

PATENT COOPERATION TREATY

JUL 26 2021

From the INTERNATIONAL PRELIMINARY EXAMINING
AUTHORITY

To:

**STEPHEN L. SCHARF
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PCT

COMMUNICATION IN CASES FOR
WHICH NO OTHER FORM IS APPLICABLE

Applicant's or agent's file reference 19501 WO	Date of mailing <i>(day/month/year)</i> 19 July 2021 (19.07.2021)
International application No. PCT/US2020/040853	International filing date <i>(day/month/year)</i> 06 July 2020 (06.07.2020)
Applicant OWENS-BROCKWAY GLASS CONTAINER INC.	

1. ☐ REPLY DUE within _____ months/days from the above date of mailing

☒ NO REPLY DUE

2. COMMUNICATION:

The International Preliminary Report on Patentability Chapter II (Form PCT/IPEA/409) mailed by the IPEA/US on 30 June 2021 contains inadvertent errors and is hereby withdrawn. Enclosed is the corrected Form PCT/IPEA/409.

Name and mailing address of the IPEA/US COMMISSIONER FOR PATENTS MAIL STOP PCT, ATTN: IPEA/US P.O. BOX 1450 ALEXANDRIA, VA 22313-1450, UNITED STATES OF AMERICA Facsimile No. (571)273-8300	Authorized officer TAMARA GRAYSAY Telephone No. (571)272-6728
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CORRECTED**PATENT COOPERATION TREATY****PCT****INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY**

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference 19501 WO	FOR FURTHER ACTION	See Form PCT/IPEA/416
International application No. PCT/US2020/040853	International filing date (day/month/year) 06 July 2020 (06.07.2020)	Priority date (day/month/year) 11 July 2019 (11.07.2019)
International Patent Classification (IPC) or both national classification and IPC IPC: C03B 5/235, 5/44, 5/182 CPC: C03B 5/2356; C03B 5/44		
Applicant OWENS-BROCKWAY GLASS CONTAINER INC.		

1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 5 sheets, including this cover sheet.

3. This report is also accompanied by ANNEXES, comprising:

- a. ☒ (sent to the applicant and to the International Bureau) a total of 10 sheets, as follows:
- ☒ sheets of the description, claims and/or drawings which have been amended and/or sheets containing rectifications authorized by this Authority, unless those sheets were superseded or cancelled, and any accompanying letters (see Rules 46.5, 66.8, 70.16, 91.2, and Section 607 of the Administrative Instructions).
 - ☐ sheets containing rectifications, where the decision was made by this Authority not to take them into account because they were not authorized by or notified to this Authority at the time when this Authority began to draw up this report, and any accompanying letters (Rules 66.4bis, 70.2(e), 70.16 and 91.2).
 - ☐ superseded sheets and any accompanying letters, where this Authority either considers that the superseding sheets contain an amendment that goes beyond the disclosure in the international application as filed, or the superseding sheets were not accompanied by a letter indicating the basis for the amendments in the application as filed, as indicated in item 4 of Box No. I and the Supplemental Box (see Rule 70.16(b)).
- b. ☐ (sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s)) _____ containing a sequence listing, in the form of an Annex C/ST.25 text file, as indicated in the Supplemental Box Relating to Sequence Listing (see paragraph 3ter of Annex C of the Administrative Instructions).

4. This report contains indications relating to the following items:

- ☒ Box No. I Basis of the report
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step and industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the international application
- ☐ Box No. VIII Certain observations on the international application

Date of submission of the demand 30 April 2021 (30.04.2021)	Date of completion of this report 17 June 2021 (17.06.2021)
Name and mailing address of the IPEA/US COMMISSIONER FOR PATENTS MAIL STOP PCT, ATTN: IPEA/US P.O. BOX 1450 ALEXANDRIA, VA 22313-1450, UNITED STATES OF AMERICA Facsimile No. (571)273-8300	Authorized officer LISA HERRING Telephone No. (571)270-1623

CORRECTED**INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY**

International application No.

