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**Datasheet for the decision
of 23 February 2024**

Case Number: T 1854/22 - 3.2.07

Application Number: 15863494.9

Publication Number: 3224003

IPC: B25J9/00, B25J11/00, B25J9/16,
B25J19/02, A47L9/28, G05D1/02

Language of the proceedings: EN

Title of invention:
SYSTEMS AND METHODS OF USE OF OPTICAL ODOMETRY SENSORS IN A
MOBILE ROBOT

Patent Proprietor:
iRobot Corporation

Opponent:
Aktiebolaget Electrolux

Headword:

Relevant legal provisions:
EPC Art. 113, 116, 100(c), 123(2), 100(b), 83, 100(a), 54, 56
RPBA 2020 Art. 12(8), 15(1), 15(3)

Keyword:

Oral proceedings - withdrawal of request for oral proceedings
- decision in writing

Grounds for opposition - added subject-matter (no) -
insufficiency of disclosure (no) - lack of patentability (no)

Decisions cited:

T 0182/89, T 0019/90, T 2619/11

Catchword:



Beschwerdekammern
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Case Number: T 1854/22 - 3.2.07

D E C I S I O N
of Technical Board of Appeal 3.2.07
of 23 February 2024

Appellant: iRobot Corporation
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Decision under appeal: **Interlocutory decision of the Opposition
Division of the European Patent Office posted on
20 May 2022 concerning maintenance of the
European Patent No. 3224003 in amended form.**

Composition of the Board:

Chairman G. Patton
Members: A. Cano Palmero
R. Cramer

Summary of Facts and Submissions

- I. The patent proprietor and the opponent lodged appeals within the prescribed period and in the prescribed form against the decision of the opposition division to maintain European patent No. 3 224 003 in amended form on the basis of the then auxiliary request 0.
- II. The opposition was filed against the patent in its entirety and was based on Article 100(a) EPC (lack of novelty and inventive step), Article 100(b) EPC (insufficiency of disclosure) and Article 100(c) EPC (unallowable amendments).
- III. In preparation for oral proceedings requested by the parties, the board communicated its preliminary assessment of the case in a communication pursuant to Article 15(1) RPBA dated 25 October 2023, according to which the decision was likely to be set aside and the patent to be maintained as granted.
- IV. With letter dated 23 November 2023 the opponent withdrew its appeal. The present appeal case is therefore directed to the appeal of the patent proprietor as sole appellant, while the opponent has the role of respondent to the patent proprietor's appeal.
- V. With letter dated 3 January 2024 the opponent (respondent) withdrew its request for oral proceedings and also indicated that it would not attend the oral proceedings scheduled for 22 February 2024.
- VI. The patent proprietor (appellant) requested

that the decision under appeal be set aside and that the patent be maintained as granted.

As a result of the opponent's withdrawal of its appeal the patent proprietor's auxiliary requests are irrelevant to the decision since they concern the claims of the patent as upheld by the opposition division or more limited claims thereof (prohibition of the *reformatio in peius*).

VII. After withdrawal of its appeal, the only remaining effective request of the opponent (respondent) is

that the appeal be dismissed.

VIII. The following documents have been filed during the opposition proceedings and are relied upon by the parties in the present decision:

- D1:** Nagatani et al., "Development of a Visual Odometry System for a Wheeled Robot on Loose Soil using a Telecentric Camera", *Advanced Robotics* 24, pages 1149-1167;
- D3:** US 2013/041549 A1;
- D5:** US 2013/030750 A1;
- D6:** KR 10-2010-0098999 A;
- D6a:** Machine translation of D6;
- D7:** DE 102 61 788 B3;
- D9:** WO 2007/010265 A1;
- D10:** KR 10-2010-0112756 A;
- D10a:** Machine translation of D10;
- D22:** KR 10-2013-0074502 A; and
- D22a:** Machine translation of D22.

IX. The lines of argument of the parties relevant for the present decision are dealt with in detail in the reasons for the decision.

