BESCHWERDEKAMMERN DES EUROPÄISCHEN PATENTAMTS

BOARDS OF APPEAL OF THE EUROPEAN PATENT OFFICE

CHAMBRES DE RECOURS DE L'OFFICE EUROPEEN DES BREVETS

Internal distribution code:
(A) [ ] Publication in OJ
(B) [ ] To Chairmen and Members
(C) [ ] To Chairmen
(D) [X] No distribution

Datasheet for the decision of 12 August 2010

Case Number: T 1119/07 - 3.4.02

Application Number: 99109539.9

Publication Number: 0957355

IPC: G01N 21/90

Language of the proceedings: EN

Title of invention:
Optical inspection of transparent containers using two cameras and a single light source

Applicant:
OWENS-BROCKWAY GLASS CONTAINER INC.

Opponent:
-

Headword:
-

Relevant legal provisions:
EPC Art. 56

Relevant legal provisions (EPC 1973):
-

Keyword:
"Inventive step - claims 1, 12 (yes)"

Decisions cited:
-

Catchword:
-

Europäisches Patentamt | European Patent Office | Office européen des brevets

Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number: T 1119/07 - 3.4.02

D E C I S I O N
of the Technical Board of Appeal 3.4.02
of 12 August 2010

Appellant: OWENS-BROCKWAY GLASS CONTAINER INC.
Three O- Plaza
One Michael Owens Way
Perrysburg, OH 43551-2999 (US)

Representative: Blumbach - Zinngrebe
Patentanwälte
Alexandrastrasse 5
D-65187 Wiesbaden (DE)

Decision under appeal: **Decision of the Examining Division of the European Patent Office posted 27 February 2007 refusing European patent application No. 99109539.9 pursuant to Article 97(1) EPC.**

Composition of the Board:

Chairman: A. G. Klein
Members: M. Rayner
M. J. Vogel

Summary of Facts and Submissions

I. The present appeal is against the decision of the examining division refusing European patent application number 99 109 539.9. The patent application concerns optical inspection of glass containers. In the examination and/or appeal proceedings reference has been made to documents including the following:-

D1 US-A-4 943 713
D2 EP-A-0 620 430
D3 WO-A-97 46329
D4 US-A-4 026 656
D5 US-A-3 963 348.

II. In the decision under appeal, the examining division substantiated its refusal with lack of inventive step. Document Dl was considered to be the closest prior art document, disclosing an apparatus for inspecting a container for opaque and stress variations in the glass of the container that affect commercial acceptability of the container.

The examining division was convinced that a comparison between first and second container images is disclosed in document Dl to the skilled person. A particularly advantageous use of polarising filters in the inspection of transparent containers was also well known in the field, for example, from document D4 or D5. Thus the skilled person when reading the teachings related to the embodiment of Figure 5 of Dl, with polarising filters, was not only directly and unambiguously made aware of the obtainable sensitivity to stress, but positively looked for achieving that

effect. The presence of defects due to stress in the glass, as well as transparent or opaque foreign bodies, leads to a less efficient detection when employing polarising filters than when using colour filters, where bright spots are due only to reflections from the transparent particles. According to document D1, as far as its colour filter embodiment is concerned, a spurious output on the camera with a bright background is simply disregarded (cf. cal. 9, lines 12 to 16). However, if polarisation filters are used, whether a bright spot in the camera with a dark background is due to a foreign transparent particle or to stress can only be decided by comparison with the output of the camera with a light background. Independently of whether or not the reason for using polarising filters is that of stress detection, it thus appeared clear that the comparison step was required. The skilled person would thus have understood from document Dl that the system implementing the polarising filters includes the comparison step.

Therefore the contribution over the prior art concerns means for rotating the container about its axis to allow detection of defects in any of the lateral surfaces of the container. Inspection of flaws at any portion of the container is regarded as a standard requirement in document D1 and has to be regarded as a standard problem. Rotation of a container about its axis is also a well known solution to the problem (see, for example, document D2 or D3) and cannot be considered to meet the requirement of inventive step.

