

Description

This invention relates to burners and, in particular, to multiple nozzle burner construction and its use for heating batch material in a cylindrical vessel.

Continuous glass melting processes conventionally entail depositing pulverulent batch materials into a pool of molten glass maintained within a tank-type melting furnace and applying thermal energy until the materials are melted into a pool of molten glass. A melting tank conventionally contains a relatively large volume of molten glass so as to provide sufficient residence time for currents in the molten glass to effect some degree of homogenization before the glass is discharged to a forming operation. These recirculating flows in a tank-type melter may result in inefficient use of thermal energy. Conventional overhead radiant heating is inefficient in that only a portion of its radiant energy is directed towards the material being melted.

As an alternative to conventional tank-type glass melting furnaces as described above, US-A 4 381 934 to Kunkle and Matesa discloses an intensified batch liquefaction process in which large volumes of batch are efficiently liquefied in a relatively small liquefaction vessel. This type of process, particularly when using intensified heat sources, produces relatively small volumes of high temperature exhaust gas. Heat from this exhaust gas may be recovered and used to directly heat a batch stream feeding the liquefaction vessel so as to improve the overall efficiency of the process.

In heating the batch material for liquefaction, it is desirable to get maximum coverage of the exposed batch within the furnace with the burners so as to use the heat efficiently. In positioning the burner to effectively heat the batch layer in a heating vessel as disclosed in US-A 4 381 934, there are several factors to be considered. When the flame from a burner is too close to the batch layer, the impact of the flame may cause the layer to become unstable. As a result, the layer may slough downwardly into the vessel causing irregularities in the batch layer thickness and undesirable product. Furthermore, the resulting turbulence may result in an increase in particulate entrainment in the burner exhaust stream. Another factor to be considered is that the flame should not be aimed directly towards the upper region of the batch layer because the intense heat may adversely affect refractory materials in the vicinity. In addition, if the burner flames have to travel an excessive distance before heating the wall, thermal efficiency is lost.

To more effectively heat a batch layer, additional burners can be positioned to provide better flame distribution in the heating vessel along the batch layer. Although this would produce better flame coverage, such an alternative would complicate the heating process by requiring additional burner hardware and the corresponding tooling, maintenance, and cooling requirements.

As an alternative, a single burner with multiple outlets could be used to reduce the number of burners while maintaining an effective flame distribution.

The single burner could spread the burner flames over a batch layer without requiring additional tooling or maintenance coats. The multi-nozzle burner could be positioned near the batch layer and its nozzle could be set to direct the burner flames in a sweeping action over the batch layer rather than directly at the batch layer. The resulting multi-flame sweeping burner could distribute the heat over the batch layer while reducing turbulence due to the flame impact on the layer.

US-A 3 127 156 to Shephard teaches a burner with a controllable flame position. A series of concentric pipes separate the flow of oxygen, air, fuel, and water along the length of the burner. There are two annular passages provided for the water used to cool the burner. Partitions in the annular passages ensure that the water enters at an inlet fitting and flows the length of the burner along one side before it returns along the other side of the burner to an outlet fitting. The burner has a single flame outlet at the tip of the burner.

US-A 3 515 529 to Love et al. teaches a side discharge burner for use in a regenerative type glass melting furnace. Cooling fluid is introduced into a chamber extending the length of the burner. The burner is supplied with a fluid fuel, such as fuel oil, under pressure, without the introduction of pressurized air as an atomizing means. The burner includes a single outlet firing from the side of the burner.

US-A 4 391 581 to Daman et al. teaches a burner for injecting fuel into passages for heated combustion air connecting the checkers with the parts of a regenerative-type glass melting furnace. A single central tube directs fuel, such as natural gas, through a water cooled jacket and out a single nozzle into the air passage tunnels. An angled tip portion is cooled by the flow of water through a cooling jacket.

EP-A 160 886 shows a burner and a nozzle into which the flame from the burner is directed and in which process air is mixed with products of combustion from the flame. The nozzle having hot gas discharge openings through which the hot gases resulting from the mixing action are projected to materials to be heated. The burner comprises an elongated outer casing enclosing conduits providing fuel and oxygen containing gas to a mixing and combustion chamber. The conduits each having a plurality of openings spaced along the conduits and being connected to each other by means of said mixing chamber which is spaced along said conduits.

