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Case Number: T 2787/19 - 3.5.03

Application Number: 15151459.3

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Language of the proceedings: EN

Title of invention:
Robot cleaning system and method for charging a cleaning robot

Applicant:
LG Electronics Inc.

Headword:
Robot cleaner/LG

Relevant legal provisions:
EPC Art. 123(2)

Keyword:
Added subject-matter - all claim requests (yes): unallowable intermediate generalisation

Decisions cited:
T 1428/17

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Case Number: T 2787/19 - 3.5.03

D E C I S I O N
of Technical Board of Appeal 3.5.03
of 5 May 2022

Appellant: (Applicant)	LG Electronics Inc. 128, Yeoui-daero Yeongdeungpo-gu Seoul 150-721 (KR)
Representative:	Vossius & Partner Patentanwälte Rechtsanwälte mbB Siebertstrasse 3 81675 München (DE)
Decision under appeal:	**Decision of the Examining Division of the European Patent Office posted on 22 May 2019 refusing European patent application No. 15151459.3 pursuant to Article 97(2) EPC.**

Composition of the Board:

Chair	K. Bengi-Akyürek
Members:	K. Peirs
	C. Almberg

Summary of Facts and Submissions

I. The appeal is against the decision of the examining division refusing the present European patent application on the grounds of

- added subject-matter (Article 123(2) EPC) and lack of an inventive step (Article 56 EPC) regarding claim 1 of the main request;
- lack of an inventive step (Article 56 EPC) regarding claim 1 of the auxiliary request.

II. A communication was issued under Article 15(1) RPBA 2020 including the board's preliminary opinion that the subject-matter of claim 1 of all claim requests contained added subject-matter (Article 123(2) EPC).

III. Oral proceedings before the board were held on 5 May 2022, at the end of which the board's decision was announced.

IV. The appellant requests that the decision under appeal be set aside and that a patent be granted on the basis of the claims of the **main request** or either of **two auxiliary requests**.

V. Claim 1 of the **main request** reads as follows (board's feature labelling; an expression in feature (j) that is particularly relevant for the present decision is emphasised by the board):

(a) "A robot cleaning system comprising:
a robot cleaner (100) comprising:
a sensor (190) for receiving a specific signal sound,

a rechargeable battery, and

a robot cleaner control unit (180); and

a recharging base (200) comprising an audio output device (210) for outputting the specific signal sound,

wherein the robot cleaner (100) further comprises a first communication unit (170) for communicating with the recharging base (200),

(b) wherein the first communication unit (170) is configured to transmit a specific sound generation requesting signal to the recharging base (200), and

(c) the audio output device (210) of the recharging base (200) is configured to output a specific signal sound, when a second communication unit (260) of the recharging base (200) receives the signal;

(d) wherein the robot cleaner control unit (180) is configured to calculate a distance from the robot cleaner (100) to the recharging base (200) based on the signal sound received by the sensor (190), when a remaining amount of the battery is less than a preset value, and

(e) wherein the robot cleaner (100) is configured to dock with the recharging base (200) to recharge the battery of the robot cleaner (100),

characterized in that

(f) the first communication unit (170) is configured to transmit a specific sound generation requesting signal to the recharging base (200), when the remaining amount of the battery is below the preset value,

(g) the robot cleaner control unit (180) is further configured to calculate a direction from the robot cleaner (100) to the recharging base (200) based on the signal sound received by the sensor (190), and

(h) being adapted to control the robot cleaner (100) to move based on the calculated distance and direction, when a remaining amount of the battery is less than a preset value,
(i) the sensor (190) is a microphone (191) for receiving the signal sound and comprises at least three microphones (191),
(j) wherein delay differences **or differences of the sound pressure** in signals of the at least three microphones (191) are triangulated to determine a location of the recharging base (200)".

VI. Claim 1 of **auxiliary request 1** reads as follows (amendments vis-à-vis claim 1 of the main request highlighted by the board):

"A robot cleaning system comprising:
a robot cleaner (100) comprising:
a sensor (190) for receiving a specific signal sound,
a rechargeable battery, and
a robot cleaner control unit (180); and
a recharging base (200) comprising an audio output device (210) for outputting the specific signal sound,
wherein the robot cleaner (100) further comprises a first communication unit (170) for communicating with the recharging base (200), wherein the first communication unit (170) is configured to transmit a specific sound generation requesting signal to the recharging base (200), and the audio output device (210) of the recharging base (200) is configured to output a specific signal sound, when a second communication unit (260) of the recharging base (200) receives the signal;