X. **Claim 1** of the patent as granted, with the feature labelling used by the parties, reads as follows:

"M1 A mobile robot (100) configured to navigate an operating environment, comprising:
M2 a body (108) containing:
M3 a drive (107) configured to translate the robot in a direction of motion;
M4 at least one processor (1010);
M5 memory (1025) containing a navigation application (1035); and
characterized by:
M6 an optical odometry sensor system (205) positioned within a recessed structure (210) on an underside of the body (108) and configured to output optical odometry data,
M7 where the optical odometry sensor system (205) comprises an optical odometry camera (440)
M7.1 including a telecentric lens (442)
M7.2 configured to capture images of a tracking surface beneath the body (108)
M7.3 and having a depth of field that provides a range of viewing distances at which a tracking surface is captured in focus from a first distance within the recessed structure (210) to a second distance below the underside of the mobile robot body (108),
M7.4 wherein the telecentric lens (442) has a depth of field in which objects are in focus at distances including distances between negative 5 to 20 mm from a bottom surface of the robot body (100); and

M8 a gyroscope (922) configured to output gyroscope measurement data."

Reasons for the Decision

1. *Procedural matters - decision in writing*
 - 1.1 The case is ready for decision which is taken in written proceedings without holding oral proceedings in accordance with Article 12(8) RPBA and with Articles 113 and 116 EPC.
 - 1.2 The board communicated its preliminary assessment of the case to the parties by means of a communication pursuant to Article 15(1) RPBA dated 25 October 2023, according to which the decision under appeal was likely to be set aside and the patent to be maintained as granted.
 - 1.3 In response to that communication, the respondent withdrew its request for oral proceedings pursuant to Article 116(1) EPC with letter dated 3 January 2024. In addition, the respondent also indicated that it would not attend the oral proceedings scheduled for 22 February 2024. Hence the respondent chose to rely on its written submissions only. Since the respondent was informed of the board's preliminary assessment of the case, on which the present decision is based, the principle of the right to be heard pursuant to Article 113(1) EPC is observed since that provision only affords the opportunity to be heard and the respondent's submissions are fully taken into account.
 - 1.4 The appellant's request for oral proceedings pursuant to Article 116(1) EPC is auxiliary to its request that

the decision under appeal be set aside and that the patent be maintained as granted. Since this request is followed by the board, the appellant's auxiliary request for oral proceedings remains procedurally inactive.

1.5 As a consequence, the board is in a position to take the present final decision on the basis of the contested decision to be reviewed and the extensive written submissions of the parties, while preserving their rights under Articles 113 and 116 EPC, so that the oral proceedings were cancelled.

1.6 The reasons for the decision given below substantially correspond to the board's preliminary opinion provided in the communication pursuant to Article 15(1) RPBA. Said opinion was not subsequently commented on nor contested by the parties, in particular by the respondent.

1.7 Under these circumstances, the board sees no reason to deviate from its above-mentioned preliminary opinion and confirms it.

2. *Patent as granted - Amendments, Articles 100(c) and 123(2) EPC*

2.1 The opposition division found in point II.12 of the reasons for the decision under appeal that the subject-matter of claims 2 to 13 of the patent as granted extended beyond the original disclosure.

2.1.1 It is common ground that claim 1 as granted was the combination of original claims 1 and 6. However, the opposition division concurred with the respondent that the original claim set did not define any dependency

between original dependent claim 6 and original dependent claims 2 to 5 and 7 to 14. Therefore, the feature combination contained in granted dependent claims 2 to 13 was not originally disclosed and could not be derived directly and unambiguously from the original claim set.

2.1.2 In addition, although the features of original claim 6, in particular "a depth of field between negative 5 to 20 mm" were mentioned at least in original description paragraphs [0009] and [0018] as being part of "certain" or "several" embodiments, it would be left to the skilled person to decide which embodiments of paragraphs [0005] to [0031] could be combined.