PCT/US2020/040853

Box No. I Basis of the report1. With regard to the **language**, this report is based on:

- ☒ the international application in the language in which it was filed.
- ☐ a translation of the international application into _____ which is the language of a translation furnished for the purposes of:
- ☐ international search (Rules 12.3(a) and 23.1(b))
- ☐ publication of the international application (Rule 12.4(a))
- ☐ international preliminary examination (Rules 55.2(a) and/or 55.3(a) and (b))

2. With regard to the **elements** of the international application, this report is based on (*replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report*):

- ☒ the international application as originally filed/furnished, or
- ☒ the description:
- pages 1-18 as originally filed/furnished.
- pages* _____ received by this Authority on _____
- pages* _____ received by this Authority on _____
- ☒ the claims:
- Nos. 1-22 as originally filed/furnished.
- Nos.* _____ as amended (together with any statement) under Article 19
- Nos.* _____ received by this Authority on _____
- ☒ the drawings:
- pages 1/6-6/6 as originally filed/furnished.
- pages* _____ received by this Authority on _____
- pages* _____ received by this Authority on _____

☐ a sequence listing - see Supplemental Box Relating to Sequence Listing.3. ☐ The amendments have resulted in the cancellation of:

- ☐ the description, pages _____
- ☐ the claims, Nos. _____
- ☐ the drawings, sheets/figs _____
- ☐ the sequence listing (*specify*): _____

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since either they are considered to go beyond the disclosure as filed, or they were not accompanied by a letter indicating the basis for the amendments in the application as filed, as indicated in the Supplemental Box (Rules 70.2(c) and (c-bis)):

- ☐ the description, pages _____
- ☐ the claims, Nos. _____
- ☐ the drawings, sheets/figs _____
- ☐ the sequence listing (*specify*): _____

5. ☐ This report has been established:

- ☐ taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rules 66.1(d-bis) and 70.2(e)).
- ☐ without taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rules 66.4bis and 70.2(e)).

6. With regard to top-up searches (Rules 66.1ter and 70.2(f)):

- ☒ A top-up search was carried out by this Authority on 17 June 2021 (17.06.2021)
- ☒ Additional relevant documents have been discovered during the top-up search.
- ☐ No top-up search was carried out by this Authority because it would serve no useful purpose.

7. ☐ Supplementary international search report(s) from Authority(ies) _____ has/
have been received and taken into account in establishing this report (Rule 45bis.8(b) and (c)).

* If item 4 applies, some or all of those sheets may be marked "superseded."

CORRECTED**INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY**

International application No.

PCT/US2020/040853

Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step and industrial applicability; citations and explanations supporting such statement**1. Statement**

Novelty (N)	Claims	1-22	YES
	Claims		NO
Inventive step (IS)	Claims		YES
	Claims	1-22	NO
Industrial applicability (IA)	Claims	1-22	YES
	Claims		NO

2. Citations and explanations (Rule 70.7)**NEW CITATIONS**

US 2119949 A (BLAU HENRY H) 07 June 1938 (07.06.1938) , Figures, Col. 2.1 lines 10-14

US 2119948 A (BLAU HENRY H) 07 June 1938 (07.06.1938) , Figs. 1, 2, 13, and Col.2.1 line 66 to Col. 2.2 line 18

US 5613994 A (MUNIZ; JOSE A. C.) 25 March 1997 (25.03.1997) , Figs. 1 and 2

US 20150283605 A1 (TAKAHASHI; KENZO) 08 October 2015 (08.10.2015) , Figures and [0042]-[0043]

Pioro et al., "Advanced Melting Technologies, Ceramic Engineering and Science Proceedings", November 2013, Fig. 1.8, 3.6A, 3.6B, 3.6C, pg. 52 and 87

EXPLANATION

Claims 1-3, 7-13, 18-21 lack an inventive step under PCT Article 33(3) as being obvious over Pioro et al. ("Advanced Melting Technologies", Ceramic Engineering and Science Proceedings · November 2013, 422 pages –hereinafter Pioro).

Regarding claim 1, Pioro (pg. 52 and Figs. 3.6A, 3.6B and 3.6C) discloses a submerged combustion melter (SCM) comprising a bottom wall, side walls extending upwardly from the bottom wall, a crown extending inwardly with respect to the side walls and over the bottom wall to establish a double-chamber SCM (B) or a multi-chamber SCM (C). Pioro discloses SCM(B) (Fig. 3.6B) and SCM(C) (Fig. 3.6C) comprise flue-gas ducts (corresponding to an exhaust port) to remove (i.e. exhaust) gases from the melting chamber. Pioro discloses SCM(B) having a single water-cooled partition plate (7) to divide the melting chamber into at least two melting sub-chambers and discloses the two melting chambers share an exhaust port. Pioro further discloses SCM(C) having partitions to divide the melting chamber into five melting sub-chambers and at least two melting sub-chambers share an exhaust port (2 occurrences). While Pioro does not explicitly state the partitions for SCM(B) or SCM(C) extending inwardly from the at least one side wall, Pioro (pg. 52) states the SCM melting chamber is divided into several chambers to provide for special conditions in each chamber, the flow arrows for SCM(B) and SCM(C) illustrate flow of material above and below the partitions, and (pg. 86) discloses melt flow underneath the partition. Therefore, based on the additional disclosure of Pioro, it would be obvious to a person having ordinary skill in the art, the partitions (corresponding to at least one baffle) extending inwardly from at least one side wall to divide the melting chamber, as claimed.

