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**Datasheet for the decision
of 10 January 2020**

Case Number: T 2289/13 - 3.4.01

Application Number: 01127862.9

Publication Number: 1209487

IPC: G01S17/46, G01S7/486

Language of the proceedings: EN

Title of invention:

Method and device for detection of an object, with background elimination

Patent Proprietor:

Datalogic Automation S.r.l.

Opponent:

Leuze electronic GmbH + Co. KG

Headword:

Relevant legal provisions:

EPC Art. 52(1)

Keyword:

Inventive step - ex post facto analysis

Decisions cited:

Catchword:



Beschwerdekammern
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Case Number: T 2289/13 - 3.4.01

D E C I S I O N
of Technical Board of Appeal 3.4.01
of 10 January 2020

Appellant: Leuze electronic GmbH + Co. KG
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Decision under appeal: **Decision of the Opposition Division of the
European Patent Office posted on 11 September
2013 rejecting the opposition filed against
European patent No. 1209487 pursuant to Article
101(2) EPC.**

Composition of the Board:

Chairman J. Geschwind
Members: F. Neumann
B. Noll

Summary of Facts and Submissions

- I. The opponent appealed against the Opposition Division's decision to reject the opposition.
- II. During the written procedure, the opponent submitted that the subject-matter of claim 1, as granted, derived in an obvious manner from D1. Moreover, the limitation in claim 1 to the processing of *only one* of the position signals amounted to an unallowable disclaimer. In addition, the opponent developed arguments to demonstrate that the claimed sensor would not function in a specific arrangement.
- III. The proprietor provided counter-arguments to all of the points raised by the opponent and explained how the claimed sensor worked, also in the specific arrangement referred to by the opponent. No consent was given to the introduction of any objection under Article 100(b) EPC.
- IV. The Board issued a communication in preparation of oral proceedings, and briefly addressed all of the issues raised. The Board indicated that the opponent's written submissions with respect to lack of inventive step were not persuasive. In addition, the Board considered that claim 1 as granted did not contain a disclaimer.
- V. During the oral proceedings, the appellant clarified that it did not contest the sufficiency of disclosure and did not wish to raise an objection under Article

100(b) EPC. Moreover, the disclaimer argument was dropped.

VI. The final requests of the parties were formulated as follows:

The appellant (opponent) requested that the decision under appeal be set aside and that the patent be revoked.

The respondent (proprietor) requested that the appeal be dismissed.

VII. Claim 1 reads as follows:

Background elimination device (1) for detecting the presence of an object within a pre-determined interval of distances contained between the background elimination device (1) itself and a pre-determined limit threshold;

the background elimination device (1) comprises:

- a photoemitter (3) which emits a beam of light pulses in a pre-determined direction;

- a photoreceiver (4) which receives a beam of light pulses reflected by an object and supplies as output a pair of position signals which indicate the distance of the object (2) from the background elimination device (1); said photoreceiver (4) having a surface (7)

which is sensitive to the position of the incident light beam and comprises a first and second output terminal (8,9) to provide for said position signals;

- a pair of amplification channels (14, 15), which amplifies said position signals, and processing means (6) which receives said position signals from the photoreceiver (4) via the amplification channels (14, 15), and, according to the position signals supply as output a first information signal which indicates the arrangement of an object (2) within said pre-determined interval of distances;

the background elimination device (1) being characterised in that it comprises:

- preliminary search means (22) which process temporarily only one of the position signals in order to supply as output a second information signal which indicates only the presence/absence of an object (2) independently from the distance of the object (2) from the background elimination device (1); and

- means for carrying out a comparison between the first and the second information signal, in order to verify the arrangement of the object within said predetermined interval of distances.

VIII. Claim 10 reads as follows:

Method for detecting the presence/absence of an object within a pre-determined interval of distances comprising the following steps:

- emitting by a photoemitter (3) a beam of light pulses in a pre-determined direction;*
- receiving by a photoreceiver (4) a beam of light reflected by an object, in order to supply as output a pair of position signals which indicate the distance of an object relative to a pre-determined point of reference; said photoreceiver (4) having a surface (7) which is sensitive to the position of the incident light beam and comprises a first and second output terminal (8, 9) to provide for said position signals;*
- processing (140) said position signals in order to supply as output a first information signal which indicates the arrangement of an object (2) within said pre-determined interval of distances;*

the method being characterised in that it comprises the following steps:

- carrying out a preliminary search (110) for the object in which only one of the said position signals is processed in order to supply as output a second information signal, which indicates only the presence/absence of an object independently from the distance of the object (2) from said pre-determined point of reference; and*

- carrying out a comparison between the first and the second information signal, in order to verify the arrangement of the object within said pre-determined interval of distances.

IX. The following documents are referred to in this decision:

D1: DE-A-198 52 173; and

D3: DE-A-43 11 691.

