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**Datasheet for the decision
of 27 September 2006**

Case Number: T 0342/04 - 3.4.02

Application Number: 95104785.1

Publication Number: 0676634

IPC: G01N 21/90

Language of the proceedings: EN

Title of invention:

Optical inspection of container dimensional parameters

Applicant:

OWENS-BROCKWAY GLASS CONTAINER INC.

Opponent:

-

Headword:

-

Relevant legal provisions:

EPC Art. 56

Keyword:

"Inventive step: no"

Decisions cited:

-

Catchword:

-



Case Number: T 0342/04 - 3.4.02

D E C I S I O N
of the Technical Board of Appeal 3.4.02
of 27 September 2006

Appellant: OWENS-BROCKWAY GLASS CONTAINER INC.
One Sea Gate
Toledo, OH 43666 (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 24 October 2003
refusing European application No. 95104785.1
pursuant to Article 97(1) EPC.

Composition of the Board:

Chairman: M. Rayner
Members: M. Stock
C. Rennie-Smith

Summary of Facts and Submissions

I. The applicant and appellant has appealed against the decision of the examining division refusing European patent application 95 104 785.1 (publication EP 0 676 634 A1) for lack of inventive step and added subject-matter. the following documents were cited:

D3: US-A-4 580 045

D4: US-A-4 256 957

D10: DD-A-273 368

II. The impugned decision is in fact the second decision refusing this application. An appeal against the first decision of refusal gave rise to decision T 41/00 of this Board in a different composition, referring the case back to the examining division for further prosecution. In particular, the examining division was to examine whether the feature in claim 1 then on file, that an iris is arranged between two lenses, is clear and disclosed in the original application documents. During the first appeal proceedings there were also observations by a third party.

III. In the grounds of appeal in this second appeal the appellant requested that a patent be granted according to a main request on the basis of claims 1 to 5 which are identical in substance with the claims underlying the impugned decision. An auxiliary request I is directed to amendments in the dependent claims. An auxiliary request II is based on a version of claim 1

amended by the insertion of a feature related to a pair of lenses (25, 27).

The appellant has provided a sketch to demonstrate the parameters of the container mouth used to indicate acceptability of the container according to D3 and the present application.

Moreover the appellant has provided the copy of a re-examination report for Australian patent no. 693157, which is based on the same priority as the present application. This report considers that the subject-matter claimed involves an inventive step in view of D10.

- IV. In an annex to the summons to the oral proceedings requested by the appellant the Board presented preliminary non-binding comments.

- V. In preparing for the oral proceedings and in reply to the comments of the Board, the appellant filed three further set of claims as auxiliary requests III, IV and V and an amended description. The appellant requested in the oral proceedings, which took place on 27 September 2006, that a patent be granted on the basis of the main request or one of auxiliary requests I to V.

VI. The versions of claim 1 according to the different requests read as follows:

Main and auxiliary request I

"1. An apparatus for inspecting containers (14) each having an open mouth (12) defining an axis, the apparatus comprising:

 a light source (16) for directing light onto the container (14),

 a camera (22) disposed with respect to said light source (16) to receive light transmitted through the container mouth (12),

 said camera (22) including a sensor (24) and a lens arrangement (25 to 28) for directing onto said sensor (24) light from the container mouth (12), such that said sensor (24) receives a two-dimensional image (12a) of the container mouth (12), and

 an information processor (30) coupled to said sensor (24) for analyzing said two-dimensional image (12a) so as to determine a dimensional parameter of the container mouth (12) and to indicate acceptability of the container (14) as a function of said parameter, characterized in that

 said lens arrangement (25 to 28) is a telecentric lens arrangement so as to focus onto sensor (24) essentially only light rays that emerge from the container mouth (12) essentially parallel to the axis of the container, lens and camera,

 said sensor (24) is a matrix array sensor, and
 said information processor (30) determines - as said dimensional parameter - a circle (12c) of greatest diameter that fits within said image (12a) of the container mouth (12)."