Pioro discloses an opening labeled "charge loading" (corresponding to at least one inlet configured for introducing glass batch to the submerged combustion melter and an opening labeled "tap-hole" (corresponding to at least one outlet) configured to remove glass from the at least two melting sub-chambers, and wherein the at least two melting sub-chambers (See flow arrows) SCM(B) and SCM(C) are configured to direct product flow in an undulating flow path between the at least one inlet and the at least one outlet. Therefore, it would be obvious to a person having ordinary skill in the art, either SCM(B) or SCM(C) disclosed by Pioro provide for the claimed SCM in claim 1.

Box No. V**Reasoned statement under Article 35(2) with regard to novelty, inventive step and industrial applicability; citations and explanations supporting such statement**

Regarding claim 2, Pioro (Figs. 3.6A-C – Legend) discloses the SCM(A) (Fig. 3.6A) as a water-cooled melting chamber. Therefore, it would be obvious to a person having ordinary skill in the art, SCM(B) and SCM(C) could also be water-cooled melting chambers.

Regarding claim 3, Pioro (pg. 52) discloses flue gases removed from the combustion chamber. Therefore, it would be obvious to a person having ordinary skill in the art, since flue gases are removed from the flue gases duct in the crown of the melting furnace, the crown is non-fluid cooled.

Regarding claim 7, Pioro (Fig. 3.6B) discloses SCM(B) having a water-cooled partition, this provides for at least one baffle includes at least one fluid-cooled baffle.

Regarding claim 8, Pioro (Fig. 1.8) discloses an SCM having an SCM water jacket including the water jacket in the side walls and extending into a partition near the crown. Therefore, it would be obvious to a person having ordinary skill in the art, the at least one fluid-cooled baffle could be configured to receive cooling fluid from the at least one side wall (i.e. SCM water jacket).

Regarding claim 9, as discussed in the rejection of claim 7 above, Pioro Fig. 3.6B) discloses SCM(B) having a water-cooled partition. Therefore, it would be obvious to a person having ordinary skill in the art, the cooling fluid includes water.

Regarding claim 10, Pioro (Fig. 3.6B) discloses SCM(B) a single exhaust duct for all of the melting sub-chambers. Therefore, it would be obvious to a person having ordinary skill in the art, combustion gases from all the melting sub-chambers for SCM(B) collect in one exhaust chamber and exhaust from one exhaust port.

Regarding claim 11, as discussed in the rejection of claim 1 above, Pioro (Fig. 3.6C) illustrates multiple partitions, specifically four partitions, which provides for a first baffle and a second baffle coupled to the at least one side wall. Pioro discloses the partitions are in a staggered configuration to provide for flow of molten material over and under partitions in an undulating flow path.

Regarding claim 12, as discussed in the rejection of claim 11 above, Pioro illustrates four partitions, which provides for the at least one baffle includes a third baffle coupled to at least one side wall, and discloses a first baffle and a third baffle staggered from a second baffle to provide for flow over and under partitions in an undulating flow path.

Regarding claim 13, as discussed in the rejection of claim 11 above, Pioro illustrates flow of molten material over and under partitions. Therefore, it would be obvious to a person having ordinary skill in the art, this provides for molten glass flow in a vertically undulated pattern.

Regarding claim 15, Pioro (Figs. 3.6B and 3.6C) illustrates the water-cooled partition plate (7) is disconnected from the crown for SCM(B) and SCM(C) discloses two partition plates disconnected from the crown. Therefore, it would be obvious to a person having ordinary skill in the art, for the at least one baffle disconnected from the crown for SCM(B) and SCM(C).

Regarding claim 18, Pioro (Fig. 3.6C) illustrates a partition plate extending from the bottom wall. Therefore, it would be obvious to a person having ordinary skill in the art, for the at least one baffle coupled to the bottom wall and the at least one side wall.

Regarding claim 19, Pioro (Figs. 3.6B and 3.6C) illustrates a charge loading opening (corresponding to at least one inlet) coupled to and extends through the crown and a charge loading opening disposed distal from the tap hole (corresponding to the at least one outlet).

Regarding claim 20, Pioro (Figs. 3.6B and 3.6C) illustrates the tap hole (i.e. at least one outlet) is coupled to a side wall and the outlet opening is such that the lower end of the outlet is below the surface of the molten glass and a center of the outlet is disposed at a surface of the molten glass and the at least one outlet is disposed distal from the at least one inlet.