X. The arguments of the parties, insofar as they are pertinent, are set out below with the reasons for the decision.

Reasons for the Decision

Background

1. The invention concerns a triangulation method and device for detecting the presence of an object within a pre-determined distance from the detection device. Any object beyond the pre-determined distance is disregarded. This type of object detection is known as *background elimination*. A light source projects a beam of light into an interrogation zone. A photoreceiver is provided, onto which a light spot reflected from an object in the interrogation zone is imaged. The position of the reflected spot on the photoreceiver corresponds to the distance of the object from the

detector. Various types of photoreceiver can be used for determining the position of the imaged spot. For example, a two-element photodiode detector (as disclosed in D1) comprises two discrete photodiodes which are mounted abutting each other. The output from each individual photodiode represents the amount of light incident on that photodiode. A further example of a suitable photoreceiver is a position-sensing detector, or PSD (as disclosed in D3), which has a single photosensitive surface and an output at each end. The amount of current from each output is proportional to the position of the imaged spot on the detector. In both cases, the difference between the two output signals is employed to determine the position of the light spot on the photoreceiver.

2. Both of these types of photoreceiver can give rise to ambiguous results. Specifically, the difference between the two output signals can be zero in two different situations: when both outputs are zero, or when both outputs have the same value. Clearly, the conclusion that no object is present is only correct in the first of these scenarios.

3. Both D1 and D3 comprise an additional processing stage to eliminate the ambiguity that arises when the difference between the output signals is zero. In D1, the outputs from the individual photodiodes 8, 9 are added in the summing element 14 (Figure 1). If the result of this operation is greater than a predetermined threshold value (chosen to be just big enough to ensure that it is not exceeded by noise or offset voltages of the electronic components), then it is concluded that an object is present (column 4, line 61 to column 5, line 30). Similarly, in D3, the outputs of the photoreceiver 20 are added in the summing

element 38 (Figure 2). If the result of this operation is greater than a predetermined threshold value, then it is concluded that an object is present (column 4, lines 31-50).

Claims 1 and 10 - inventive step (Article 56 EPC)

4. In the following, reference is made only to claim 1. However, the opponent indicated that its submissions applied equally to claim 10.
5. The opponent considers D1 to represent the closest prior art. D1 discloses a device which detects the presence of an object within a predetermined range of distances from the device. Both parties agree that the device of D1 comprises a photoemitter, a photoreceiver, a pair of amplification channels and processing means as defined in the preamble of claim 1.
6. The only feature of the preamble of claim 1 which the parties do not agree is disclosed in D1 is "*said photoreceiver (4) having a surface (7) which is sensitive to the position of the incident light beam and comprises a first and second output terminal (8,9)*". In particular, the opponent submitted that, although D1 employed a two-element photodiode sensor, it could nevertheless be considered as comprising a continuous surface which was sensitive to the position of the incident light beam. Indeed, the individual photodiodes were mounted abutting each other, providing, effectively, a single-surface photodetector with two outputs.
7. The proprietor expressly stated that the photoreceiver of claim 1 was intended to be a PSD-type device, and

submitted that the two-element photoreceiver of D1 could not be considered to be the same as the photoreceiver of claim 1. The wording of claims 1 and 10 - which defined that the photoreceiver had "a surface" which comprised "a first and a second output terminal" - was intended to exclude two-element detectors of the type disclosed in D1.

8. As will be seen below, it is not decisive for the assessment of inventive step whether the claimed photoreceiver is a PSD-type device (as intended by the proprietor) or a two-element photodiode device (as known from D1).
9. It is not contested that D1 does not disclose the features of the characterising portion of claim 1.
10. Starting from D1, the opponent submitted that the problem to be solved by the distinguishing features set out in the characterising portion of claim 1 was the simplification of the circuitry of D1. This was a standard problem which the skilled person would always be looking to solve. Indeed, D1 itself set out to achieve a reliable object detection using as simple a circuit as possible (see column 1, lines 52-55).
11. The opponent noted that the summing element 14 of D1 was provided to establish whether an object was present somewhere along the line of sight of the projected light beam. Specifically, if the sum of the signals from the outputs of the two photodiodes was greater than a predetermined threshold, then it was concluded that an object was present. After having determined that an object was present, it could be established, using the differential element 13, whether the object was located in the range of interest.

12. The opponent submitted that, in order to simplify the circuitry of D1, the skilled person would realise that the summing circuit could be dispensed with. The information regarding the presence of an object could be just as accurately derived from a single one of the position signals output from the photoreceiver. As long as light was detected by at least one of the photodiodes, it could be reliably concluded that an object was present in the line of sight of the projected beam. No information would be lost by using just one of the position signals.
13. The Board does not agree.
14. As explained above, the sensor of D1 comprises two photodiodes arranged in abutment with each other. Each photodiode has its own output terminal. When the reflected light spot is incident on both photodiodes, both output terminals will provide a non-zero signal. However, when the light spot shifts to one end of the photoreceiver, only one photodiode will be illuminated and therefore only one output terminal will provide a non-zero signal. Thus, if only one of the outputs were to be processed, the situation could arise in which the photodiode being interrogated returns a zero output reading, although an object is, in fact, present, but reflects light only onto the other photodiode. This would lead to the wrong conclusion that an object was not present. This false-negative would not arise as long as the outputs of both photodiodes were added together, as in D1 (column 2, lines 31-39). Even if one output signal were to be zero, the sum of the signals would be non-zero, indicating that at least one of the photodiodes has registered light reflected from an object.

