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D E C I S I O N
of 4 May 1995

Case Number: T 0649/93 - 3.5.2

Application Number: 85110759.9

Publication Number: 0174549

IPC: B07C 5/34

Language of the proceedings: EN

Title of invention:
Means for identifying and recording bottles and/or bottle hampers

Patentee:
HALTON OY

Opponent:
Tomra Sytems A/S

Headword:
-

Relevant legal provisions:
EPC Art. 56

Keyword:
"Inventive step - yes"

Decisions cited:
-

Catchword:
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Case Number: T 0649/93 - 3.5.2

D E C I S I O N
of the Technical Board of Appeal 3.5.2
of 4 May 1995

Appellant: (Opponent)
Tomra Sytems A/S
P.O. Box 278
N-1371 Asker (NO)

Representative:
TER MEER - MÜLLER - STEINMEISTER & PARTNER
Artur-Ladebeck-Strasse 51
D-33617 Bielefeld (DE)

Respondent: (Proprietor of the patent)
HALTON OY
Teollisuustie 2
SF-47400 Kausala (FI)

Representative:
Pellmann, Hans-Bernd, Dipl.-Ing.
Patentanwaltsbüro
Tiedtke-Bühling-Kinne & Partner
Bavariaring 4
D-80336 München (DE)

Decision under appeal: **Decision of the Opposition Division of the European Patent Office dated 21 May 1993 rejecting the opposition filed against European patent No. 0 174 549 pursuant to Article 102(2) EPC.**

Composition of the Board:

Chairman: W. J. L. Wheeler
Members: M. R. J. Villemin
W. M. Schar

Summary of Facts and Submissions

I. The Appellant contests the decision of the Opposition Division rejecting the Appellant's opposition against European patent No. 0 174 549.

II. The patent in suit has one claim, worded as follows:

"Means for identifying and recording bottles (4, 5), said means comprising a light source (2) emitting a linear light bar for illuminating said bottles (4, 5) being examined, a light receptor means (1) for examining said bottles (4, 5) momentarily, a conveyor (6) for transporting said bottles (4, 5) past said receptor means (1) and said light source (2), a data processing unit (11, 12, 13) to which an image formed by said light receptor means (1) is supplied after being transformed into digital form for identifying said bottles (4, 5) and a recording means (14) for recording said images of said bottles (4, 5) characterized in that said light receptor means (1) and said light source (2) are disposed above said conveyor (6) and are so arranged that the vertical plane passing through the longitudinal central axis of said conveyor (6) also passes through said receptor means (1) and said light source (2) and that said light receptor means is a semiconductor matrix camera (1) disposed above said conveyor (6) so that a focusing plane (AA'BB') of said camera (1) is inclined against the conveying plane of said conveyor (6) and intersects the conveying plane of said conveyor at a line perpendicular to the longitudinal central axis of said conveyor (6), that said light source (2) is so disposed in relation to said conveyor (6) and said camera (1), that a projection of the light line (DD') of the light source (2) extending in the longitudinal direction of the linear light bar of said light source

(2) and a central axis plane (ECEC') of said camera (1), which central axis plane (ECEC') is perpendicular to said focussing plane (AA'BB') and passes through the center of said camera (1), intersect each other in said focussing plane (AA'BB') of said camera (1) at a line (CC') which is arranged perpendicular to the longitudinal central axis of said conveyor (6) and parallel to the conveyor plane, light emitted by said light source (2) being reflected from said bottles (4, 5) to said camera (1), whereby as said conveyor (6) transports said bottles (4, 5) past a point of examination, said camera (1) delivers to said data processing unit (11, 12, 13) sharp images taken of several parts of said bottles (4, 5), said parts of said bottles being at different heights on said bottles (4, 5) and being observed in different parts of said inclined focussing plane (AA'BB') corresponding to the different heights of said parts of said bottles (4, 5), and in a memory of said data processing unit (11, 12, 13) a synthetic, three-dimensional picture of said bottles (3, 4, 5) is formed."