Regarding claim 21, Pioro (Figs. 3.6B and 3.6C) illustrates a tank with one partition and a tank with four partitions and illustrates flow of molten material over and under partitions. Therefore, it would be obvious the undulating flow path is along a longitudinal axis that extends from a first side wall proximate the charge loading opening (i.e. inlet) to a second side wall proximate to the tap hole (i.e. outlet) and is along a vertically transverse axis that extends from the bottom wall to the crown.

Box No. V

Reasoned statement under Article 35(2) with regard to novelty, inventive step and industrial applicability; citations and explanations supporting such statement

Claims 4-6 lack an inventive step under PCT article 33(3) as being obvious over Pioro et al. ("Advanced Melting Technologies", Ceramic Engineering and Science Proceedings · November 2013, 422 pages – hereinafter Pioro) in view of Blau et al. (US 2,119,949 – hereinafter Blau).

Regarding claims 4-6, as discussed above, Pioro discloses a fluid-cooled partition (i.e. baffle), but fails to explicitly teach a non-cooled baffle. However, Blau (Figures) discloses baffles for redirecting flow in a glass tank and (Col. 2.1 lines 10-24) can be formed of refractory material (claim 5), non-cooled refractory material (claim 4), and discloses refractory material including alumina and silica (i.e. silicon dioxide). Therefore, based on the additional teachings of Blau, it would be obvious to person having ordinary skill in the art, the partitions (i.e. baffles) of Pioro as a non-fluid-cooled baffle, as claimed in claim 4, the non-fluid cooled baffle is a refractory material, as claimed in claim 5, and the refractory material includes silicon dioxide and/or alumina.

Claims 14 and 22 lack an inventive step under PCT article 33(3) as being obvious over Pioro et al. ("Advanced Melting Technologies", Ceramic Engineering and Science Proceedings · November 2013, 422 pages – hereinafter Pioro) in view of Blau et al. (US 2,119,948 – Blau'948).

Regarding claims 14 and 22, as discussed in the rejection of claims 1 and 11 above, Pioro teaches partitions (i.e. baffles) in the melting tank, but fails to disclose molten glass flows in a laterally undulated pattern or the undulating flow path is along a laterally transverse axis. However, Blau'948 discloses (Figs. 1, 2, 13, and Col 2.1, line 66 to Col. 2.2 line 18) discloses glass-melting tanks comprising baffles for directing flow including baffles incorporated into the side wall to form undulating flow laterally (Fig. 13 arrows). Therefore, it would be obvious to a person having ordinary skill in the art, a melter comprising baffles in the side wall wherein molten glass flows in a laterally undulated pattern between the inlet and the outlet, as claimed in claim 11. Further, with the teaching of directing flow with baffles in the tank laterally and the additional teachings of Blau'948, it would be obvious to a person having ordinary skill in the art an undulating flow path formed generally along a longitudinal axis that extends from a first side wall proximate the charging opening (i.e. inlet) to a second side wall proximate to the tap hole (i.e. outlet) and is along a laterally transverse axis that extends from a third side wall to a fourth side wall, where the laterally transverse axis is substantially perpendicular to the longitudinal axis.

Claim 16 lack an inventive step under PCT article 33(3) as being obvious over Pioro et al. ("Advanced Melting Technologies", Ceramic Engineering and Science Proceedings · November 2013, 422 pages – hereinafter Pioro) in view of Muniz et al. (US 5,613,994 – hereinafter Muniz).

Regarding claim 16, as discussed in the rejection of claim 1 above, Pioro discloses partitions in the melting tank, such as a single partition (i.e. baffle) or multiple partitions (i.e. baffles) to affect flow in the melting tank. Pioro fails to disclose the at least one baffle is removable from the at least one side wall. However, Pioro discloses tests can be performed without a water-cooled partition (pg. 87) and Muniz (Figs. 1 and 2) discloses a mobile barrier and suggests it can be adjusted outside of the flow path. Therefore, it would be obvious to a person having ordinary skill in the art, to perform testing with a mobile barrier, where barrier can be adjusted outside of the flow path (i.e. it is removable) from the at least one

Claim 17 lack an inventive step under PCT article 33(3) as being obvious over Pioro et al. ("Advanced Melting Technologies", Ceramic Engineering and Science Proceedings · November 2013, 422 pages – hereinafter Pioro) in view of Takahashi (US 2015/0283605).

