



(51) International Patent Classification:

C03B 25/06 (2006.01) F27B 9/36 (2006.01)
C03B 29/06 (2006.01) F27D 1/00 (2006.01)
C03B 27/00 (2006.01) F27D 99/00 (2010.01)
F27B 9/34 (2006.01)

(21) International Application Number:

PCT/TR2017/050209

(22) International Filing Date:

23 May 2017 (23.05.2017)

(25) Filing Language:

Turkish

(26) Publication Language:

English

(30) Priority Data:

2016/07000 26 May 2016 (26.05.2016) TR

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(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM,

(54) Title: A HEATING OVEN FOR SPINDLE TYPE TEMPERING LIMES

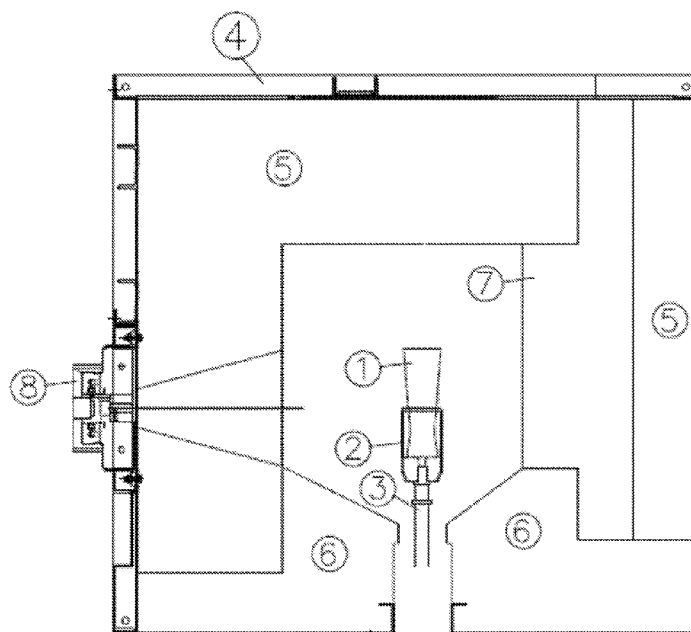


Figure 1

(57) Abstract: The invention relates to a heating oven developed for spindle type tempering furnaces used in production lines of household glass products (plates, bowls, glasses, etc.).



TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW,
KM, ML, MR, NE, SN, TD, TG).

Published:

- *with international search report (Art. 21(3))*
- *before the expiration of the time limit for amending the
claims and to be republished in the event of receipt of
amendments (Rule 48.2(h))*

DESCRIPTION

A HEATING OVEN FOR SPINDLE TYPE TEMPERING LINES

5 **Field of the Invention**

The invention relates to a heating oven developed for spindle type tempering process used in production lines of tableware glass products (plates, bowls, glasses, etc.).

Background of the Invention

10 Tempering is a process in which thermal treatment is applied to the glass in order to increase the thermal and mechanical strength thereof. First, the glass is homogeneously heated to a temperature close to the softening point (650-700°C), and immediately thereafter it is rapidly cooled down under jet stream (air jets). In this manner, while the outer glass surface becomes solid by being cooled down rapidly, the inner portion at the
15 plastic forming temperature is stressed under pressure. As a consequence, compression stress occurs on the outer glass surface while tensile stress is formed in the inner portion.

The thus produced tempered glass product has higher thermal shock endurance and mechanical breaking strength and when broken, it breaks into small pieces.

20 In tempering process, heating the glass homogeneously throughout the entire wall thickness to the tempering temperature is critical in terms of the tempering process. In this process, the glass products are carried by means of the so-called metal baskets (i.e. tournette) in tunnel-type ovens and heated along the oven.

25 In the spindle type tempering furnaces of prior art, the heating tunnel construction is made of a refractory structure absorbing the heat. The burners, the heat sources, are locally located on the tunnel side surface and they heat the tunnel refractory structure with a flame having a temperature between 1300°C and 1700°C.

The technical problems regarding such ovens used in the known state of the art are explained below:

- The need for heating the entire refractory structure constituting the oven to a suitable temperature: In order to ensure a homogeneous temperature distribution, the refractory structure, which is heated and cooled slowly, is required to be heated entirely. A refractory structure of a high density ($2-2.5 \text{ kg/m}^3$) is needed for heat absorption and radiation. A time period of at least 10-12 hour is needed in order for the system to be ready for the tempering process. Hence, the heating process requires high power consumption.
- Low insulation due to the flame burning inside the system: Since the system in the state of the art is an open-flame system, the flame root temperature as well as the temperature of the regions being subject to flame increases excessively, and so it becomes compulsory to use high temperature-resistant materials in these regions. Therefore, not only the insulation of the oven becomes difficult but also heat losses over the wall increase.
- High power consumption: Due to the need for heating the oven as a whole and location of the flame at long intervals inside the oven, the oven must be supplied with energy more than required for heating the glass product. This, in turn, increases power consumption.