wherein the robot cleaner control unit (180) is configured to calculate a distance from the robot cleaner (100) to the recharging base (200) based on the signal sound received by the sensor (190), when a remaining amount of the battery is less than a preset value, and
wherein the robot cleaner (100) is configured to dock with the recharging base (200) to recharge the battery of the robot cleaner (100),
characterized in that
the robot cleaner control unit (180) is configured to stop the robot cleaner (100) from cleaning, when the remaining amount of the battery is below the preset value,
the first communication unit (170) is configured to transmit a specific sound generation requesting signal to the recharging base (200), when the remaining amount of the battery is below the preset value,
the robot cleaner control unit (180) is further configured to calculate a direction from the robot cleaner (100) to the recharging base (200) based on the signal sound received by the sensor (190), and being adapted to control the robot cleaner (100) to ***then*** move ***to the recharging base (200)*** based on the calculated distance and direction, when a remaining amount of the battery is less than a preset value,
the sensor (190) is a microphone (191) for receiving the signal sound and comprises at least three microphones (191),
wherein delay differences ~~or differences of the sound pressure~~ in signals of the at least three microphones (191) are triangulated to determine a location of the recharging base (200).".

VII. Claim 1 of **auxiliary request 2** includes all the features of claim 1 of auxiliary request 1 and further includes, at the end, the following feature:

";
wherein the robot cleaner control unit (180) is adapted to turn on the sensor (190) when the remaining amount of the battery falls below the preset value;
wherein the robot cleaner control unit (180) is adapted to inactivate the sensor (190) when the remaining amount of the battery is at the preset value or more".

Reasons for the Decision

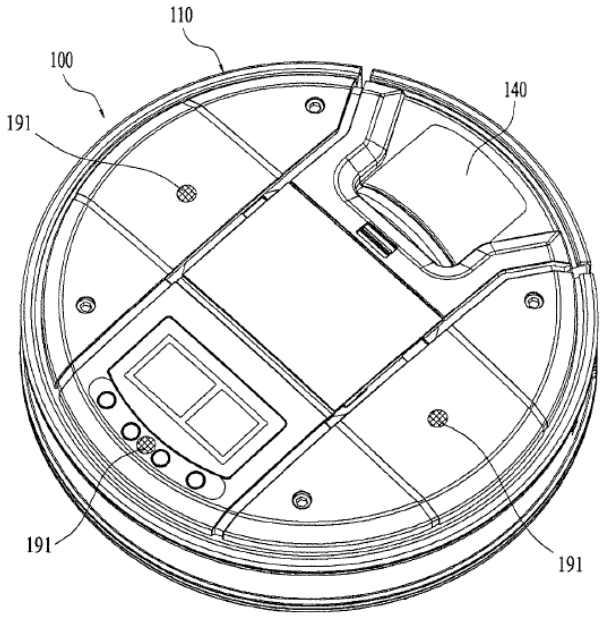
1. *Technical background*

The present application concerns a robot cleaning system (see Figure 1 of the application reproduced below) involving robot cleaner 100 with dust collection unit 140, three microphones 191, a rechargeable battery and a control unit. In particular, the present application relates to the situation when the voltage of the rechargeable battery drops below a predetermined level during the robot cleaner's operation. If that is the case, robot cleaner 100 sends out a signal to request its recharging base to output a specific (inaudible) sound.

Upon detection of this specific sound by microphones 191, the robot cleaner's control unit can derive where the recharging base is located. This is done via triangulation using delay differences and differences in sound pressure between the sound received by microphones 191, where the former allows to determine a direction towards the recharging base and

the latter a distance to the recharging base.

FIG. 1



By using sound as a basis for the triangulation, the present invention avoids a typical problem connected with conventional robot cleaners that determine the recharging base's location by means of an infrared (IR) beam where objects can block reception of the IR beam.

2. *Main request: claim 1 - added subject-matter*

The board concurs with the conclusion drawn in Reasons 11 of the appealed decision that **feature (j)** adds subject-matter extending beyond the content of the application as filed, contrary to Article 123(2) EPC. The board notes in this respect that original claim 6, to which feature (j) is related, does not include the expression "or differences of the sound pressure" emphasised in point V above.