Regarding claim 17, as discussed in the rejection of claim 1 above, Pioro discloses partitions in the melting tank, such as a single partition (i.e. baffle) or multiple partitions (i.e. baffles) to affect flow in the melting tank. Pioro fails to disclose an angle of the at least one baffle is adjustable. However, Takahashi (Figures and [0042]-[0043]) discloses a partition palate for adjusting flow of a molten material where the angle of the partition plate is adjustable to affect melting of material. Therefore, based on the additional teachings of Takahashi, it would be obvious to person having ordinary skill in the art, the partitions in the apparatus of Pioro could be improved by allow further adjustment of flow to affect melting.

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
PATENT COOPERATION TREATY**

International Application No.:	PCT/US2020/040853
Applicant:	Owens-Brockway Glass Container Inc.
International Filing Date:	06 July 2020
Attorney Docket No.:	19501
In Response to:	Written Opinion Mailed 13 October 2020

ARTICLE 34 AMENDMENT AND RESPONSE TO WRITTEN OPINION

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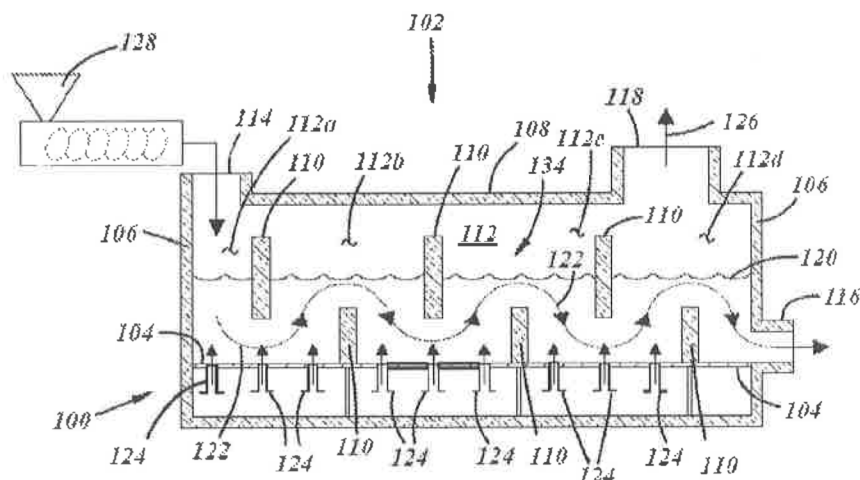
This Amendment is in response to the Search Report and Written Opinion mailed 13 October 2020 in connection with the subject application. The period for filing this Article 34 Amendment expires twenty-two months from the 11 July 2019 priority date, *i.e.*, 11 May 2021.

REMARKSItem V

Original claims 1-22 of the application as filed were rejected as lacking novelty and/or an inventive step in view of US 2006/105899 A1, cited as reference D1, US 2014/090423 A1, cited as reference D2, and/or FR 1120864 A, cited as D3.

Independent claim

1, with merely illustrative reference to a non-limiting example via FIG. 1A at right, recites a submerged combustion melter (102), comprising a bottom wall (104); at least one side wall (106)

**FIG. 1A**

extending upwardly from the bottom wall; a crown (108) extending inwardly with respect to the at least one side wall and over the bottom wall to establish a melting chamber (112); an exhaust port (118) configured to exhaust gas from the melting chamber; at least one baffle (110) extending inwardly from the at least one side wall to divide the melting chamber into at least two melting sub-chambers (112a, 112b, 112c, 112d) that share the exhaust port; at least one inlet (114) configured for introducing a glass batch to the submerged combustion melter; at least one outlet (116) configured to remove molten glass from the at least two melting sub-chambers; and wherein the at least two melting sub-chambers are configured to direct product flow in an undulating flow path (122) between the at least one inlet and the at least one outlet.

D1, with reference to FIG. 1 at right, discloses a furnace for melting compositions comprising silica, and more specifically, glass compositions including glass frits. The furnace, as shown in FIG. 1, consists of three tanks