One of the applications used in the state of the art with a view to overcome these technical problems and which differs from the typical open-flame ovens described above is the Patent Application No. US5594999. This invention discloses an oven with radiant emitting walls in which the temperature distribution is provided by radiation energy. The radiant emitting walls generate primarily infrared radiation and have a non-uniform temperature distribution so that the temperature of the lower portion of the oven can be selectively adjusted to be significantly higher than the temperature of the upper portion. The burners that are linearly disposed allow for a homogeneous temperature distribution.

Summary and Objects of the Invention

In the heating oven according to the invention, a radiant type burner which performs flameless radiation and emits heat via convection is used as a heat source.

The energy is supplied all along the oven and with the used burner system and burner location, an efficient convective heating and radiation is provided for heating the glass product and the medium.

Thanks to the fact that the open flame used in the ovens within the state of the art is not utilized in the oven according to the invention, it becomes possible to use a refractor (0.2 - 0.5 kg/m³) with a lower density. With the elimination of the indirect transfer of the energy to the product, the power consumption values are reduced; and also with the elimination of the need for heating the refractory structure, unlike the state of the art, it is made possible that the oven reaches the temperatures to start the tempering process at a much shorter time (2 - 4 hours).

It is aimed by developing the heating oven according to the invention to:

- Achieve a homogeneous temperature distribution, and thus heat the glassware product homogeneously as a result of supplying the energy to the system all along the oven,
- Heat the glass product and the environment more efficiently and homogeneously with the efficient and joint use of the convection and flameless burning effect formed on the porous surface,
- Perform a better insulation thanks to the advantages provided by the radiant heating and homogeneous burning,
- Obtain a power consumption 30 - 50% less than that of the ovens in the state of the art,
- Start the production process more rapidly thanks to the shorter time required for the tempering furnace to reach the tempering temperatures (tempering conditions) than that in the state of the art, and
- Increase the process efficiency by 5 - 10%.

Description of the Drawings

The drawings for a better understanding of the heating oven developed with the present invention and the explanations related thereto are given below.

Fig. 1: Cross-sectional view of the tunnel oven with radiant heating.

Fig. 2: Front view of the radiant burner inside the tunnel.

Description of the Parts/Sections/Aspects forming the Invention

5 The parts and components which are shown in the drawings illustrating the heating oven developed with the present invention for a better understanding of the invention are enumerated individually and the reference numbers corresponding thereto are presented below.

1. Glass product
- 10 2. basket
3. Shaft for the basket
4. Tunnel oven with radiant heating
5. Low-density tunnel insulation construction
6. Insulation concrete
- 15 7. Insulation brick (low density)
8. Radiant burner

Detailed Description of the Invention

In the heating oven (4) developed with the present invention, there exist more than
 20 one heating zones and a radiant burner (8) is used for each zone, said radiant burner extending along the related zone. The radiant burner (8) is positioned at the same height as the glass product (1) in the outer portion of the oven tunnel such that the porous reactor configuration in the front surface thereof will face the interior of the oven (4). The burning occurs in the burner in the radiant burner (8) and the porous configuration (reactor)
 25 disposed in the front surface of the burner (8) radiates towards the oven (4) interior.

The burner surface temperature of the radiant burner (8) used in the oven (4) according to the invention may reach up to the temperature value of 1200°C.

The top and side wall of the oven (4), on which the radiant burner (8) is positioned, are covered with low-density (0.2 - 0.5 kg/m³) insulation construction (5), wherein said

construction (5) has a geometry starting from the reactor portion in the front surface of the radiant burner (8) and expanding towards the inner portion of the oven (4) and thus, the heat formed in the (8) burner is distributed into the oven (4) and by way of radiation and convective.

5 The employed low-density insulation construction (5) also prevents the radiant burner (8) from being affected by the high temperature (600°C - 700°C) inside the oven (4). Thus, there is no longer any need for an additional insulation for protecting the burner reactor configuration against burning.