III. In the proceedings before the Opposition Division, the Appellant argued that the subject-matter of the patent lacked novelty and did not involve an inventive step. A large number of prior art documents were cited, of which only the following have been referred to in the appeal proceedings:

C: Booklet "3-D Scanning" produced by the Technical Arts Corporation, available in August 1983,

D: "3-D Machine Perception" by B. Altschuler, Proceedings of SPIE - The International Society for Optical Engineering, Washington, Vol. 283 pages 56 to 60, April 23-24, 1981,

F: US-A-2 910 908

6: FR-A-2 520 267.

IV. After an exchange of written submissions, oral proceedings were held before the Board on 4 May 1995.

V. The Appellant requested that the decision under appeal be set aside and that the patent be revoked, and argued essentially as follows:

Document C represented the most pertinent prior art. There were only two features recited in the claim of the patent in suit which were not disclosed in document C:

(a) the use of a light source emitting a linear light bar, instead of a laser with a beam spreader,

(b) the linear light bar and the central axis plane of the camera intersect in the focal plane of the camera in a line (CC') parallel to the conveyor plane, instead of in the conveyor plane.

The system according to document C was able to identify three-dimensional bodies of different kinds and shapes, such as: footballs or boxes being conveyed in a row, broken cookies among unbroken ones, or missing components on a thick film hybrid circuit. The skilled person would easily realize that bottles in a hamper constituted a typical three-dimensional object of the kind which the system would be able to identify. Therefore, there could be no prejudice against using the system according to document C as a means for identifying and recording bottles. Bottles were always a bit roughened around the neck and reflected diffusely.

As to feature (b), document C did not mention explicitly where the focal plane of the camera and the light plane intersected, but it was commonplace that the focal plane of a camera should be as close as possible to the object to be observed. Thus, if the mouths of standing bottles were to be detected, it would be obvious to arrange the intersection line of the focal plane and the light plane above the conveyor plane at the same height as the bottles' mouths.

As to the feature (a), the use of a linear light bar in apparatus for detecting objects of different shapes was known from documents D, F and 6. The apparatus described in document F did not just measure the surface area of glass sheet, it could also detect broken edges. Thus, such a device was available to the skilled person and it could not involve an inventive step to replace the laser (which was the more modern technology) shown in document C with a source emitting linear light bar (which was older technology), especially as one of the pictures in document C showed a row of lasers extending across the width of the conveyor.

The contested patent did not disclose that the light bar should extend beyond the edges of the conveyor, which was necessary in order to reflect light from a non-diffusely reflecting bottle at the edge of the conveyor into the camera's field. Thus, the patent relied on some diffuse reflection. A row of lasers with beam spreaders would work just as well.

The Appellant concluded that the subject-matter of the only claim of the patent in suit lacked an inventive step within the meaning of Article 56 EPC. Hence, the patent should be revoked.

VI. The Respondent requested that the appeal be dismissed and argued essentially as follows:

The original (Finnish) application for the patent was made in 1984. At that time there were only three types of system known for detecting bottles: (1) light barrier systems, e.g. as shown in document 6, which could not detect overlapping bottles, (2) ultrasonic systems and (3) mechanical feeler systems. No one had previously used a light reflection system for detecting bottles.

The apparatus described in document C did not detect bottles. Document C disclosed a device for identifying three-dimensional bodies in which a central axis plane of the camera intersected the focusing plane at a line (corresponding to the line CC' mentioned in the claim of the patent in suit) perpendicular to the longitudinal central axis of the conveyor but lying in the plane of the conveyor, whereas the claim specified "parallel to the conveyor plane". The light source of the device according to document C was a laser source with a beam spreader to produce a diverging light plane, whereas the claim specified "a light source emitting a linear light bar". The system according to document C could not identify bottles which did not reflect light diffusely but directly, because it could not be guaranteed that light reflected from the bottlenecks would reach the camera if the bottles were not arranged along the axis of the conveyor belt. Light beams reflected outwards from bottles disposed off-centre could not be detected by the camera. A shadow was formed behind each detected object, so that objects in this shadow area could not be detected by the device. The skilled person would not consider using the system described in document C for detecting bottles. However, it was exactly the detection of bottles disposed

off-centre or one behind the other in a hamper which was the purpose of the present invention and ensured by the means according to the claim.

