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D E C I S I O N
of 26 July 2002

Case Number: T 0109/00 - 3.4.2

Application Number: 95104695.2

Publication Number: 0676633

IPC: G01N 21/90

Language of the proceedings: EN

Title of invention:
Container sealing surface inspection

Applicant:
OWENS-BROCKWAY GLASS CONTAINER INC.

Opponent:

-

Headword:

-

Relevant legal provisions:
EPC Art. 54, 56

Keyword:
"Inventive step - yes"

Decisions cited:

-

Catchword:

-



Case Number: T 0109/00 - 3.4.2

D E C I S I O N
of the Technical Board of Appeal 3.4.2
of 26 July 2002

Appellant: OWENS-BROCKWAY GLASS CONTAINER INC.
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Decision under appeal: Decision of the Examining Division of the
European Patent Office posted 1 September 1999
refusing European patent application
No. 95 104 695.2 pursuant to Article 97(1) EPC.

Composition of the Board:

Chairman: E. Turrini
Members: A. G. M. Maaswinkel
V. Di Cerbo

Summary of Facts and Submissions

I. The appellant lodged an appeal, received on 23 October 1999, against the decision of the examining division, dispatched on 1 September 1999, refusing the European patent application 95 104 695.2. The fee for the appeal was paid on 23 October 1999 and the statement setting out the grounds of appeal was received on 5 January 2000.

The examining division objected that the subject-matter of independent claims 1 and 10 was not patentable under Article 52(1) EPC because of lack of novelty (Article 54 EPC) and the dependent claims did not involve an inventive step (Article 56 EPC), having regard to the following documents:

(D1) EP-A-0 497 477

(D2) EP-A-0 388 600

(D3) DE-C-3 801 626.

II. In reply to a communication of the board, the appellant filed with a letter dated 24 April 2002 a new set of claims 1 to 12 and amended pages 1 and 1a of the description.

III. With letter dated 12 July 2002 the appellant filed new claims and amended description pages and requested that the decision under appeal be set aside and a patent be granted on the basis of the following documents:

Claims: No. 1 to 12, according to the request as filed with the same letter;

- Description:** pages 1 and 1a, according to the request as filed with the same letter;
pages 2, as filed with the letter dated 9 June 1998;
pages 3 to 9 as originally filed;
- Drawings:** sheets 1/2, 2/2 filed with the letter dated 5 February 1999.

IV. The wording of claim 1 reads as follows:

"Apparatus for inspecting the finish (34) of a container (22) having a central axis (25) and an open mouth surrounded by an axially facing sealing surface (36) for sealing engagement with a container cap, said apparatus comprising:

means (26) for rotating the container (22) about a rotational axis coinciding with the central axis (25);

a light source (42) positioned to direct an incident beam (44) of light energy at an acute angle onto the sealing surface (36) of a container in said rotating means,

light sensor means (46) disposed to receive light energy reflected (45) by the sealing surface (36),

said light source (42) and said light sensor means (46) being disposed above the sealing surface (36) of the container (22) and positioned such that said beams incident (44) and reflected (45) from the sealing surface (36) of the container are in a plane perpendicular to the sealing surface (36), and

means (52) for detecting variations (36a, 36b) at the sealing surface (36) of the container,

characterized in that

the light (44, 45) from said light source (42) to said light sensor means (46) is in a plane parallel to the central, rotational axis (25) of the container (22) which plane is at a distance equal to the radius of the sealing surface (36) to be inspected,

said incident beam (44) is a narrow collimated beam which intersects said sealing surface (36) at a position or point (A, A', A'') and the reflected light beam (45) impinges upon said light sensor means (46) at a corresponding position or point (B, B', B''),

in that said detecting means (52) is designed to detect variations (36a, 36b) in level of the sealing surface (36) by interpreting the position of the point (B, B', B'') on said sensor means (46, 50) as the actual level of the sealing surface (36) with respect to said light source (42) and said sensor means (46) at a corresponding position or point (B, B', B''), and

in that variations (36a, 36b) are detected by said detection means (52) as a function of position of incidence of the reflected light beam (45) on said light sensor means (46, 50) as the container (22) rotates."