2.1 As regards a direct and unambiguous support for this expression, the appellant referred to paragraph [0048] of the application as filed. While it correctly pointed out that a literal basis is not required to ensure compliance with Article 123(2) EPC, the preferred embodiment of this paragraph does not provide a direct and unambiguous disclosure for a general triangulation as required by feature (j). Instead, it teaches a specific form of sound-source localisation which analyses differences between the sound pressures received at each of the microphones 191. It is apparent from original paragraph [0048] that this specific form of sound-source localisation hinges on two elements which are not specified in features (a) to (j):

2.1.1 The first one of these two elements is the use of a predetermined look-up table which can "be searched and used by the control unit" to calculate the distance from the robot cleaner to the recharging base. The board holds in this respect that the clause "*the received sound pressure decreases , which is tabalized to be searched and used by the control unit*" of paragraph [0048] as filed cannot be construed in the sense that it would refer to a mere "memory" in which the received sound pressure is stored such that it can be used by the control unit to calculate the distance and which, contrary to a look-up table, could possibly be an implicit feature of the claimed robot cleaning system. This is because the skilled reader would immediately understand that the expression "to be searched" in this clause would only make technical sense in the context of a look-up table defining a correspondence between the distance from the sound source and the received sound pressure. Moreover, the board cannot see how the control unit could possibly derive the distance to the sound source solely based on

a value of the received sound pressure stored in a memory, without any knowledge neither of

- which sound pressure the "specific signal sound" of original paragraph [0048] and feature (c) was transmitted with

nor of

- how the distance to the recharging base affects the received sound pressure as detected by the robot cleaner's microphones.

2.1.2 The second one of these two elements is that the specific sound signal is transmitted as a uniform sound pressure. The board holds this particular shape of the sound-pressure characteristic to be inextricably linked to *how* the distance is calculated in the present application. Contrary to the appellant's opinion, a *uniform* sound pressure is not inherent to **features (a) to (j)**. Rather, the skilled reader would immediately recognise, based on their common general knowledge, that the "triangulation" according to feature (j) could, for instance, rely on a *directional* sound beam. While a *uniform* sound-pressure characteristic will arguably work better, this does not necessarily mean that the skilled reader would dismiss the use of a *directional* sound-pressure characteristic as a "non-workable embodiment".

2.2 When a claim is restricted to a preferred embodiment, as is presently the case, it is normally not permitted to extract isolated features from a set of features which have originally been disclosed in combination for that embodiment. As set out in **T 1428/17** (Reasons 1.4), such an amendment, i.e. intermediate generalisation, is

only justified in the absence of a clearly recognisable functional or structural relationship among these features. From points 2.1.1 and 2.1.2 above, it is immediately apparent that such a justification is not present for the amendment underlying feature (j). Therefore, feature (j) amounts to an unallowable intermediate generalisation.

2.3 In conclusion, claim 1 of the main request does not comply with Article 123(2) EPC.

3. *Auxiliary requests: claim 1 - added subject-matter*

3.1 Claim 1 of both **auxiliary requests** on file differs from claim 1 of the main request, amongst others, in that

- the expression "or differences of the sound pressure" is removed from feature (j);
- the robot cleaner control unit is configured (cf. the text in bold and italics in point VI above)

(k) to stop the robot cleaner from cleaning when the remaining amount of the battery is below the preset value;

(l) to control the robot cleaner to then move to the recharging base based on the calculated distance and direction.

3.2 Although removing the alternative "differences of the sound pressure" aligns feature (j) with original claim 6, the board holds that **features (k) and (l)** have no direct and unambiguous disclosure in the claims of the application as filed. In fact, the application as filed comprises only a single passage which might be related to these features, namely original

paragraph [0051]. While this paragraph may be ambiguous, it can be interpreted, to the appellant's benefit, such that the robot cleaner may move to the recharging base on the basis of the distance and the direction calculated from the "receiving sound".

However, even when applying this interpretation, the teaching of original paragraph [0051] cannot be taken out of context. Contrary to what was stated by the appellant, paragraph [0051] as filed does not mention "the receiving sound" as a broad conceptual reference: neither this paragraph nor paragraph [0050] as filed, to which the appellant also referred, comprises a direct and unambiguous disclosure for the skilled reader to this effect. There is no indication for the skilled person other than that

- the term "the receiving sound" (emphasis added) of original paragraph [0051],

- the phrase "the sound received by microphone 191" (emphasis added) of paragraph [0050] as filed

and, likewise,

- the phrase "the sound transmitted from the recharging base" (emphasis added) of original paragraph [0049]

refer to the sound received by the robot cleaner's microphones and via which the distance is actually calculated as set out in original paragraph [0048]. It is, however, this distance which, according to paragraph [0051] as filed, is eventually used to move the robot cleaner "to the recharging base". As a result, the calculation of the distance referred to in

original paragraph [0051] necessarily involves the same two elements as mentioned in points 2.1.1 and 2.1.2 above. That these two elements are not encompassed in claim 1 of auxiliary requests 1 and 2 amounts, similarly to claim 1 of the main request, to an unallowable intermediate generalisation.

3.3 Hence, claim 1 of each of the auxiliary requests on file does not comply with Article 123(2) EPC either.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chair:

B. Brückner K. Bengi-Akyürek

Decision electronically authenticated