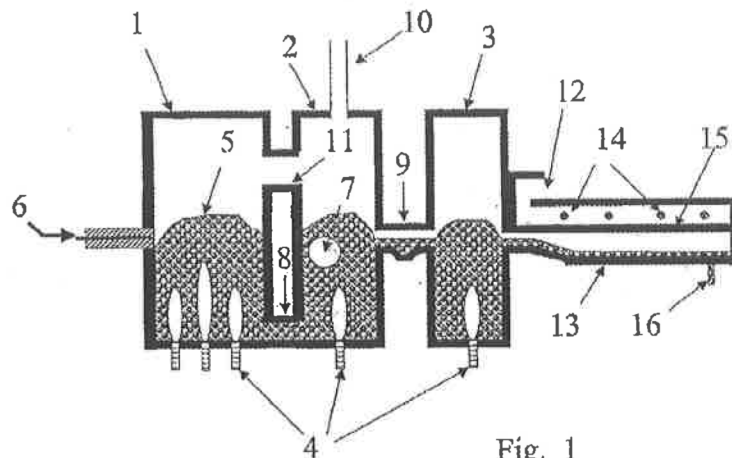


Fig. 1

(1, 2, 3) equipped with submerged burners 4, where the level of glass is indicated by 5. Silica and a fluxing agent are introduced into the first tank 1 at position 6. Thinner and coloring oxides are introduced into the second tank 2 at position 7. Glass flows from the first tank 1 via throat 8 and from the second tank 2 to the third tank 3 via the spout 9. The second tank 2 includes a flue 10 for removing flue gases. The glass leaves the third tank 3 to undergo a fining step in zone 13.

While D1 may disclose a furnace that melts silica, it does not disclose or suggest the submerged combustion melter comprising at least one baffle (110) extending inwardly from the at least one side wall to divide the melting chamber into at least two melting sub-chambers or wherein the at least two melting sub-chambers are configured to direct product flow in an undulating flow path (122) between the at least one inlet and the at least one outlet, as recited in independent claim 1. Instead, D1 discloses multiple tanks (1, 2, 3) in series connected by the throat 8 or the spout 9, not "a baffle, separating the furnace in two sections." D1 fails to disclose any baffle extending inwardly that divides the tanks (1, 2, 3) into any sub-chamber. The Written Opinion stated that D1 teaches a submerged combustion melter with a baffle; however, D1 only

teaches a furnace with multiple tanks, and the walls of the tanks cannot be baffles because they do not extend inwardly.

Additionally, D1 fails to teach multiple melting sub-chambers configured to direct product flow in an undulating flow path between the at least one inlet and the at least one outlet. The flow in each tank (1, 2, 3), or even between tanks, is not undulating, or having a rising and falling or wavy flow, but instead is linear. Because D1 teaches multiple tanks (1, 2, 3) in series, fails to teach any baffle extending inwardly from the at least one side wall to divide the melting chamber into at least two melting sub-chambers, and fails to teach multiple melting sub-chambers configured to direct product flow in an undulating flow path, the furnace of D1 is different than the submerged combustion melter as recited in independent claim 1.

Further, D1 addresses the problem of melting silica compositions to have a low stone content and with a low energy consumption, but neglects the problem and solution of changing molten glass batch flow paths in a submerged combustion melter for better control of the batch flow inside the melter by using baffles to create an undulating flow, which in turn increases batch minimum residence time and reduces/eliminates short-circuiting of un-melted raw batch materials, as addressed by the submerged combustion melter of independent claim 1. Thus, the subject matter recited in independent claim 1 is novel and includes an inventive step over D1.

[Intentionally blank]

D2, with reference to FIG. 5 below, discloses a submerged combustion melter 1. The melter 1 comprises an extension defined by a floor portion 2E and a roof portion 4E, an optional step 50 and an exit or throat 52 positioned substantially near floor portion 2E to allow molten glass undergoing fining 28A, with few or no bubbles, to exit the melter 1 as fined molten glass. The submerged combustion melter 1 provides a fining zone 24 downstream of a melting zone 22 for treatment of turbulent, foamy molten glass before it enters downstream equipment.