The wording of claim 10 reads as follows:

"A method of inspecting the finish of a container (22) having a central axis (25) and an open mouth surrounded by an axially facing sealing surface (36) for sealing

engagement with a container cap, said method comprising the steps of:

- (a) rotating the container (22) about its axis (25),
- (b) directing an incident beam (44) of light energy at an acute angle onto the sealing surface (36) of the container as it rotates such that the beam is reflected from the sealing surface (36) in a plane perpendicular to the sealing surface,
- (c) positioning light sensor means (46) in said perpendicular plane to receive the light beam (45) reflected from the sealing surface (36),
- (d) providing means (52) for detecting variations (36a, 36b) at the sealing surface (36) of the container (22)

characterized in that

- (a') the rotating sealing surface (36) at the area to be inspected moves tangentially along the plane in which the light (44, 45) from the light source (42) to the sensor means (46) travels,
- (b') the incident beam (44) is a narrow collimated beam which intersects said sealing surface (36) at a position or point (A, A', A"), and the reflected light beam (45) impinges upon said light sensor means (46) at a corresponding point (B, B', B") which has a position on said sensor that varies with the level of the sealing surface (36) with respect to said sensor, and

(d') the position of said point (B, B', B") on the sensor is interpreted as the actual level at the sealing surface (36) of the container (22) and variations (36a, 36b) in the level are detected as a function of variations in position of incidence of the reflected light beam (45) on said sensor means (46) as the container rotates."

Claims 2 to 9 are dependent on claim 1. Claims 11 and 12 are dependent on claim 10.

V. The arguments of the appellant may be summarised as follows:

Document D1 discloses an apparatus and a method for inspecting the end of an object for a defect with the features of the preambles of claim 1 and claim 10. In the apparatus disclosed in D1, the upper end portion of the object is illuminated by one light source with a broad light beam or by a pair of light sources and during the motion of the object its illuminated edges are imaged as two bright lines onto a pair of sensors disposed at a predetermined angle relative to each other and arranged in cameras laterally and above the moving direction of the object area to be inspected. The signals are added and subtracted in a processing apparatus, thereby detecting defects in the object surface. In order to provide two bright lines from the edges of the moving object the light source and cameras must be arranged *orthogonal* to the direction of movement. Therefore the apparatus disclosed in document D1 differs from the apparatus according to the invention in the arrangement of the light source and sensor means (in *radial* direction as opposed to the *tangential* direction in the invention); in the

illumination (one broad light source or a pair of light sources, in order to illuminate two edges of the object; whereas the apparatus according to the invention uses a narrow, collimated light beam illuminating the surface at one point); and in the nature of the signal processing (document D1 always requiring a set of sensors and associated signal processor to compare the two signals; in the apparatus of the invention the position of the reflected light beam on the sensor is evaluated).

A further apparatus and method comprising the features of the preambles of claims 1 and 10 is disclosed in document D2, which is considered to represent the closest prior art. This apparatus includes a light source emitting a beam forming an illuminated area across the sealing surface of the container and a camera having an array of light sensitive elements and receiving the reflected light from the surface to be inspected. The light source, camera and beam define a plane extending *radially* to the direction of the moving outer surface. Faults or checks as lines-over-finish or blisters can be detected from the image thus received, which, however, does not carry information about the *level* of such inspected surface. The apparatus defined in claim 1 and the method of claim 10 differ from the apparatus and method known from document D2 in the arrangement of the light source and sensor means, which are in *tangential* direction to the moving surface (in document D2: *radial* arrangement); and in the size of the light beam, which is narrow and collimated to illuminate and detect a point on the surface (in document D2: illuminated area).

These difference between the subject-matter of the

independent claims and the system known from D2 solve the objective problem to provide an apparatus and method enabling to obtain information on the *height* of the surface deviations of the container to be inspected.

The solution defined in the independent claims is based on the principle of triangulation. Document D3, which had been cited by the examining division for this principle of triangulation, is, however, a document from the quite remote technical field of rotating circular scanners for detecting the level of a welding seam. The principles of documents D1 and D2 differ so much from the principle underlying document D3 that these cannot readily be combined.

Therefore the claimed solution is not obtainable in an obvious way from a combination of the cited documents.