III. The appellant requests that the decision under appeal be set aside and a patent granted on the basis of a main request as specified in its letter dated 16.03.2010, or, alternatively, on the basis of auxiliary requests presented with the statement of grounds for appeal. Oral proceedings were also requested on an auxiliary basis.

According to the appellant, the decision under appeal used a two step reasoning that document D1 would be both suitable for and intended for detecting stress. However, the apparatus disclosed in Fig. 5 of document Dl was not intended for stress detection, nor was it even suitable for stress detection.

If the apparatus of document Dl were used with polarisers and if - hypothetically - a stress defect were present in the bottle bottom, it is at least doubtful whether that stress defect could be detected at all. The reason is that stress detection is very sensitive. Stray light has to be avoided to obtain a detectable signal in the dark field. So referring to the embodiment shown in Figure 5 of document Dl and using the polarisers, even if some light which passed through the first polariser 11, through a hypothetical defect in the bottle bottom and the second polariser 12 were to reach camera 2' in Figure 5 of document Dl, the signal analysis would be extremely difficult due to the optical noise from the light rays L1 and L2 shown in Figure 5. With stress detection the signal is small and needs a low noise background to be detected. However in the known apparatus the noise on camera 2' would be significant, as, in particular, the signal from the strong blast of unpolarised light directed from

mirror 7 through the bottle (rays L1, L2) would make it very difficult, if not impossible, to use the configuration to find stressed areas in the glass of the bottom of the bottle. The stress signal pattern around stressed stones, letters and numbers moulded on the outside of the glass and so on is soft edged due to the stress gradient in the surrounding glass and is generally of low amplitude, the result being it produces a low contrast signal. An opaque object such as a stone shows a signal with a very sharp edge and generally blocks 100% of the light from the bright field background, i.e., it produces a high contrast signal. Causes of optical noise can possibly direct rays L1, L2, i.e. the unfiltered light, up to camera 2'. These rays are not polarised, because they did not pass through the diffuser 5 and the polariser, but come from mirror 7. The other polariser 12 would block only one polarisation direction of this stray light, letting the perpendicular polarisation direction through to camera 2’. Therefore, the apparatus as shown in Figure 5 of document Dl, in a version with polarisers, is not suitable for stress detection and a person skilled in the art would not have concluded from Figure 5 of document Dl that it would be suitable.

However, the decision under appeal also goes further, by arguing that the apparatus of document Dl would not only be suitable, but would even be intended for stress detection. The suitable argumentation might be used for a pure novelty consideration, but not for reading further features into document Dl which are simply not disclosed, because the apparatus was not intended for stress detection. It is true that documents D4 and D5 refer to stress/strain detection, but document Dl does

not. Thus the skilled person would not try to combine the teaching of D1 with stress detection documents. Moreover, according to document D1, the image sensor 2 is provided to detect opaque foreign particles, and image sensor 2' is provided to detect transparent foreign particles within the returnable bottle. These are different particles lying on the bottle bottom with no correlation regarding their position. Therefore, it is not necessary to compare the images of the opaque and transparent foreign particles, but it is sufficient to treat them independently. Thus, comparing the images, as defined in both independent claims, is not only not disclosed in D1 to compare, but is also not obvious in view of the teaching of D1, as for the field of application of the D1 teaching there would be no benefit of doing so.

IV. In a communication following the statement of grounds for appeal, the board informed the appellant that it seemed to be clear that stress and opaque detection were as such well known. However, supposing the skilled person were to have used polarisers in following the particular teaching of document D1, it seemed questionable whether this person would have considered the known apparatus would function for stress detection because of the light injected by the light reflection mirror 7. The doubt cast in this respect by the appellant seemed credible and is confirmed by, for instance, the first paragraph in column 4 of document D2. Particularly relevant seemed to be the moulding of letters and numbers on the outside of the bottom of the container.