10 Furthermore, the wall of the oven (4) facing the radiant burner (8) consists of two layers: the low-density insulation brick (7) above and the low-density insulation construction (5) below; on the other hand, the bottom of the oven (4) on which the spindle (2) located on the shaft (3) carries the glass product (1) along the oven (4) is covered with insulation concrete (6), having a space in order for the spindle (2) to move along the oven (4) tunnel.

15 The heating oven (4) according to the invention may be used for in-line and off-line tempering of tableware glass made of opal, soda-lime or borosilicate glass in spindle type tempering system.

CLAIMS

1. A heating oven (4) developed for in-line and off-line tempering of household products made of opal, soda-lime or borosilicate glass in spindle type tempering lines, characterized in comprising:
- A low-density ($0.2 - 0.5 \text{ kg/m}^3$) insulation construction (5) covering the top, side wall of the oven on which the radiant burner (8) is positioned, and the wall facing the radiant burner (8),
 - An insulation concrete (6) covering the bottom of the oven (4) on which the spindle (2) located on the spindle shaft (3) carries the glass product (1) along the oven (4),
 - A low-density insulation brick (7) positioned on the low-density insulation construction (5) which is located on the wall facing the radiant burner (8),
 - More than one heating zone, and
 - A radiant burner (8) which is disposed in the heating zones such that it will extend, for each zone, along the related zone and which is positioned at the same height as the glass product (1) in the outer portion of the oven tunnel such that the porous reactor configuration in the front surface thereof will face the interior of the oven (4).
2. The heating oven (4) according to Claim 1, characterized in that the radiant burner (8) is configured such that the heat formed as a result of the burning operation in the burner inside the burner (8) will be distributed into the oven (4) by means of the porous reactor arranged in the front surface thereof.
3. The heating oven (4) according to Claim 1, characterized in that the burner surface temperature of the radiant burner (8) is up to the temperature value of 1200°C .
4. The heating oven (4) according to Claim 1, characterized in that the low-density insulation construction (5) positioned on the side wall of the oven, on which the radiant burner (8) is positioned, has a geometry starting from the reactor portion in the front surface of the radiant burner (8) and expanding towards the inner portion of the oven (4).

5. The heating oven (4) according to Claim 1, characterized in that the insulation concrete (6) covering the bottom of the oven (4) has a space in order that the spindle (2) can move along the oven (4) tunnel.

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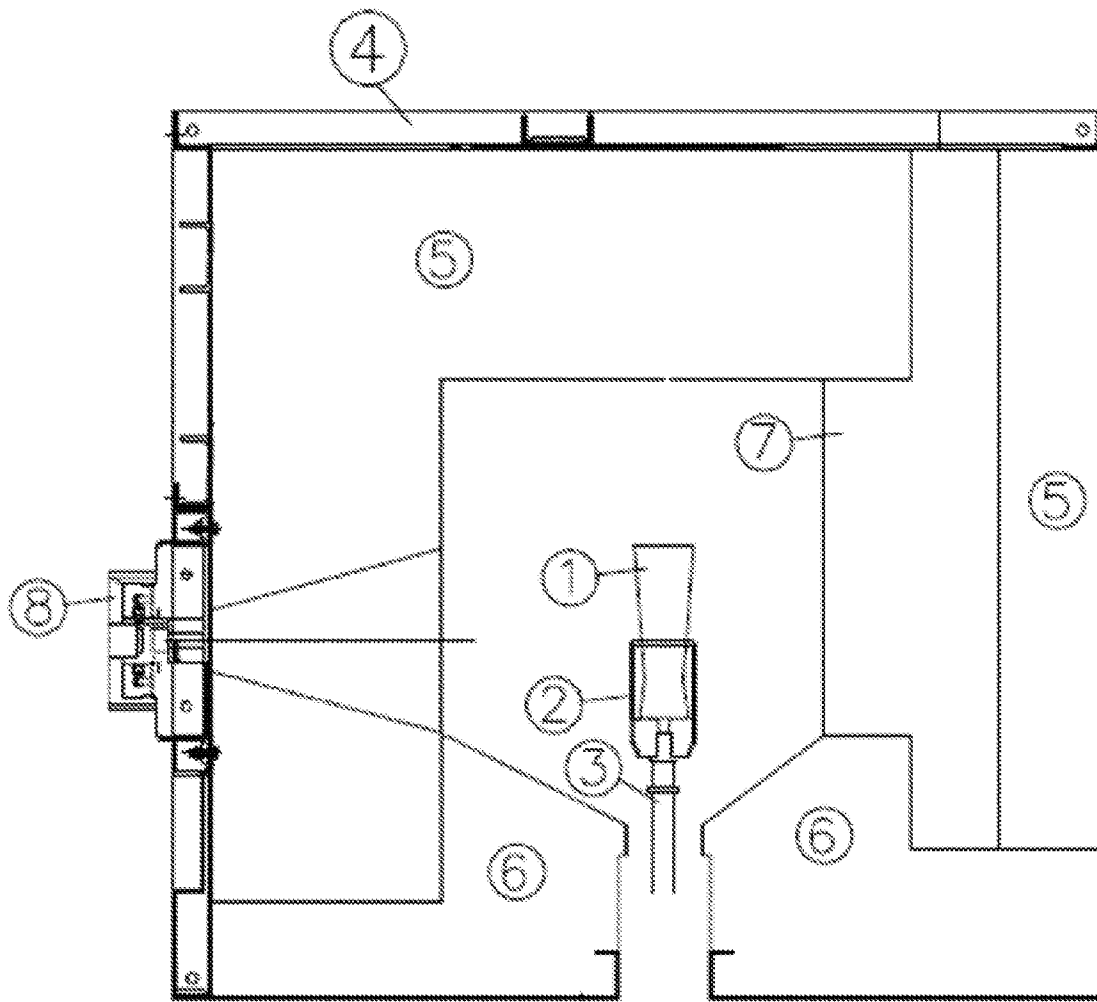