2.2 The board disagrees for the following reasons.

2.2.1 It is undisputed and established jurisprudence that, when assessing the allowability of amendments under Article 123(2) EPC, the so-called "gold standard" is to be applied, namely to assess what a skilled person would derive directly and unambiguously, using common general knowledge, and seen objectively and relative to the date of filing, from the whole of these documents as filed.

2.2.2 As correctly pointed out by the appellant, it is also established case law that the structure of the claims should not be disproportionately considered in detriment of what was really disclosed to the skilled person (see Case Law of the Boards of Appeal [CLB], 10th edition 2022, II.E.1.3.2, and T 2619/11). In this respect, the board additionally notes that there is no apparent contradiction or technical incompatibility between the features of original claim 6 and those of the further original dependent claims.

- 2.2.3 In addition, the board concurs with the appellant that in the case at hand at least original paragraph [0009] further supports the introduction of the features of claim 6 in "several embodiments".
- 2.2.4 In view of the above, the board concludes that the skilled person is not presented with new technical information extending beyond the original disclosure due to the new combination of features, so that the claims according to the patent as granted meet the requirements of Article 123(2) EPC.
- 3. *Patent as granted - Sufficiency of disclosure, Articles 100(b) and 83 EPC*
 - 3.1 The respondent argued that the opposition division erred in its finding (see point II.13 of the reasons for the decision under appeal) that the patent as granted was sufficiently disclosed.
 - 3.1.1 In particular, the respondent held that the essential numerical parameter "depth of field" of the telecentric lens was ill-defined. As a consequence, the skilled person is left in doubt about which technical measures are necessary to put the claimed subject-matter to practice. In the absence of a definition of an acceptable amount of blurring or circle of confusion, the skilled person is unable to determine the position at which the depth of field of the given optical system ends, and in particular whether it ends outside the recess or within the recess. In addition, the respondent argued that if the term "in focus" used in claim 1 as granted was given its literal technical meaning, the invention could not be carried out since a

conventional telecentric lens has one single plane on the object side for a given position that is on focus.

- 3.1.2 The respondent further argued that the patent does not clearly indicate at least one way enabling the person skilled in the art to carry out the invention, especially to provide a telecentric lens with a depth of field of -5 to 20 mm from a bottom surface of the robot body.
- 3.2 The board is not persuaded by the arguments of the respondent for the following reasons.
 - 3.2.1 The board firstly concurs with the appellant that the parameter "depth of field" is not ill-defined. In the board's view, the skilled person is well aware what is meant by this parameter and its dependency on the geometric and optical parameters. Although the claims do not explicitly define an acceptable amount of blur, the level of blur or circle of confusion that can be applied is detailed at least in paragraph [0057] of the description, namely bleeding of up to two adjacent pixels.
 - 3.2.2 The argument of the respondent that the opposed patent does not disclose a "single working example" is not persuasive. The board is rather of the view that the decisive issue in the case at hand is whether there are serious doubts substantiated by verifiable facts that the person skilled in the art, using common general knowledge, would be unable to carry out the invention (see CLB, *supra*, II.C.9, first two paragraphs, in particular in relation to T 19/90 and T 182/89). In the present case, the board is convinced that such serious doubts are not present, and that the skilled person, using common general knowledge, would be in the

position to provide a lens with the claimed depth of field taking into account the acceptable level of blur.

3.2.3 In view of the above, the board fails to identify an error in the findings of the opposition division and considers the claimed invention to be sufficiently disclosed.

4. *Patent as granted - Novelty, Articles 100(a) and 54 EPC*

4.1 The respondent argued that the subject-matter of claim 1 as granted was anticipated by documents D1 and D3, and contested the reasoned findings of the opposition division that neither of these documents disclosed a robot with a recessed structure within which an optical odometry sensor system was positioned (see points II.14.1 and II.14.3 of the decision under appeal).

