this effect, however, is not mentioned in the contested patent and the board believes that the skilled person would do so at best under the condition that the LED strings can still be bent into the desired shape.

The skilled person would then, according to such circumstances, select values for parameters like the width and length of the LED dies 122, the material of the supports 124, the thickness, the width and the length of the supports 124 as well as their overlap with the LED dies 122 and the distance between adjacent LED dies.
It would do so using its common general knowledge by routine trial and error, as submitted by the opponent, and would thereby arrive at LED strings with supports of sufficient length and width for the intended purposes.

The exact lower limits defined in features **c1** and **c2** are arbitrary, as set out above (see section 7.4.1) and can therefore not contribute to inventive step. Thus, the argument of the proprietor, that the skilled person *could* have, but *would not have* arrived at features **c1** and **c2** is not convincing.

It follows from the above that the subject-matter of claim 1 as granted is not inventive under Article 56 EPC in view of D8 combined with the common general knowledge.

The board notes that according to the contested decision, the opponent and the proprietor did not present any (with respect to their written submissions) additional arguments regarding inventive step starting from D8 during the oral proceedings before the opposition division. In the absence of such arguments, the opposition division essentially repeated, in the contested decision (section 2.2.3.7), its conclusion already set out in its communication annexed to the summons dated 25 September 2020 (section 2.1.3.7, penultimate paragraph).
The board further notes that in these summons, the opposition division essentially states its consideration "that the skilled person would only modify the LED light source disclosed in D8 to include the features c1) and c2) with hindsight", without giving any detailed reasons why it preferred the arguments of the proprietor over the arguments of the opponent.

8. Auxiliary request 0

8.1 The opponent submitted that auxiliary request 0 was filed late, after the communication of the board, and should therefore not be admitted into the proceedings under Article 13(2) RPBA.

8.2 The proprietor submitted that auxiliary request 0 was filed in reply to the issue that the flexibility of the holding elements did not depend on their lengths and widths alone, raised for the first time by the board in its communication. It was further filed in good time before the oral proceedings and should therefore be admitted.

8.3 A new issue raised for the first time in a communication under Article 15(1) RPBA might in principle be considered as an exceptional circumstance in the sense of Article 13(2) RPBA. In the present case, however, the issue that the flexibility of the holding element does not only depend on its length was brought up by the opponent (paragraph [29] of the grounds of appeal) and only elaborated in more detail by the board in section 7.1.3(b) of its communication dated 13 September 2023. The board thus believes that in the present case, there are no exceptional circumstances in the sense of Article 13(2) RPBA.

In addition, the electrically conductive supports 124 of D8 may be metal ribbons, as disclosed in paragraph [0092] mentioned already with respect to the main request. Further, as also set out with respect to the main request (see section 5.3.3 above), the supports 124 disclosed in D8 are considered to be flexible/bendable. Therefore, the board concluded that the amendment of claim 1 of auxiliary request 0 is *prima facie* not suitable to resolve the issue raised with respect to the main request. The board therefore saw no reason to exercise its discretion under Article 13(1) RPBA to admit auxiliary request 0.

For these reasons, the board decided not to admit auxiliary request 0 into the proceedings.

9. Auxiliary requests I to XIX

Auxiliary requests I to XIX were initially filed during the opposition proceedings with letter dated 17 January 2020 and re-filed with the reply to the grounds of appeal.

The opposition division did not comment on any of these auxiliary requests, nor on any of the granted dependent claims (on which most of the amendments in the independent claims of these auxiliary requests are based), in the relevant summons to oral proceedings (dated 25 September 2020). During the opposition proceedings the opponent made some brief comments concerning auxiliary requests I to XV (but not auxiliary requests XVI to XIX) in its submission dated 11 March 2021, referring to documents D5, D6, D8 and the skilled person's common general knowledge. Earlier the opponent had further commented on dependent claims 2, 3 and 8 (on which some of the amendments in the independent claims of the auxiliary requests are based) in its submission dated 17 January 2020.

At the end of the oral proceedings before the opposition division the opposition was rejected. Consequently, auxiliary requests I to XIX were not discussed during the oral proceedings before the opposition division and the contested decision does not refer to any of these requests, either.
The same applies to dependent claims 2, 3, 4, 6, 7, and 8.

That is, the opposition division did not take position at all on any of the auxiliary requests, the corresponding comments of the parties or on any of the dependent claims. In addition, it did not comment in detail on the submissions of the parties relating to inventive step starting from D8 since the parties did not present any new arguments in that respect during the oral proceedings before the opposition division. Furthermore, most of the brief comments of the opponent concerning these requests refer to D5 and D6 and not to D8; none of them refers to a combination starting from

D8 and taking into account the skilled person's common general knowledge, which is now regarded as rendering the subject-matter of claim 1 as granted not inventive as set out above.

It follows from the above that in the present case, the board could not decide the case without inevitably presenting for the first time the board's assessment on an exceptionally wide range of previously unaddressed subject-matter and corresponding objections of the opponent. In particular, the board would have had to consider for the first time, in the framework of assessing inventive step, multiple combinations of documents, in particular starting from D8, that had previously not been discussed and without any indication of the opinion of the opposition division on the matters to be decided.
The board considers that in the present case, this is not appropriate in view of the primary object of the appeal proceedings to review the decision under appeal in a judicial manner (Article 12(2) RPBA, see also *Case Law of the Boards of Appeal of the EPO*, 10th edition 2022, section V.A.9.3.2 a), second paragraph).

The board therefore concludes that in the present case, there are special reasons within the meaning of Article 11 RPBA for remitting the case to the opposition division (see Article 111(1) EPC) for further prosecution as requested by the opponent and consented to by the proprietor.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The case is remitted to the opposition division for further prosecution.

The Registrar: The Chairman:

S. Sánchez Chiquero T. Häusser

Decision electronically authenticated