Figure 1

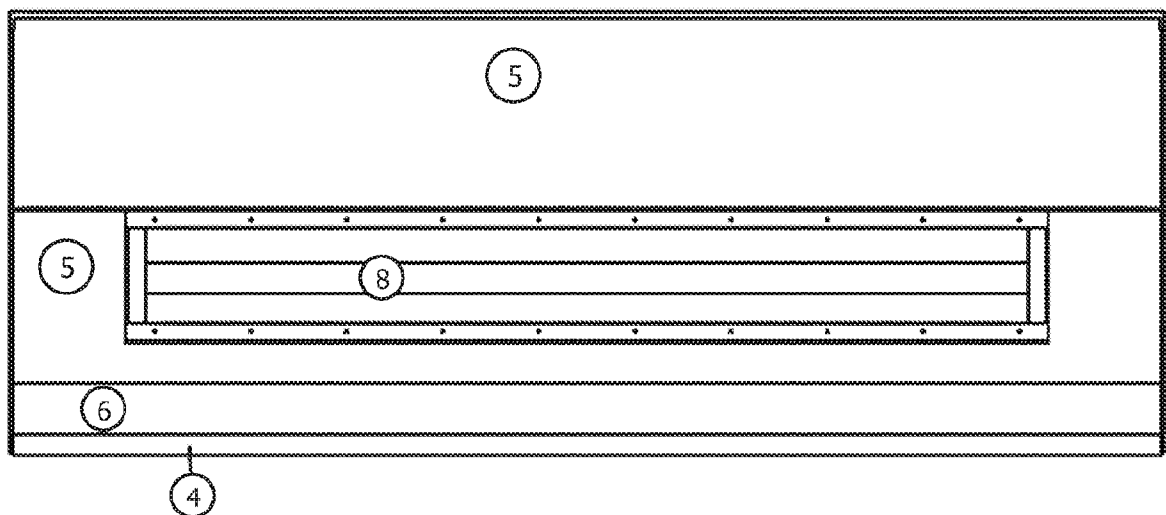


Figure 2

INTERNATIONAL SEARCH REPORT

International application No
PCT/TR2017/050209

A. CLASSIFICATION OF SUBJECT MATTER INV. C03B25/06 C03B29/06 C03B27/00 F27B9/34 F27B9/36 F27D1/00 F27D99/00 ADD. According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED Minimum documentation searched (classification system followed by classification symbols) C03B F27B F27D C04B Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) EP0-Internal, WPI Data		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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X	US 6 501 784 B1 (BOEHM ALEXANDER [DE] ET AL) 31 December 2002 (2002-12-31) column 2, line 2; figure 1 column 4, lines 35-53 ----- -/--	1
☒ Further documents are listed in the continuation of Box C. ☒ See patent family annex.		
* Special categories of cited documents : "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family		
Date of the actual completion of the international search 3 November 2017		Date of mailing of the international search report 10/11/2017
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016		Authorized officer Flügel, Alexander

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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
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INTERNATIONAL SEARCH REPORT

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