EP-A 190 091 which is a document according to Art. 54(3) EPC describes a burner comprising an elongated outer casing enclosing conduits providing fuel and oxygen containing gas to a mixing chamber. The conduits extending along the whole length of said outer casing and being generally parallel and adjacent to each other. The conduits each having a plurality of openings connected to each other by means of a plurality of separate mixing chambers spaced along said conduits, said mixing chambers including tube portions extending from said conduits and forming combustion nozzles.

It would be advantageous to have a multi-outlet

burner that could distribute its heating flames over a desired surface so as to maximize transfer of heat to batch material on said surface while reducing direct impingement by the flames on the batch and surrounding refractory.

SUMMARY OF THE INVENTION

It is the object of this invention to provide a burner with multiple outlets to spread the flames from said burner over a layer of material for better heat distribution.

This object is attained by the burner comprising an elongated outer casing enclosing a first conduit and a second conduit, said conduits extending essentially along the whole length of said outer casing, and a coolant conduit which fills said casing with coolant, and a coolant outlet, wherein said first conduit generally parallels and is adjacent to said second conduit and each one of the first and second conduits has a plurality of first and second openings spaced along said first and second conduits, said openings being connected to each other by means of a plurality of mixing chambers spaced along said first and second conduits, characterized in that said mixing chambers include tube portions extending from said conduits forming combustion nozzles directing flames resulting from the combustion of fuel and gas in each of said mixing chambers in a predetermined direction.

Nozzles at the mixing chambers direct the resulting flame in a predetermined direction. The coolant conduit, housed within the casing and extending the length of the burner, circulates coolant within the casing to cool the burner. In one embodiment of the invention, a first portion of the burner positions the burner within a heating vessel and a second portion of the burner includes the burner nozzles. The two portions can be angularly affect from one another.

The multiple nozzle burner taught in this invention spreads the flames over a surface to provide more effective heating than a single outlet burner. The nozzles are positioned on a longitudinally extending portion of the burner, which can extend in any direction. As a result, the burner can conform to the surface it is heating. For example, if the surface is curved, the extending portion can substantially parallel the surface so that the multiple nozzles can more evenly distribute the burner flame. In addition, the nozzles of the burner in the present invention can be positioned to direct the flame in a sweeping direction over the surface rather than directly at the surface so as to reduce flame impact and maintain surface stability during heating. Since the burners in the present invention can replace several single outlet burners and still provide effective heat distribution, there is less equipment and associated maintenance as well as reduced burner access requirements and a simplified heating arrangement.

The burner may contain a third conduit having a third opening and said second conduit having a fourth opening and further including an additional tube section connecting said third and fourth openings.

The size and/or shape of said openings may vary. In a preferred embodiment the mixing chambers are circumferentially spaced along said burner. The mixing chambers may be located at selected positions of a nozzle portion of the elongated casing and said nozzle portion is angularly offset from a first portion of said elongated casing. Said nozzle portion may be normal to said portion of said casing. In one embodiment of the invention said first and second conduits each include a first and second portion wherein said second portion of each of said conduits is angularly offset from said first portion of said respective conduits and further wherein said mixing chambers are positioned along said second portions of said conduits.

Preferably, said burner includes a plurality of first conduits and a plurality of second conduits and further including a fuel supply conduit and a gas supply conduit wherein an end of each of said first conduits and said second conduits is connected to either said fuel supply conduit or said gas supply conduit, respectively, so as to supply fuel or gas to each of said first conduits or second conduits from said fuel supply conduit or said gas supply conduit.

The burner according to the invention is preferably used for heating a material surface encircling a central cavity including a generally cylindrical vessel with said material surface being disposed along the walls of said vessel, a lid portion and an outlet to allow said heated material to exit said cavity by providing a burner within the cavity, wherein the elongated casing of said burner including a positioning portion extending through said lid portion and said nozzle portion extending along said material surface and directing a plurality of flames from said longitudinally nozzle portion towards said surface.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an isometric cut away view, with portions removed for clarity of a liquefaction vessel with burners in accordance with the preferred embodiment of the present invention.