4.2 According to the respondent, claim 1 as granted did not include any limitations with respect to either a "recessed structure" or a "bottom surface of the robot body". In figure 6(b) of D1, the bottom surface of the flaps facing the tracking surface could be considered as the bottom surface and the flaps themselves formed a recessed structure.

4.2.1 The board disagrees and rather concurs with the appellant that the flaps of the robot of D1 are not recessed from any surface, and as such cannot form a recessed structure. In addition, considering the lower edges of the flaps as an underside of the robot **body** can only be seen by the board as a forced and misleading interpretation of the disclosure of D1.

4.2.2 The board thus concurs with the reasoned finding of the opposition division that D1 does not disclose at least

a recessed structure on an underside of the body within which an optical odometry sensor is positioned.

4.3 With regard to D3, the respondent argued that figure 14 showed a movement sensor 606 in a structure that is recessed from the underside of the vehicle body. The features relating to the recessed structure were thus anticipated by D3.

4.3.1 The board is not persuaded by the arguments of the respondent and concurs with the opposition division that the sensor 606 and the structure on which the sensor is placed are rather mounted at the frontside of the vehicle, not the underside.

4.4 In view of the above, the board fails to identify an error in the findings of the opposition division and considers the subject-matter of claim 1 as granted to be novel in view of D1 or D3.

5. *Patent as granted - Inventive step, Articles 100(a) and 56 EPC*

5.1 Claim 1 - document D5 as closest prior art

5.1.1 Distinguishing features

It is undisputed that D5 does not disclose a telecentric lens, which has been identified by the parties as feature M7.1.

The respondent disputed the opposition division's finding (see point II.16.1 of the decision under appeal) that D5 also did not disclose the feature of the telecentric lens **"having a depth of field that provides a range of viewing distances at which a**

tracking surface is captured in focus from a first distance within the recessed structure to a second distance below the underside of the mobile robot body", which has been identified by the parties as feature **M7.3**.

In particular, the respondent was of the view that, since the amount of acceptable blurring is not limited by claim 1, the "depth of field" parameter is undefined and not measurable. As such, feature M7.3 cannot provide a distinction over document D5. Even if feature M7.3 could be seen as having a limiting nature, the respondent was of the view that if the robot cleaner of D5 travelled across a high-pile carpet that is deeper than the distance between the underside of the robot body and the wheels, the odometry camera sensor 125 would capture images of this tracking surface. How blurry these images are is of no concern, since this remains undefined in claim 1. Since the camera of D5 is able to capture images within the recess and below the underside of the robot body, feature M7.3 is anticipated by D5.

The board does not agree and concurs with the opposition division's finding that feature M7.3 functionally defines the range at which a tracking surface is captured, which in the board's view has a limiting nature.

The board also agrees with the appellant and the opposition division that according to paragraph [0070], D5 merely discloses that the lens has a "short focal distance and a deep depth", and that it cannot be derived from this passage that the depth of field at least extends from positions within the recessed structure.

As a consequence, the board concludes that the subject-matter of claim 1 differs from the known robot of D5 at least in features M7.1 and M7.3.

5.1.2 Technical effect and problem to be solved

The respondent argued that in the event that feature M7.3 could be seen as a distinguishing feature with respect to D5, then the assessment of inventive step with regard to features M7.1 and M7.3 should be treated under the consideration of partial problems, in line with the findings of the opposition division.

In particular, the respondent concurred with the assessment of the opposition division that feature M7.3 provided the technical effect of enabling the capture of focus when the height of a carpet below the robot exceeds the distance between the underside of the mobile robot and the bottom of the wheel. The partial problem to be solved by feature M7.3 is to be seen as to *"capture of focus when the height of a carpet below the robot exceeds the distance between the underside of the mobile robot and the bottom of the wheel"* (see decision under appeal, points II.16.2 and II.16.3).