Auxiliary request II

"1. An apparatus for inspecting containers (14) each having an open mouth (12) defining an axis, the apparatus comprising:

 a light source (16) for directing light onto the container (14),

 a camera (22) disposed with respect to said light source (16) to receive light transmitted through the container mouth (12),

 said camera (22) including a sensor (24) and a lens arrangement (25 to 28) for directing onto said sensor (24) light from the container mouth (12) , such that said sensor (24) receives a two-dimensional image (12a) of the container mouth (12), and

 an information processor (30) coupled to said sensor (24) for analyzing said two-dimensional image (12a) so as to determine a dimensional parameter of the container mouth (12) and to indicate acceptability of the container (14) as a function of said parameter, characterized in that

 said lens arrangement (25 to 28) is a telecentric lens arrangement comprising a pair of lenses (25, 27) and a telecentric lens (28) wherein an entrance pupil (26) with said pair of lenses (25, 27) functioning as an iris in combination with the telecentric lens (28) so as to focus onto sensor (24) essentially only light rays that emerge from the container mouth (12) essentially parallel to the axis of the container, lens and camera,

 said sensor (24) is a matrix array sensor, and
 said information processor (30) determines - as

said dimensional parameter - a circle (12c) of greatest diameter that fits within said image (12a) of the container mouth (12)."

Auxiliary request III

"1. An apparatus for inspecting containers (14) for geometric characteristics, each container (14) having an open mouth (12) defining an inside diameter and an axis, the apparatus comprising:

 a light source (16) for directing light onto the container (14)

 a camera (22) disposed with respect to said light source (16) to receive light transmitted through the container mouth (12),

 said camera (22) including a sensor (24) and a lens arrangement (25 to 28) for directing onto said sensor (24) light from the container mouth (12), such that said sensor (24) receives a two-dimensional image (12a) of the container mouth (12), and

 an information processor (30) coupled to said sensor (24) for analyzing said two-dimensional image (12a) so as to determine the presence or absence of a choked region (12b) as well as an effective inside diameter of the container mouth (12) and to indicate acceptability of the container (14) as a function of a comparison between effective inside diameter and a desired minimum diameter, characterized in that

 said lens arrangement (25 to 28) is a telecentric lens arrangement so as to focus onto sensor (24) essentially only light rays that emerge from the

container mouth (12) essentially parallel to the axis of the container, lens and camera,

said sensor (24) is a matrix array sensor, and said information processor (30) determines - as said effective inside diameter - a circle (12c) of greatest diameter that fits within said image (12a) of the container mouth (12), said circle (12c) of greatest diameter being located asymmetrically relative to said mouth axis."

Auxiliary request IV

"1. An apparatus for inspecting containers (14) each having an open mouth (12) defining an inside diameter and an axis, by optical measurement of the inside diameter of the container mouth (12), and for accepting or rejecting containers (14) dependent upon whether the container mouth (12) has desired minimum diameter, or not, the apparatus comprising:

a light source (16) for directing light onto the container (14),

a camera (22) disposed with respect to said light source (16) to receive light transmitted through the container mouth (12),

said camera (22) including a sensor (24) and a lens arrangement (25 to 28) for directing onto said sensor (24) light from the container mouth (12), such that said sensor (24) receives a two-dimensional image (12a) of the container mouth (12), and

an information processor (30) coupled to said sensor (24) for analyzing said two-dimensional image (12a) so as to determine the presence or absence of a choked region (12b) and an effective inside diameter of the container mouth (12) and to indicate acceptability

of the container (14) as a function of a comparison between effective inside diameter and a desired minimum diameter,

characterized in that

said lens arrangement (25 to 28) is a telecentric lens arrangement so as to focus onto sensor (24) essentially only light rays that emerge from the container mouth (12) essentially parallel to the axis of the container, lens and camera,

said sensor (24) is a matrix array sensor, and said information processor (30) determines - as said effective inside diameter - a circle (12c) of greatest diameter that fits within said image (12a) of the container mouth (12), said circle (12c) of greatest diameter being located asymmetrically relative to said mouth axis,

and in that

a reject mechanism is provided for removing containers (14) from the inspection conveyor line."