FIG. 2 is a cross-sectional view of a preferred embodiment of a burner of the type shown in FIG. 1 showing gas, fuel, and cooling conduits and nozzle arrangement.

FIG. 3 is a top view of the burner embodiment of FIG. 2.

FIG. 4 is a cross-sectional view through lines 4-4 of FIG. 2 showing gas, fuel, and cooling conduits and nozzle arrangement.

FIG. 5 is a bottom view of a nozzle portion of the embodiment of the burner shown in FIG. 2.

FIG. 6 is a cross-sectional view of an alternate embodiment of the burner.

FIG. 7 is a cross-sectional view, similar to FIG. 4 of an alternate burner showing a multi-directional nozzle arrangement.

FIG. 8 is a side view of the burner of FIG. 7 showing various nozzle portions.

FIG. 9 is a cross-sectional view similar to FIG. 4 of another alternate embodiment of the burner.

FIGS. 10 and 11 are side views of alternate burner arrangements positioned adjacent a surface to be

heated and showing various burner flame configurations.

FIG. 12 is an isometric view of an alternate burner arrangement.

DETAILED DESCRIPTION OF THE INVENTION

This invention, as presented, is preferably used in the melting process taught in US-A 4 381 934 to Kunkle et al. but can be used in any heating and/or melting process which uses heat sources such as gas burners, where distribution of the heat on the impacted material is of prime importance.

In a batch liquefaction process as described in US-A 4 381 934, batch is deposited in a liquefaction vessel which is adapted to apply intense heat to the batch in a relatively small space to rapidly convert the batch to a liquefied state. Liquefied batch flows out of the vessel into a connecting vessel.

FIG. 1 illustrates a liquefaction vessel 10 similar to the type disclosed in US-A 4 496 387 to Heithoff et al.

A drum 12 that may be fabricated of steel is supported on a circular frame 14 which, in turn, is mounted for rotation on a plurality of support rollers 16 and aligning rollers 18, about a generally vertical axis corresponding to the centerline of the drum 12. A batch outlet assembly 20 below the drum 12 includes the bushing 22 having an open center 24. A lid 26 is provided above the drum 12 and may be supported by way of a frame 28. The lid 26 may include at least one opening 30 for inserting a burner 32. In the preferred embodiment, the lid 26 includes openings for a plurality of burners 32 and is composed of a ceramic refractory material, but the lid may be any high temperature resistant material, e.g. high temperature resistant steel.

Within the liquefaction vessel 10, a stable layer of unmelted batch 34 is maintained on the walls of the drum 12 encircling the central cavity within which combustion takes place, as shown in FIG. 1. The flames 36 from the burners 32 causes a surface portion 38 of the batch 34 to become liquefied and flow downwardly through the bottom opening 24 of the outlet assembly 20. The liquefied batch then flows out of the liquefaction vessel 10 and may be collected in a vessel (not shown) below the liquefaction vessel 10 for further processing as needed. Exhaust gases can escape downwardly through bottom opening 24 or upwardly through an opening in the lid 26 and into an exhaust outlet 40.

Although not limiting in the present invention, the burner 32 as shown in FIGS. 2, 3, 4 and 5 preferably has an L-shaped configuration with a plurality of nozzles 42 along its extended leg portion 44. The extended leg portion 44 provides a desirable distribution of the burner flames 36 as will be discussed later. Specifically referring to FIG. 2, the burner 32 further includes an outer casing 46 with end plates 48 and 50 surrounding a conduit 52, combustion gas conduit 54 and a fuel conduit 56 to form a chamber to remove coolant entering the burner 32 by way of conduit 52. It is to be understood that subsequent references to combustion gas includes both pure oxygen and oxygen containing gas as well as any