The board is not convinced by the formulation of the technical problem made by the respondent and the opposition division. As correctly indicated by the appellant, the technical problem formulated by the opposition division is formulated in a way that is directed towards the claimed solution.

The board thus rather concurs with the appellant that the objective technical problem should be formulated in

a more general way, namely as to provide for improved localisation capabilities of a mobile robot.

5.1.3 Obviousness of feature M7.3 - combination with the common general knowledge or with the teaching of any of D7 or D22

The respondent argued that, starting from D5, feature M7.3 was rendered obvious in view of the common general knowledge. In particular, the skilled person would have extended the depth of field range at least over all ranges in which the tracking surface is expected to be encountered. In the case that the robot would travel across a high-pile carpet, the tracking surface would lie within the recess and consequently the depth of field would have to be adapted in an obvious manner to capture images within the recessed structure, as required by feature M7.3.

The board disagrees and concurs with the appellant that according to paragraph [0070] of D5, this robot and its camera sensor is configured to capture the floor, which is the surface to be cleaned. D5 aims indeed at monitoring situations in which the floor along which the robot cleaner is moving is not even and the "distance between the image sensor and the floor becomes long", and where the lens has a short focal distance and a deep depth.

Although as pointed out by the respondent D5 mentions the word "carpet" in paragraph [0081], the board, in view of the above, is not convinced that the general disclosure of D5 is directed to a robot which is suitable for use on high-pile carpets, so that the skilled person in view of the objective technical problem would have no motivation to adjust the depth of

field of D5 as required by feature M7.3. The skilled person's common general knowledge also does not change this assessment of the disclosure of D5.

Furthermore, the board is of the view that neither D7 nor D22 provides a clear disclosure or teaching for feature M7.3.

In particular, D7 teaches in paragraph [0012] a depth range of 25 mm, extending from 5 to 30 mm above the floor surface; and further teaches to maintain a distance of 7 mm between the lower side of the lens and the working range. As correctly found by the opposition division, independently from the optical deep of depth, there is no disclosure or hint in D7 to capture surfaces within a recessed structure according to feature M7.3.

D22 teaches a "depth of field of ± 7 mm with respect to the reference surface, which is the portion where the fibers are pressed by the wheels". Similarly as with D7, the board is convinced that there is neither a direct disclosure nor a motivation in D22 to capture surfaces within the recessed structure as required by feature M7.3.

In this light, the board concludes that the skilled person, starting from D5 as closest prior art and in view of the objective technical problem, would not arrive at the subject-matter of claim 1 (in particular feature M7.3) in an obvious manner considering the teachings of D7, D22 or the common general knowledge of the skilled person.

5.2 Claim 1 - document D7 as closest prior art

5.2.1 Distinguishing features

It is undisputed that D7 does not disclose a gyroscope, which has been identified by the parties as feature M8.

In analogy to D5, the respondent argued that feature M7.3 cannot provide any distinction over D7. The board, for similar reasons as for D5, is of the view that feature M7.3 functionally defines the range at which a tracking surface is captured, which has a limiting nature.

In addition, the board concurs with the appellant that D7 also fails to disclose a recessed structure on an underside of the robot body within which the optical odometry sensor system is positioned according to the feature identified by the parties as M6.

The board thus concludes that D7 does not disclose at least features M6, M7.3 and M8.

5.2.2 Technical effect and problem to be solved

The respondent argued that in the event that feature M7.3 could be seen as a distinguishing feature with respect to D7, then the assessment of inventive step with regard to features M8 and M7.3 should be treated under the consideration of partial problems, in line with the findings of the opposition division.

The respondent was of the view that the technical effect achieved by recessing the optical odometry sensor in the robot was to allow the robot to have a smaller distance to the floor surface while not damaging the optical odometry sensor. The partial objective technical problem could be formulated as how

to allow the robot of D7 to travel at a smaller distance to the floor surface while avoiding damage to the optical odometry sensor.