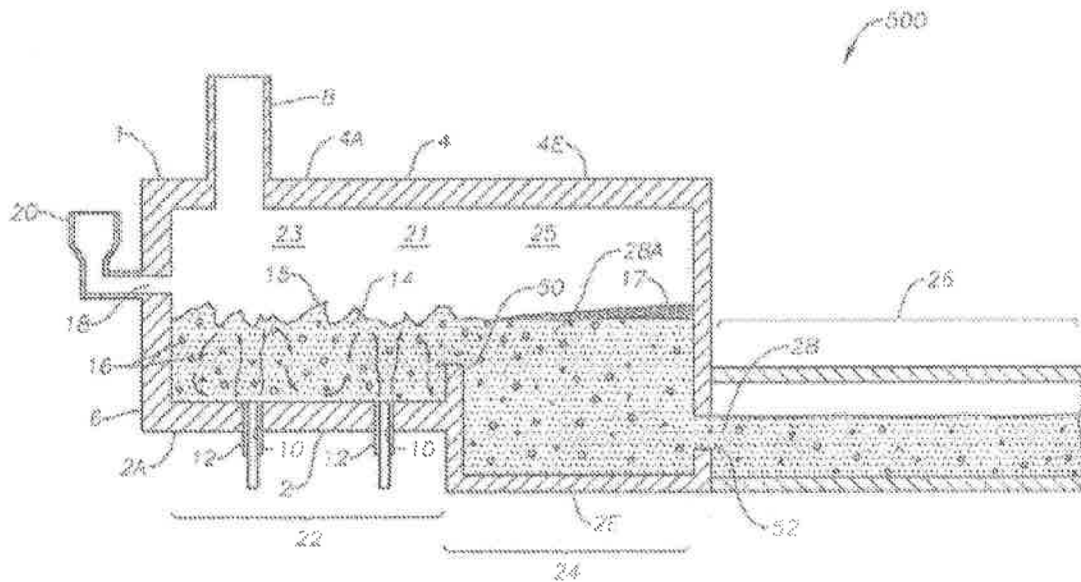


Fig. 5

While D2 may disclose a submerged combustion melter 1 having an optional step 50 in the furnace 1, it does not disclose or suggest a submerged combustion melter comprising at least one baffle (110) extending inwardly from the at least one side wall to divide a melting chamber into at least two melting sub-chambers, or wherein the at least two melting sub-chambers are configured to direct product flow in an undulating flow path (122) between the at least one inlet and the at least one outlet, as recited in independent claim 1. Instead, D2 discloses a melter 1 with a melting zone 22, with no baffle(s) or sub-chambers, and a fining zone 24 separated from

the melting zone 22 by an optional step 50. The optional step 50 separates the turbulent, foamy molten glass 14 in the melting zone 22 from the molten glass undergoing fining 28A, but is not a baffle that divides the melting chamber into at least two melting sub-chambers, as recited in claim 1. Because D2 fails to disclose at least one baffle that divides a melting chamber into at least two melting sub-chambers as recited and arranged in independent claim 1, D2 also fails to disclose at least two melting sub-chambers configured to direct product flow in an undulating flow path between the at least one inlet and the at least one outlet. The molten glass flow in D2 only flows from the melting zone 22 to the fining zone 24 and down to the exit/throat 52.

Further, D2 addresses the problem of a lack of melter footprint or size outside of the submerged combustion melting zone that might provide time downstream of the melting zone for treatment of turbulent, foamy molten glass before it enters downstream equipment, but neglects the problem and solution addressed by the submerged combustion melter recited in independent claim 1 of changing molten glass batch flow paths in a submerged combustion melter for better control of the batch flow inside the melter by using baffles to create an undulating flow, which in turn increases batch minimum residence time and reduces/eliminates short-circuiting of unmelted raw batch materials. Thus, the subject matter recited in independent claim 1 is novel and includes an inventive step over D2.

D3 discloses a glass tank furnace and shaft oven through which vitrifiable materials flow in contact with overhead flames. The glass tank furnace includes at least one partition that allows material flow to follow a path in a broken line.

While D3 may disclose a glass tank furnace with partitions, it does not disclose or suggest the submerged combustion melter comprising at least one baffle (110) extending inwardly from the at least one side wall to divide the melting chamber into at least two melting

sub-chambers or wherein the at least two melting sub-chambers are configured to direct product flow in an undulating flow path (122) between the at least one inlet and the at least one outlet, as recited in independent claim 1. D3 is completely silent regarding, *inter alia*, a submerged combustion melter. Thus, the subject matter recited in independent claim 1 is novel and includes an inventive step over D3.

Accordingly, it is respectfully submitted that the subject matter recited in independent claim 1 is novel and involves an inventive step over the cited references D1, D2, and D3.

Dependent claims 2-22 are also novel and include an inventive step both by reason of their dependency from independent claim 1 and because of the additional inventive elements set forth therein.

For example, dependent claim 11 recites the submerged combustion melter of claim 1, wherein the at least one baffle includes a first baffle and a second baffle, the first baffle coupled to the at least one side wall and the second baffle coupled to the at least one side wall, wherein the first baffle and the second baffle are in a staggered configuration. D3, which is cited in the Written Opinion, does not disclose, teach, or otherwise suggest a submerged combustion melter having a first baffle and a second baffle in a staggered configuration. Instead, D3 discloses a flame oven that produces vitrifiable material using flames, not a submerged combustion melter. D1 and D2 also fail to disclose, teach, or otherwise suggest a first baffle and a second baffle coupled to a side wall and in a staggered configuration. Thus, dependent claim 11 is novel and includes an inventive step over the cited references D1, D2, and D3, either alone or in combination.