V. Independent claims 1 and 12 of the main request are worded as follows.

"1. Apparatus for inspecting a container (14) for opaque and stress variations in the glass of the container that affect commercial acceptability of the container, comprising:

means (39) for rotating a container (14) about its axis,

a light source (16), including a diffuser (20) and a polariser (22), for directing diffuse polarised light through a container (14) in said rotating means (39),

a first camera (24) disposed with respect to said rotating means (39) to receive diffuse polarised light transmitted from the light source (16) through a portion of the container (14), so that said first camera (24) receives a first image of said container portion in which opaque variations appear dark against an otherwise bright background,

a second camera (28) disposed with respect to said rotating means (39) to receive diffuse polarised light through substantially a portion of the container (14), and including a second polariser (32) at cross orientation to said first polariser (22) and

image processing means coupled to said first camera (24) and said second camera (28) for receiving associated images of said container portion, including means for detecting and discriminating between variations in the glass of the container,

wherein said diffuse polarised light is for imaging in both said first and second cameras (24, 28) thus producing said first image and a second image of the same portion of the container (14) as illuminated by said light source (16), said second image being a

bright image of stress variations in the container portion that alter polarisation of the diffuse polarised light passing therethrough against an otherwise dark background
and wherein said image processing means is an image processor (41) that detects and discriminates between opaque and stress variations in the glass of the container as a function of a comparison between said first image and said second image.

12. A method of inspecting a container (14) for opaque and stress variations in the glass of the container that affect commercial acceptability of the container, comprising the steps of:
(a) rotating the container (14) about its axis,
(b) directing diffuse polarised light from a light source (16) including a first polariser (22) through the container toward first and second cameras (24, 28) simultaneously,
(c) receiving at said first camera (24) an first image of a portion of the container (14) in which opaque variations appear dark against a bright background said first image being produced by said diffuse polarised light,
(d) receiving at said second camera (28) a second image of the same portion of the container, wherein the second camera (28) includes a second polariser (32) at crossed orientation to said first polariser (22) normally creating a dark background on said second camera (28), wherein stress variations in the glass of the container (14) alter the polarisation of the diffuse polarised light transmitted therethrough to pass through the second polariser (32) thus producing said second image on the second camera (28) by in-said

diffuse polarised light, and in which stress variations appear bright against the otherwise dark background, and

(e) comparing said first image at said first camera (24) and said second image at said second camera (28) and detecting opaque and stress variations in the glass of the container (14) as a function of the comparison between said first and second images at said first and second cameras (24, 28)."

Reasons for the Decision

1. The appeal is admissible.

2. Document D1

2.1 Figure 5 of document D1 discloses a light source 4 disposed under a bottle 1. An optical filter 11 for passing red light is disposed over a light diffusion plate 5 arranged between the light source and bottle. There is also a light reflection mirror 7 located around the light diffusion plate 5. A half mirror 10 for splitting incident light into separate paths differing by 90° in travelling direction is disposed between the mouth of a bottle 1 and image sensors 2, 2'. An optical filter 12 disposed in front of one image sensor 2' prevents red light passing but permits blue light. The optical filters 11 and 12 render the light diffusion plate 5 a dark field to the image sensor 2'. On the other hand, the light diffusion plate 5 and the optical filter 11 are presented as a red bright field to the image sensor 2.

2.2 In operation, the red light passing to sensor 2 enables inspection of the foreign particle made of opaque and half transparent materials, which are detected as a dark shade in the red bright field. The part of the red light passing through the mouth of the bottle 1 and reflected by the half mirror 10 towards the image sensor 2' for transparent particles is prevented by optical filter 12 from passing and does not reach the image sensor 2'. However, a part of the white light from the lamp 4 travels toward the mirror surface 7A of the light reflection mirror 7 located outside the light diffusion plate 5 and is reflected thereon. This reflected light is introduced into the bottle bottom from the outside. If there is a transparent foreign particle, a part of the light reflected on the surface of the foreign particle 8 passes through the mouth of the bottle 1 and is reflected by the half mirror 10. The reflected light passes through the optical filter 12 and reaches the image sensor 2', which sensor detects the transparent foreign particle as a bright light in the dark field. Part of the light passes the half mirror 10 and reaches the image sensor 2, but does not contribute to inspecting foreign particle by the image sensor 2 and the electronic processor 3 at all.