Auxiliary request V

"1. An apparatus for inspecting containers (14) each having an open mouth (12) defining an inside diameter and an axis, by optical measurement of the inside diameter of the container mouth (12), and for accepting or rejecting containers (14) dependent upon whether the container mouth (12) has desired minimum diameter, or not, the apparatus comprising:

a light source (16) for directing light onto the container (14),

a camera (22) disposed with respect to said light source (16) to receive light transmitted through the

container mouth (12),

said camera (22) including a sensor (24) and a lens arrangement (25 to 28) for directing onto said sensor (24) light from the container mouth (12), such that said sensor (24) receives a two-dimensional image (12a) of the container mouth (12), and

an information processor (30) coupled to said sensor (24) for analyzing said two-dimensional image (12a) so as to determine the presence or absence of a choked region (12b) as well as an effective inside diameter of the container mouth (12) and to indicate acceptability of the container (14) as a function of a comparison between effective inside diameter and a desired minimum diameter,

characterized in that

said lens arrangement (25 to 28) is a telecentric lens arrangement so as to focus onto sensor (24) essentially only light rays that emerge from the container mouth (12) essentially parallel to the axis of the container, lens and camera,

said sensor (24) is a matrix array sensor, and said information processor (30) determines - as said effective inside diameter dimensional parameter - a circle (12c) of greatest diameter that fits within said image (12a) of the container mouth (12), said circle (12c) of greatest diameter being located asymmetrically relative to said mouth axis, in that

said light source (16) is arranged for directing light from beneath the container and into the container in a direction generally parallel to the axis of the container and container mouth, wherein said light source (16) includes a lamp (18) and a

diffusor (20),

and in that

a reject mechanism is provided for removing containers (14) from an inspection conveyor line.

"

Reasons for the Decision

1. Main and auxiliary request I

1.1 An apparatus for inspecting containers according to the preamble of claim 1 according to the main request corresponds to what is disclosed in document D3, see Figure 1 together with the related description.

1.2 The claimed subject-matter differs from this prior art by the following features:

(a) the lens arrangement (25 to 28) is a telecentric lens arrangement so as to focus onto sensor (24) essentially only light rays that emerge from the container mouth (12) essentially parallel to the axis of the container, lens and camera,

(b) the sensor (24) is a matrix array sensor, and

(c) the information processor (30) determines - as the dimensional parameter - a circle (12c) of greatest diameter that fits within the image (12a) of the container mouth (12).

- 1.3 The objective problem solved by feature (a) is related to making the size of the image of the container mouth independent of the distance from the container mouth to the sensor. Hence, this corresponds to the generally known effect of a telecentric lens arrangement. Moreover such a telecentric lens arrangement is described in D10, see abstract, disclosing an apparatus for automatic checking of the cross-section of tube portions, e.g. for mini halogen lamps with cross-sectional narrowing. In the apparatus of D10, see Figures 1 and 2, light emitted from lamp 7 is directed on tube portion 3 and focused by a lens on aperture 16 such that only light rays that emerge parallel to the axis of the tube portion reach sensor 6 of the CCD camera. It is indicated in D10, see page 2, first paragraph, 14th to 16th line, that this arrangement serves the purpose of varying distance between measured object and camera having no effect on the result of the measurement. It was thus obvious for a person skilled in the art to employ a telecentric lens arrangement of the kind disclosed in D10 for analysing the image of the container mouth.
- 1.4 As regards feature (b) D3 discloses a video camera (34), for which at the priority date of the present application the skilled person would of course use one of the type employing a CCD sensor which is a matrix array sensor.
- 1.5 As to feature (c) it can be gathered from D3, see column 3, lines 25 to 32 and 41 to 44, that excessive choke of a bottle is determined by computing the area subtended by opening 22 as well as computing the smallest diameter of the opening. This smallest

diameter of the opening corresponds to the circle of greatest diameter that fits within the image of the container mouth, as is defined in feature (c).

- 1.6 The appellant made reference to an examination report of the Australian patent office in which it was stated that a skilled person would not have regarded document D10 as relevant because it did not determine acceptability of container mouths for automatic filling and capping equipment.

The Board is, however, convinced that the use of a telecentric lens arrangement is generally known for measuring purposes, eliminating the need to carefully control the distance of the measured object. This finding is exemplified by D10 whose optical arrangement can obviously be applied to the apparatus known from D3, the more so in view of the fact that both documents have in common the measurement of the cross-section of a glass tube.