Dependent claim 12 recites the submerged combustion melter of dependent claim 11 and independent claim 1, wherein the at least one baffle includes a first baffle, a second baffle, and a

third baffle coupled to the at least one side wall, wherein the first baffle and the third baffle are staggered from the second baffle. D3, which is cited in the Written Opinion, does not disclose, teach, or otherwise suggest a submerged combustion melter having a first baffle and a third baffle that are staggered from a second baffle. Instead, D3 discloses a flame oven that produces vitrifiable material using flames, not a submerged combustion melter. D1 and D2 also fail to disclose, teach, or otherwise suggest a first baffle, a second baffle, and a third baffle coupled to a side wall, where the first baffle and the third baffle are staggered from the second baffle. Thus, dependent claim 12 is novel and includes an inventive step over the cited references D1, D2, and D3, either alone or in combination.

Dependent claim 13 recites the submerged combustion melter of dependent claim 11 and independent claim 1, wherein molten glass flows in a vertically undulated pattern between the inlet and the outlet. D3, which is cited in the Written Opinion, does not disclose, teach, or otherwise suggest a submerged combustion melter wherein vitrifiable material flows in a vertically undulated pattern. Instead, D3 discloses a flame oven with vitrifiable materials that follow a broken line route in a side-to-side pattern. Nowhere does D3 even suggest that the vitrifiable materials flow in a vertically undulated path. Additionally, D3 discloses a flame oven that produces vitrifiable material using flames, not a submerged combustion melter. D1 and D2 also fail to disclose, teach, or otherwise suggest wherein molten glass flows in a vertically undulated pattern between the inlet and the outlet. Thus, dependent claim 13 is novel and includes an inventive step over the cited references D1, D2, and D3, either alone or in combination.

Dependent claim 14 recites the submerged combustion melter of dependent claim 11 and independent claim 1, wherein molten glass flows in a laterally undulated pattern between the

inlet and the outlet. D3, which is cited in the Written Opinion, does not disclose, teach, or otherwise suggest a submerged combustion melter wherein vitrifiable material flows in a laterally undulated pattern. Instead, D3 discloses a flame oven with vitrifiable materials, not a submerged combustion melter. Nowhere does D3 even suggest that the vitrifiable materials flow in a laterally undulated path through a submerged combustion melter. D1 and D2 also fail to disclose, teach, or otherwise suggest wherein molten glass flows in a vertically laterally pattern between the inlet and the outlet. Thus, dependent claim 14 is novel and includes an inventive step over the cited references D1, D2, and D3, either alone or in combination.

Additionally, D3 is concerned with providing a homogenous vitrifiable material in a narrow oven by including partitions, but neglects recognizing the issues associated with providing better control of batch flow inside a submerged combustion melter to reduce/eliminate short-circuiting of un-melted raw batch material, for example undissolved silica, as addressed by the subject matter recited in independent claim 1 and dependent claims 11, 12, 13, and 14. Thus, dependent claims 11, 12, 13, and 14 include an inventive step over the cited references D1, D2, and D3, either alone or in combination.

Dependent claim 15 recites the submerged combustion melter of independent claim 1, wherein the at least one baffle is disconnected from the crown. D1 and D2, which are cited in the Written Opinion, do not disclose, teach, or otherwise suggest a submerged combustion melter having a baffle disconnected from the crown. As discussed above, D1 does not disclose any baffle whatsoever, but instead discloses multiple tanks (1, 2, 3) in series connected by the throat 8 or the spout 9, not “a baffle, separating the furnace in two sections.” D1 fails to disclose any baffle extending inwardly that divides the tanks (1, 2, 3) into any sub-chamber, but discloses a furnace with multiple tanks, where the walls of the tanks cannot be baffles because they do not

extend inwardly. Also, and as discussed above, D2 does not disclose any baffle whatsoever, but instead discloses a melter 1 with a melting zone 22, with no baffle(s) or sub-chambers, and a fining zone 24 separated from the melting zone 22 by an optional step 50. The optional step 50 separates the turbulent, foamy molten glass 14 in the melting zone 22 from the molten glass undergoing fining 28A, but is not a baffle that divides the melting chamber into at least two melting sub-chambers. Thus, D1 and D2 fail to disclose, teach, or otherwise suggest at least one baffle disconnected from the crown, and dependent claim 15 is novel and includes an inventive step over the cited references D1 and D2, either alone or in combination.

Thus, claims 1-22 are novel and include an inventive step over D1-D3.

It therefore is believed and respectfully submitted that claims 1-22 meet the novelty and inventive step requirements of the PCT.

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