2.3 The optical filters 11 and 12 can be replaced with polarising filters of which the polarising characteristics are different. In other words, it is possible to use a polarising filter used instead of the filter 12 which does not allow the light from the polarising filter used instead of the optical filter 11. Since inspecting the opaque and half transparent foreign particles is combined with inspecting the transparent foreign particle via the half mirror and

the color or polarising filter, it is possible to positively detect transparent in addition to opaque foreign particles.

3. Novelty

3.1 From the foregoing, it can be seen that the teaching of document D1 combines two essentially independent detection methods, functioning with a separate kind of light source, diffuse red light for the opaque particles and white light for the transparent particles. These light sources take a different route into the bottle, from the red filter and from the mirror 7, respectively. Light reaching the bright red background camera from transparent particles is not used and there is no comparison between the images produced as this is not necessary.

3.2 Accordingly, novelty of the subject matter of claim 1 is provided not only by the rotating means as identified by the examining division but also by the diffused light being for imaging in both cameras and the discrimination by comparison of the images. If polarisers are used in place of the colour filters, the situation does not change with respect to detection of opaque and transparent particles, because light from the diffuser is still blocked from reaching the dark background camera.

3.3 The board is therefore satisfied as to novelty of the subject matter of claim 1.

3.4 The board accepts that stress determination was well known, but it does not accept that there is an implicit disclosure for the skilled person to use the teaching of document D1 for this purpose. There are a number of reasons for this, for example document D1 does not mention stress at all. Moreover, the disclosure is concerned with recycled bottles, where unlike newly manufactured bottles, the stressed bottles would already have been sorted out after manufacture. Furthermore, as the examining division said, the light background signal would need to be evaluated to discriminate over transparent particles, yet document D1 explicitly states that this is not used with colour filters and does not make any contrary comment for polarisers. As the appellant argued, the transparent and opaque particles are separate, why should the skilled person have implicitly understood any comparison was necessary? Finally, the appellant has pointed out that the stray unpolarised light from the mirror 7 would make it very difficult if not impossible to find stressed areas in the bottom of the bottle. This is confirmed, for example by column, 4,lines 1-4 of document D2.

"where such a convex or concave portion as a character or a design pattern is present on an outer face of the bottom of the glass vessel, weak light which is not produced by polarisation may possibly enter the camera".

Thus the board had to conclude that the skilled person would not have considered document Dl to have an implicit disclosure that its system implemented with polarising filters includes a comparison step.

3.5 Accordingly, the board considers reading of the novel features into the disclosure of document D1 can only be done using hindsight.

4. Inventive Step

4.1 Since it is not directly concerned with stress determination, the board doubts whether document D1 can be considered as closest prior art. Supposing, arguendo, that this be done, then the problem addressed by the novel features can be considered to be enabling classification of stress and opaque variations in a container. The solution is not only not implicitly known from document D1, but also not obvious for the reasons given in section 3.4 above. In particular, the skilled person would, as the appellant argued, consider stray unpolarised light from the mirror 7 would make it very difficult if not impossible to find stressed areas in the bottom of the bottle.

4.2 The other prior art documents offer no teaching towards solving this problem and hence do not call inventive step into question, for example documents D2 and D5 use only one camera. Documents D4 and D4 disclose two cameras but not for discriminating opaque and stress variations based on comparison of images. Consequently, combinations of the teachings of these documents do not lead to a convincing argument against inventive step. Moreover, no other document in the file offers any basis for such an argument.

4.3 Accordingly, the board reached the view that an inventive step within the meaning of Article 56 EPC 1973 can be considered present in the subject matter of claim 1.

4.4 For similar reasons, the board reached the same conclusion in relation to independent method claim 12.

5. The board has no other convincing objection speaking against grant of a patent based on the main request of the appellant.

6. In view of the positive view of the board in relation to the main request, neither consideration of the auxiliary requests in this decision nor oral proceedings before the board is necessary.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the first instance with the order to grant a patent based on the following application documents

Description

Pages

1, 2, 2a, 3-9 as filed with the letter dated 16 March 2010

Claims

1-14 as filed with the letter dated 16 March 2010

Drawings

Figures 1, 2, 3A and 3B as filed with the letter dated 16 March 2010

The Registrar The Chairman

M. Kiehl A. G. Klein