- 1.7 The appellant argued that in D3 only circles around the axis of the container mouth are considered, because only symmetric chokes are assumed. In contrast to that the teaching of the present application is based on the finding that the filling nozzle also enters the container mouth when the circle of greatest diameter fitting within the image of the container mouth is off-axis, i.e. in the more realistic case of an asymmetric choke where the bottle can be knocked by the filling device so long as it fits and does not break the bottle. Hence the circle of greatest diameter determined in accordance with the present application is distinctly different from the "smallest diameter" mentioned in D3.

1.8 This argument is also not accepted by the Board. The citation in D3 referred to by the appellant, i.e. column 3, lines 21 to 23, "Similar results could be obtained by calculating the centre of opening 22 and comparing it to a standard centre", is related only to the detection of bottles having excessive lean, as is clear from the sentence before "Similar results" stating that "...subcircuit 60 provides a signal to reject mechanism 54 to later reject that bottle for excessive lean". The situation of choke is discussed in D3 in column 3, lines 25 to 32, "Subcircuit 62 similarly determines whether a particular bottle has an excessive choke by computing the area subtended by opening 22 as well as computing the smallest diameter thereof". For the skilled person the use of the term "smallest diameter" only makes sense, if it is assumed that choke can also be asymmetric and the circle selected automatically receives the filler, even though shown central in Figures 3 or 5. Then the smallest diameter mentioned in D3 defines a circle of the greatest diameter fitting within the image of the container mouth, as claimed in accordance with feature (c).

1.9 Therefore taking into due account the essential arguments of the appellant the Board concludes that the subject-matter of claim 1 according to the main and first auxiliary request does not involve an inventive step within the meaning of Article 56 EPC.

2. *Auxiliary request II*

Claim 1 according to this request differs from claim 1 according to the main request in that the telecentric lens arrangement is further defined by the feature "comprising a pair of lenses and a telecentric lens wherein an entrance pupil with said pair of lenses functioning as an iris in combination with the telecentric lens".

2.1 The appellant stated that this request was formulated in view of the first decision of the Board, questioning whether an iris arranged between two lenses was disclosed in the documents as originally filed, because the original description only referred to an entrance pupil. The appellant stated further that it is clear to the skilled reader that in the context of the application the terms "entrance pupil" and "iris" are in fact interchangeable. The advantage of this feature is related to the use of a standard objective lens containing an iris.

2.2 The Board is satisfied that the added feature is disclosed in the original documents. However, this feature adds nothing inventive to the claimed subject-matter because the use of standard optics falls within the routine expertise of the skilled person.

3. *Auxiliary request III*

3.1 Claim 1 of this request is directed to the detection of an asymmetric choked region (12b) as shown in Figure 3 on the basis of the circle of greatest diameter (12c) being located asymmetrically relative to the mouth axis.

3.2 The appellant advanced the argument that only symmetric choke is considered in D3 and hence only coaxial circles are used for comparison as is apparent from Figure 5.

3.3 However, the Board is of the opinion that in D3 the comparison of the centre of the opening with a standard centre is only made for the detection of excessive lean, whereas for excessive choke the smallest diameter of the opening is determined, as is shown above. The smallest diameter corresponds to a circle of greatest diameter of the opening and includes situations in which this circle of greatest diameter is located asymmetrically relative to the mouth axis.

4. *Auxiliary request IV*

4.1 In claim 1 according to this request there is defined in addition a reject mechanism provided for removing containers from an inspection conveyor line.

4.2 This feature is also obvious to the skilled person in view of the fact that in D3, see column 3, lines 23 to 24, it is stated that "a bottle is rejected if it has computed parameters outside predetermined adjustable limits".

5. *Auxiliary request V*

The additional feature in claim 1 of this request is related to the light source being arranged for directing light from beneath the container and into the container in a direction generally parallel to the

axis of the container and container mouth, wherein said light source includes a lamp and a diffuser.

- 5.1 The appellant argued that this arrangement of the light source is not suggested by D3 disclosing two light sources 30 and 32 arranged to illuminate the interior of each bottle through the side walls and from above.
- 5.2 This argument is also not accepted by the Board. Illumination along the axis of the container is an obvious alternative, which is known from D10, see Figure 1, and moreover from D4, see Figure 1, disclosing in addition a diffuser 3, as is claimed in accordance with the auxiliary request V.
6. Therefore the subject-matter of none of the auxiliary requests II to V involves an inventive step within the meaning of Article 56 EPC.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar:

The Chairman:

M. Kiehl

M. Rayner