Document D emphasised that good results were obtained by a combination of flood flash and planar illumination. The camera was not fixed, it was mounted on the wrist of a manipulator. The use of a linear bar light was indeed known from document F. However, the apparatus described there was for the determination of the surface area of sheet-like objects. It could detect broken sheets, but it was not obvious to use it to detect three-dimensional objects of different heights. Figure 4 of document F showed flood lighting.

The extremely important feature, that the line of intersection CC' was arranged parallel to the conveyor plane (and not in the conveyor plane), could not be derived from any of the cited prior art documents. A bottle at the edge of the conveyor would have parts facing towards the centre of the conveyor which would reflect light into the camera.

The Respondent played a video tape showing the invention in use and explained that the system reliably detected glass and plastics bottles of different heights, with or without caps.

Reasons for the Decision

1. The notice of appeal did not contain an explicit statement identifying the extent to which amendment or cancellation of the impugned decision was requested, as required by Rule 64(b) EPC. However, it was implicit that the Appellant requested that the decision under

appeal be set aside and the patent revoked, since this had been requested in the proceedings before the Opposition Division. Thus, in accordance with the practice of the Boards of Appeal, the appeal is admissible, see e.g. decisions T 32/81 (OJ EPO, 1982, 225) and T 7/81 (OJ EPO, 1983, 98).

2. The question in dispute in the present appeal is whether the subject-matter of the only claim of the contested patent involves an inventive step within the meaning of Article 56 EPC.

2.1 According to the Appellant, document C represents the closest prior art. The Board agrees. This document discloses means for identifying and recording three-dimensional objects with widely varying optical characteristics, comprising the following features recited in the claim of the contested patent:

a light source (a laser with an optical spreader) emitting a plane of light for illuminating the objects being examined (document C, page 5, taking the cover sheet as page 1),

a light receptor means (camera) for examining said objects momentarily,

a conveyor for transporting said objects past said receptor means and said light source,

a data processing unit to which an image formed by said light receptor means is supplied after being transformed into digital form for identifying said objects (document C, page 7) and

a recording means for recording said images of said objects,

wherein

said light receptor means and said light source are disposed above said conveyor and are so arranged that the vertical plane passing through the longitudinal central axis of said conveyor also passes through said receptor means and said light source (document C, pages 4 and 5),

said light receptor means is a semiconductor matrix camera ("Solid State CID camera", see page 9 of document C) disposed above said conveyor so that the focusing plane of said camera is inclined against the conveying plane of said conveyor and intersects the conveying plane of said conveyor at a line perpendicular to the longitudinal central axis of said conveyor (document C, page 4 and 5),

said light source is so disposed in relation to said conveyor and said camera, that the plane of light of said light source and a central axis plane of said camera, which central axis plane is perpendicular to said focusing plane and passes through the centre of said camera, intersect each other at a line which, in order to produce sharp images, must, for practical purposes, be in or close to the focusing plane of the camera and which is arranged perpendicular to the longitudinal central axis of said conveyor (document C, page 4 and 5),

light emitted by said light source is reflected from said objects to said camera, whereby as said conveyor transports said objects past a point of examination, said camera delivers to said data processing unit sharp images taken of several parts of said objects, said parts of said objects being at different heights on said objects and being observed in or close to different

parts of the inclined focusing plane corresponding to different heights of said parts of said objects, and

in a memory of the data processing unit a synthetic, three-dimensional picture of the objects is formed (document C, page 8, col. 1, last but one paragraph).