other gas that will support combustion with the fuel. To protect the burner 32 from the high temperature environment of the heating vessel 10, the coolant, preferably but not limited to water, enters the burner 32 through inlet 58, travels the length of conduit 52 and exits at open end 60. The coolant fills the outer casing 46 and flows therethrough exiting the burner 32 at outlet 62. Gas and fuel enter the burner 32 through inlets 64 and 66 and pass through are kept separated by conduits 54 and 56, respectively. End plates 68 and 70 seal the ends of the conduits to isolate the fuel and gas from the coolant moving to the outlet 62. Referring to FIGS. 4 and 5, openings 72 in gas conduit 54 and openings 74 in fuel conduit 56 allow the gas and fuel to mix at the nozzles 42. Each tube 76 forms a mixing chamber at the nozzle 42 for the gas/fuel mixture and directs it in the desired direction. Because the burner 32 is cooled by a coolant circulated through conduit 52 and casing 46, all weldments and other connecting or attaching arrangements are watertight. Due to the high temperature and corrosive environment, the components of the burners are preferably stainless steel but can be any type of material that can operate for a prolonged period within that environment.

In the preferred embodiment conduits 54 and 56 are rectangular with a common wall plate 78 as shown in FIG. 4 but it is understood that other conduit configurations can be used. For example, it would be obvious to one skilled in the art that a pair of rectangular tube sections placed wall-to-wall or other similar configurations would give an equivalent structure. While the openings 72 and 74 as shown in FIG. 5 are rectangular, the openings can be of any shape and size that provides a desired gas/fuel mixture and flame characteristics, e.g., round, oval, rectangular with curved end portions, etc. Moreover, the openings 72 and 74 need not be of the same size or configuration at any one nozzle, and further, the openings can vary from nozzle to nozzle.

It should be understood that other fuel, gas and coolant conduit arrangements are included within the teachings of this invention. For example, FIG. 6 shows a rectangular casing 146, surrounding combustion gas conduit 154 and fuel conduit 156. Conduits 154 and 156 are generally circular in cross-section. Openings 172 and 174 in gas conduit 154 and fuel conduit 156 respectively allow the gas and fuel to combine in mixing area 176. Plate 80 divides the casing 146 and provides a coolant inlet passageway 82 and coolant outlet passageway 84 through which the coolant flows to cool the burner 32.

The length of the tube 76 combined with the size and configurations of the openings 72 and 74 will determine the spread angle A of the flame 36 from the burner 32 as shown in FIG. 4. The shape of the tube 76 can be modified, for example, to a conical section to further modify the spread angle. Although not limiting in the present invention, the spread angle is preferably about 10 to 15°. This spread angle concentrates the burner flames 36 and better directs them over the batch layer so that the total flame is closer to surface 38 of batch 34

and it can more efficiently heat the batch material.

The burner arrangement shown in FIG. 1 illustrates how the flame coverage is directed so as to spread the flames 36 over the surface portion 38 of the batch 34 at an acute angle between the flame and batch 34. As the angle between the burner flame 36 and surface portion 38 is reduced from 90°, the flame 36 is directed to pass along the batch surface 38 rather than directly impact it. This arrangement effectively transfers heat to the batch for liquefaction because more of the batch surface 38 is directly exposed to the flames 36 but does not effect the stability of the batch 34.

FIG. 7 shows a cross-section of a burner 32 that is similar to FIG. 4, but shows a second nozzle 86 along with nozzle 42. The nozzles 42 and 86 are shown to be approximately at right angles to one another but can be at any appropriate angle required to get the desired burner configuration. Casing 46 encloses conduits 52, 54 and 56 along with an additional gas conduit 88. Opening 90 in gas conduit 88 and additional opening 92 and fuel conduit 56 feed tube section 94 of the nozzle 86. It is obvious that as an alternative, conduits 54 and 88 could be the fuel conduits and conduit 56 could be the gas conduit. The nozzles can be positioned in groups of pairs as shown in the left hand portion of FIG. 8 or staggered as shown in the right hand portion of FIG. 8. This multiple nozzle arrangement can be used in any desired burner configuration.

Referring to FIG. 9 an additional fuel or gas conduit could be added to the burner 32 to provide additional nozzle positions about the burner circumference. Specifically, coolant conduit 252 passes through the pairs of gas conduits 254 and fuel conduits 256. Openings 272 in the gas conduits 254 and 274 in the fuel conduits 256 allow the gas and fuel to mix at nozzles 242.