5.2.3 Obviousness of feature M7.3 - combination with the common general knowledge or with the teaching of any of D5 or D22

The respondent argued that starting from D7 as closest prior art, and in view of the objective technical problem posed above, the skilled person would arrive at the subject-matter of claim 1 as granted in an obvious manner with the help of the common general knowledge or in view of the teachings of D5 or D22.

The board disagrees and is of the view that, even considering the objective technical problem proposed by the respondent, the subject-matter of claim 1 as granted is inventive starting from D7 as closest prior art, for the following reasons.

As correctly found by the opposition division in point II.17 of the decision under appeal, even if the motivation to lower mobile robots as far as possible could be acknowledged, there is no disclosure or teaching in the prior art to provide a working range of an odometry camera within a recessed structure capturing images within the recess.

Indeed, as already concluded in points 5.1.1 and 5.1.3 above, none of documents D5, D7 or D22 directly discloses or teaches feature M7.3. It follows that even under a forced combination of these teachings, the skilled person would not arrive at the subject-matter of claim 1 as granted.

The board is also of the view that the skilled person would not arrive at the claimed invention only with the help of the common general knowledge. Contrary to the respondent's allegation, the board does not consider that recessing of the sensor into the robot while lowering the underside of the robot body is a "*simple structural change*" that does not require any inventive considerations, but rather results in major design changes that depart from what is customary for the skilled person.

In sum, the board concludes that the skilled person, starting from D7 as closest prior art, and in view of the objective technical problem posed by the respondent, would not arrive at the subject-matter of claim 1 (in particular with respect to feature M7.3) in an obvious manner considering the teachings of D5, D22 or the common general knowledge of the skilled person.

5.2.4 Documents D6, D9 or D10 as closest prior art

The respondent argued that the subject-matter of claim 1 as granted is obvious starting from any of documents D6, D9 or D10 as closest prior art.

For D6, the respondent argued in the same manner as for D5, whereby the only distinguishing feature was feature M7.1, and feature M7.3 was not limiting.

The board, for the same reasons as those given for D5, is of the view that the subject-matter of claim 1 is inventive starting from D6 as closest prior art.

With respect to D9 and D10, the respondent argued that the only difference to the claimed robot was feature M8.

Apart from arguing that feature M7.3 was not limiting, the respondent also argued that D9 aimed at a maximization of the depth of field of the optical system and that it was evident from multiple passages of D9 (page 5, line 15 to page 6 line 17; page 15, lines 10 to 14; page 16, first paragraph; page 21, lines 6 to 11 and figures 3B, 4, 8 and 9) that the depth of field reached into the recessed structure in which the optical odometry sensor was disposed. The board disagrees and is of the view that none of these passages cited by the respondent provides a direct disclosure of feature M7.3.

Also D10 fails to disclose feature M7.3. Although a distance range including 57.4 mm and 77.3 mm (or 55 mm to 80 mm in page 5, lines 36 to 39 of D10a) is disclosed, the board does not see from these ranges a direct disclosure that the depth of field extends from a recessed structure as required by feature M7.3.

In consequence, and for the same reasons as those given for D7, the board concludes that the subject-matter of claim 1 is inventive starting from either of D9 or D10 as closest prior art.

5.3 In view of the above, the board fails to identify an error in the findings of the opposition division and considers the subject-matter of claim 1 as granted to be inventive.

6. *Conclusions*

6.1 It follows from the above that the appellant has convincingly demonstrated the incorrectness of the decision under appeal that the patent as granted does

not meet the requirements of Article 123(2) EPC.
Therefore, **the decision under appeal is to be set aside.**

6.2 In addition, the board, after taking into account the arguments of both parties, fails to identify an error in the findings of the opposition division that claim 1 as granted meets the further requirements of the EPC, including those of Articles 83, 54 and 56 EPC. The patent is therefore to be maintained as granted.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The patent is maintained as granted.

The Registrar:

The Chairman:



G. Nachtigall

G. Patton

Decision electronically authenticated