Reason for the Decision

1. The appeal is admissible.
2. *Amendments - Article 123(2) EPC*
 - 2.1 Claim 1 differs from claim 1 as originally filed in that the light source, the sensor means and the light beam from the source to the sensor means reflected by the sealing surface define a plane which is parallel to the rotational axis of the container and at a distance equal to the radius of the sealing surface, i.e. are arranged in a plane *tangential* with respect to the rotating container surface. This feature is supported by the Figures and the corresponding passage in the

original description, see Figure 1 (*to be compared with Figure 1 of document D2, where a **radial** arrangement with respect to the rotation direction is disclosed*) and Figure 3, showing such a tangential arrangement including a second pair of light source and sensor means. Furthermore the present claim defines that the incident beam is a *collimated* beam which is incident at an *acute angle* onto the sealing surface. This feature finds its support in the embodiment of Figure 1, see page 6, lines 5 to 6.

2.2 Method claim 10 includes the corresponding method features, which are equally supported by the cited passages in the original disclosure.

2.3 Other minor amendments in the dependent claims equally find their support in the application as originally filed.

2.4 Therefore the Board is satisfied that the application documents are in conformity with Article 123(2) EPC.

3. *Novelty*

3.1 Document D1 shows in the Figures an apparatus for inspecting the finish of a container (glass 3) comprising means (turntable 4) for rotating the container; a light source (5) positioned to direct an incident beam of light at an acute angle (Figures 3 and 9) onto the sealing surface of the container; and light sensor means (1, 2) disposed to receive light reflected by the sealing surface. The light source and light sensor means are disposed above the sealing surface of the container and the incident and reflected beams are in a plane perpendicular to the sealing

surface. The apparatus further includes image processing means 12 for detecting variations at the sealing surface of the container. Differing from the requirement in claim 1 of the application in suit, in the apparatus disclosed in document D1 the light from the light source to the light sensor means is in a plane which is not parallel to but coincides with the central rotational axis of the container, therefore this plane is not *tangential* to the rotation direction of the container surface, but intersects this surface in *radial* direction, the plane including the centreline of the surface. Furthermore in the apparatus disclosed in document D1 the light source does not emit a narrow collimated beam but either comprises a *pair* of light sources 5 (Figures 2 and 3) or a single light source emitting a divergent beam (Figures 8 and 9).

- 3.2 Document D2 discloses an apparatus for inspecting the finish of the sealing surface of a container. As shown in Figures 1 and 2 this apparatus includes means (26) for rotating the container about a rotational axis (23) coinciding with the central axis; a light source (strobe 42) positioned to direct an incident beam of light energy at an acute angle (claim 1) onto the sealing surface (36) of a container (32) in the rotating means; light sensor means (camera 48) disposed to receive light energy reflected by the sealing surface; wherein the light source is positioned to direct the light downwardly onto the sealing surface at an angle to the axis 23 (column 6, lines 8 to 15), whence the light source and the light sensing means define a plane perpendicular to the sealing surface. Furthermore this apparatus includes means (information processor 52 and image memory 54) for detecting variations at the sealing surface of the container

(Figure 3).

As is illustrated in Figure 4 of document D2, this plane defined by the light source (illuminated area 58) and the sensor (field of view 48a of camera 48) is orthogonal to the sealing surface, i.e. the plane is arranged in *radial* direction. Furthermore the illuminated area 58 does not result from a narrow collimated beam, which is also visible from Figure 11. Therefore the features of the characterising portion of claim 1 are not known from this document.

3.3 Document D3 discloses an optical seam position sensor for a welding torch and is not related to an apparatus for inspecting the finish of a container within the definition of claim 1.

3.4 Therefore the subject-matter of claim 1 is novel within the meaning of Article 54 EPC.

For the same reasons the subject matter of claim 10 is considered novel, because this claim defines a method of inspecting the finish of a container with the method features corresponding to the apparatus features of claim 1.

4. *Inventive step*

4.1 Documents D1 and D2 disclose apparatuses and methods for inspecting the finish of a container with the features of the preamble of claims 1 and 10 of the application in suit. Therefore in addressing the question of inventive step, both disclosures may be considered as a suitable starting point for the problem-solution approach.

4.2 The subject-matter of claim 1 differs from the inspection apparatus according to D1 and the one known from D2 essentially in the arrangement of the light source and the sensor means with respect to the sealing surface of the container under inspection; the choice of the shape of the incident beam; and the data processing of the detected signal. According to the appellant, these differences solve the problem of the detection of the actual height or level of the sealing surface.