2.2 The system shown in document C is described as being able to determine visual details for objects with different optical characteristics (see page 7, middle column, bottom paragraph). The following applications are mentioned: measuring the precise volume inside a concave cylinder head moving along a production line, detecting a missing component on a thick film hybrid circuit, inspecting complex shapes like turbine blades and screw threads during production, checking cookies before packaging, checking tires, determining the orientation of a random work piece moving along a production line. In the applications mentioned in document C, the objects which are checked are all such as to reflect light sufficiently diffusely for the camera to be able to "see" the line of light cast on their surface. The Appellant argued that the system according to document C could also be used to identify bottles. However, as pointed out by the Respondent, bottles with smooth shiny surfaces do not reflect light diffusely and the light source shown in this document (a laser with a spreader) produces a light plane diverging from a point source so that most of the light rays reflected geometrically from a curved surface of a glass bottle would pass outside the field of view of the camera, in particular from bottles standing at some distance from the central longitudinal axis of the conveyor. Because of this, the camera would not "see" enough of the line of light falling on the bottle to enable the system to identify reliably different types of bottle. In any case, it appears to the Board that if

the system described in document C could detect bottles, it would not help the Appellant's argument, because there would then be no need to modify it, so it would not be obvious to replace the laser and optical spreader with a light source emitting a linear light bar.

2.3 The apparatus according to the claim of the patent in suit is able to identify bottles of different kinds and sizes, even when they stand side by side in a hamper and do not reflect light diffusely. Starting from the prior art according to document C, this is achieved by:

(a) replacing the laser and optical spreader with a light source emitting a linear light bar;

(b) disposing the camera in relation to the conveyor and the light source so that the plane of light produced by the light source and a central axis plane of the camera perpendicular to the focusing plane intersect in the focusing plane at a line which is parallel to the conveyor plane.

2.4 Regarding feature (a), it is known from document F to use a linear light source to produce a narrow light band on the surface of a glass sheet travelling on a conveyor so that the reflected beam is picked up by a television camera (see col. 4, lines 26 to 31). This apparatus determines the surface area (square footage) of the sheets. It can detect broken edges, but there is no hint that the arrangement could be used to identify three-dimensional objects of different heights.

2.5 The use of a linear light bar in a vision system is also known from document D. However, the light source shown in that document generates two kinds of light flashes: a flood light covering the whole field of view of the camera and a plane of light illuminating only some parts

of an object within the field of view. The former is used to find shape features and outlines of objects in two dimensions, while the latter supplies depth information for only those parts of the objects that are illuminated. There is no indication that the system could be operated with only a light bar source to improve the detection of objects which do not reflect diffusely. Furthermore, the light source and camera are mounted on a manipulator, not arranged as specified in the claim of the patent in suit.

2.6 Document 6 discloses a means for identifying and recording bottles comprising all the features recited in the preamble of the claim. A light source emitting a linear light bar and a linear detector are disposed on either side of a conveyor belt. The bottles are identified by assessing the length of the shadow cast by a bottle on the linear detector when it passes through the light plane emitted by the linear light source. This document gives no hint to the skilled person that he could use the reflection of the light bar off the bottles to identify them.

2.7 Regarding feature (b) in paragraph 2.3 above, the light source and the camera shown in document C are so arranged that the intersection of the light plane with a central axis plane of the camera is perpendicular to the conveyor's longitudinal axis and lies in the conveyor plane, as can be seen from the figures on pages 4, 5 and 7, where the sharp image of the intersection of the light plane with the conveyor plane is taken as the baseline for the Z coordinate. It is specified in the claim of the patent in suit that this intersection lies parallel to the conveyor plane, not in it. With hindsight, this may appear to be the result of routine adjustments which the skilled person **could** carry out on the system known from document C to adapt it to the

particular task of identifying bottles. However, in the opinion of the Board, in the absence of any hint to do that and without prior knowledge of the present invention, the skilled person **would not** have any reason to adjust the system shown in document C in accordance with feature (b).

2.8 In summary, the Board finds that neither the teaching of the cited prior art documents C, F, D and 6, nor the general knowledge in the relevant technical field would make it obvious to the skilled person to arrive at the claimed means for identifying and recording bottles. Thus, the subject-matter of the only claim of the contested patent involves an inventive step within the meaning of Article 56 EPC.

3. Hence, it follows that the appeal must be dismissed.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

M. Kiehl W. J. L. Wheeler