15. The summing element is therefore essential to the object detection process used in D1. Without it, false-negatives would arise when light is incident on the extreme ends of the photoreceiver. For this reason, the skilled person would not consider dispensing with the summing element and processing temporarily only one of the position signals in order to supply a signal which indicates only the presence/absence of an object.
16. The opponent insisted that it would be clear to the skilled person which of the two output signals would have to be processed in order to establish whether or not an object was present. The situation would, therefore, not arise in which the skilled person would process the output signal from the "wrong" photodiode.
17. As noted by the opponent itself, the stated aim of the invention of D1 was to provide a triangulation sensor for detecting the presence of an object within a predetermined distance from the sensor, which permits the most reliable object detection possible *with as simple a circuit as possible* (column 1, lines 52-55). The simple circuit proposed by D1 employs a summing element to determine the presence of an object. In the absence of any prompting in D1, and without the benefit of hindsight, the skilled person would not realistically choose to dispense with the summing element. In fact, in view of the essential nature of the summing element in D1 in the elimination of false-negatives, it would be counter-intuitive to do so.
18. The opponent submitted, furthermore, that the photoreceiver of D1 was not necessarily composed of two photodiodes, as has been assumed in the above reasoning. Specifically, column 3, lines 53-55 stated

that the receiver consisted of sensing elements, which *could be* photodiodes. The photoreceiver of D1 could, therefore, be a single-element PSD. The above arguments with regard to the loss of information if the "wrong" output were processed, were therefore not valid, since each terminal of a PSD-type device would always have a non-zero current when light is incident on the photoreceiver.

19. The Board notes that the passage referred to by the opponent makes clear that the photoreceiver of D1 is made up of two discrete sensor elements. It is explicitly stated that the receiver comprises a proximity element ("Nahelement") and a distance element ("Fernelement"). The arguments presented above are therefore not invalidated by this submission.

20. Following a different line of argument, the opponent submitted that, although D3 concerned a single element PSD-type detector, the structural features of the sensing arrangement were very similar to those of D1. Furthermore, D3 also used the same approach as D1, in that the two output signals were added to establish whether an object was present in the line of sight, before it was established whether the object was in the range of interest. In particular, D3 disclosed an adjustment procedure which allowed a predetermined base distance, beyond which the presence of any object could be ignored, to be set. The procedure involved adjusting the amplification of the signals from both of the output terminals separately until the difference signal between the two amplified signals was zero. By adjusting the amplifier settings, the base distance could be set to a desired value (see Figure 4 and column 5, line 57 to column 6, line 23). In order to ensure that the summed signal provided a reliable

result, one of the two output currents was maximally amplified and the amplification of the other output current was adjusted accordingly (column 2, lines 23-48; claim 6). The opponent submitted that since the larger of the two output currents was maximally amplified, there would be no reason to consider the weaker of the two signals when determining the presence of an object. The maximally amplified signal would be sufficient for this purpose.

21. Therefore, even although D3 also disclosed that both output signals were added together to determine the presence of an object, it would be obvious to dispense with the summing circuit. So the skilled person, starting from D1 and taking the teaching of D3 into account to solve the problem of circuit simplification, would modify the circuitry of D1 such that only one of the output signals was processed in order to determine the presence/absence of an object.
22. The Board cannot agree.
23. The Board acknowledges that it would be possible to use just one of the output signals when a PSD-type sensor, of the type used in D3, is employed. However, starting from D1, as the opponent does, the skilled person would not consider employing just one of the output signals to see if an object is present, since this would potentially return false-negatives, as explained above. Moreover, even taking the disclosure of D3 - which employs a PSD-type sensor - into account, the skilled person receives no prompting to dispense with the summing element. There is no suggestion in D3 to consider only one of the two output signals. Even although the strongest signal is maximally amplified, and could, conceivably, be sufficient on its own to

indicate the presence of an object, D3, nevertheless, determines the sum of the signals (claim 6 and column 2, lines 36-48).

24. The opponent submitted, further, that it was known from D3 to calibrate the sensor such that the detection range was limited between two locations d_{\min} and d_{\max} , which produced non-zero signals at the output terminals (see Figure 4). This calibration ensured that neither signal would be zero, and so the problem of false-negatives would not arise. Consequently, only one of the output signals would need to be processed to establish the presence/absence of an object, and the summing circuit could be dispensed with.
25. The Board reiterates that there is no suggestion in either D1 or D3 to dispense with the summing circuit used in either of those sensors, and no suggestion to process just one of the output signals to establish the presence/absence of an object. In the absence of any such indication, the opponent's submissions are based on hindsight.
26. As a result, it is not obvious to modify the device of D1 to include a preliminary search means which processes temporarily only one of the position signals in order to indicate the presence/absence of an object. Consequently, the subject-matter of claim 1 involves an inventive step.
27. Corresponding considerations apply to independent claim 10, which therefore also comprises an inventive step.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar:

The Chairman:



D. Meyfarth

J. Geschwind

Decision electronically authenticated