4.3 A similar problem, i.e the problem of controlling the quality of the sealed surface in a container is also addressed in documents D1 and D2. For instance, in document D1, column 8, lines 3 to 13, the detection of uneven or varying height of the lip of the glass surface is discussed. Similarly document D2 discusses in the context of Figure 3A to 3E different exemplary types of unacceptable variations in the sealing surface. Therefore the issue is whether the skilled person, starting from the teaching of either document D1 or D2, would find in the apparatuses disclosed in these prior art documents an incentive to implement the particular solution defined in claim 1.

4.3.1 The inspection apparatus disclosed in document D1, see in particular column 5, line 16, includes a pair of light sensors (CCD cameras) wherein onto each camera the outer portion and inner portion of the lip of a glass surface to be inspected is imaged. By rotating the container and successively photographing the lip at sufficient small pitch the incremental pictures are image-processed to result in two bright lines, which can be compared to detect defects in the container surface. For this particular comparison process both

inner and outer portions of the upper surface lip must be illuminated, which in the apparatus according to document D1 is realised by either two light sources (Figure 3) or a single light source with a correspondingly divergent beam (Figure 9). A modification of the light distribution employed in these embodiments by replacing this by a narrow collimated beam would no longer provide the required simultaneous illumination of the inner and outer portions of the lip. Furthermore, in order to sample the inner and outer portions of the lip during rotation of the glass container the CCD camera in the apparatus according to document D1 is arranged *orthogonal* to the direction of rotation, i.e. in *radial* direction. If this arrangement were to be modified to a tangential (parallel to the direction of rotation) the idea of comparing the inner and outer portion of the lip would have to be abandoned. Furthermore, since according to document D1 the apparatus already provides information of the uneven or varying height of the container surface, there is no obvious incentive to modify that apparatus in the way as defined in claim 1.

- 4.3.2 In the inspection apparatus disclosed in document D2 an angular portion of the container surface is imaged onto a linear (Figure 4) or two-dimensional detector (Figure 5) array, the entire container surface being recorded by scanning the detector signals during the rotation of the container around its axis. Also for this process it appears essential that for each scan the angular portion of the surface area is illuminated by the light source, which excludes the use of a narrow collimated beam. Furthermore also in this device the orientation of light source and detector is orthogonal to the direction of rotation of the surface, which at

least for the linear detector in Figure 4 appears compulsory. Therefore it is not obvious why the skilled person would modify illumination pattern and the orientation of light source and sensor means in the inspection apparatus disclosed in D2 as defined in claim 1.

- 4.3.3 During the examination procedure reference had been made to document D3 for showing that the principle of triangulation and lateral effect diodes for determining height differences of a rotating surface was known. According to this document, the surface seam welded by a torch to be inspected is illuminated with a pencil-like beam, which therefore corresponds to a narrow collimated beam.

In the opinion of the board, a combination of the teachings of document D3 with either one of documents D1 or D2 would not *a priori* appear to be obvious, because the requirements with respect to the illumination schemes of these documents are irreconcilable with the pencil-like beam employed in the system of document D3. Furthermore the arrangement of the triangulation position sensor with respect to the welding torch in the apparatus according to document D3 is concentric in the embodiment of Figure 1 and eccentric in the embodiment of Figure 2, in both embodiments the beam scanning the area in a concentric circular pattern. Therefore this arrangement does not suggest to modify the radial arrangement of light source and sensor means used in documents D1 and D2 to a *tangential* arrangement as in the apparatus defined in claim 1.

- 4.4 Therefore claim 1 is neither anticipated nor made

obvious by the available prior art. Claims 2 to 9 are dependent on claim 1 and therefore, their subject-matters also involve an inventive step.

For similar reasons the subject-matter of claim 10 is considered patentable, because this claim defines a method of inspecting the finish of a container with the method features corresponding to the apparatus features of claim 1. Claims 11 and 12 are appended to claim 10 and hence equally patentable.

5. For the above reasons, the Board finds that the appellant's request meets the requirements of the EPC and that a patent can be granted on the basis thereof.

Order

For these reasons it is decided:

1. The decision under appeal is set aside.
2. The case is remitted to the department of first instance with the order to grant a patent on the basis of the following documents:

Claims: No. 1 to 12, according to the request as filed with the letter dated 12 July 2002;

Description: pages 1 and 1a, according to the request as filed with the letter dated 12 July 2002;
pages 2, 2a filed with the letter dated

9 June 1998;
pages 3 to 9 as originally filed;

Drawings: sheets 1/2, 2/2 filed with the letter
dated 5 February 1999.

The Registrar:

The Chairman:

P. Martorana

E. Turrini