The internal construction of the burner shown in FIGS. 2 through 5 is also applicable to other burner configurations such as, but not limited to, those shown in FIGS. 10 and 11. Rather than having the nozzles 42 in a horizontal alignment along leg portion 44 as shown in FIG. 2, the nozzles 42 can be spaced vertically relative to each other and, if desired, to generally conform to the exposed surface 38 of the batch 34. If the heating operation allows, the nozzle 42 may be oriented to direct the flames 36 directly at the material surface. As an alternative and specifically referring to FIG. 11, the nozzles 42 may also direct the flames 36 from the nozzles 42 in a non-normal direction relative to the longitudinal axis of the burner 32. In addition, nozzles 86 can be added and/or nozzle spacing can be varied to affect desired changes in the burner configuration.

With continued reference to FIG. 11, in a melting arrangement where layer stability is an important consideration, the flame size at each nozzle of the burner 32 may be varied to provide a smaller directly impacting flame at the upper portions of the batch wall, and larger sweeping flames along its lower portions, thus maintaining wall stability.

It should be appreciated that other burner configurations using the burner and nozzle design of the

present invention can be adapted for use in any heating and/or melting operation. Since the nozzles 42 are located along a generally longitudinally extending portion of the burner 32, such as leg portion 44 shown in FIG. 2, the extending portion can be of any configuration required to provide efficient and effective heating. For example, in a melting process as previously discussed, a complete ring burner within the vessel 10 could be used to provide a continuous curtain of sweeping flames along the batch surface. Alternatively, the burner 32 could have a plurality of extending portions as shown in FIG. 12. Portions 96 extend outwardly from a common hub 98 at one end of main member 100 to heat additional area from a single central gas and fuel source. In addition, the portions 96 can extend outwardly from hub 98 at different levels to form a multi-nozzle, multi-level burner.

According to the preferred use of the burner in the melter known from US-A 4 381 934 glass batch material is heated by using an oxygen containing gas as combustion gas. Fuel and combustion gas are passed through a stationary lid positioned above the rotating cavity of the melter. The nozzle portion of the burner according to the invention is preferably oriented generally parallel with the material surface in the melter. The flames may be swept over the material surface. The heating of the material surface liquefies said material on a sloped surface. Additional material is fed onto the material surface and liquefied material is drawn from said surface.

Claims

1. A burner (32) comprising an elongated outer casing (46) enclosing a first conduit (56) and a second conduit (54), said conduits (54, 56) extending essentially along the whole length of said outer casing (46), and a coolant outlet conduit (52) which fills said casing (46) with coolant, and a coolant outlet (62), wherein said first conduit (56) generally parallels and is adjacent to said second conduit (54) and each one of the first and second conduits (54, 56) has a plurality of first and second openings (72, 74) spaced along said first and second conduits (54, 56), said openings (72, 74) being connected to each other by means of a plurality of mixing chambers (76) spaced along said first and second conduits (56, 54), characterized in that said mixing chambers (76) include tube portions extending from said conduits (54, 56) forming combustion nozzles (42) directing flames (36) resulting from the combustion of fuel and gas in each of said mixing chambers (76) in a predetermined direction.

2. The burner as in claim 1, characterized by including a third conduit (77) having a third opening (90) and said second conduit (54) having a fourth opening (92) and further including an additional tube section (94) connecting said third and fourth openings (90, 92).

3. The burner as in claim 1, characterized in that the size and/or shape of said first and second openings (72, 74) vary.

4. The burner of claims 1 to 3, characterized in that said mixing chambers (76, 94) are circumferen-

and it can more efficiently heat the batch material.

The burner arrangement shown in FIG. 1 illustrates how the flame coverage is directed so as to spread the flames 36 over the surface portion 38 of the batch 34 at an acute angle between the flame and batch 34. As the angle between the burner flame 36 and surface portion 38 is reduced from 90°, the flame 36 is directed to pass along the batch surface 38 rather than directly impact it. This arrangement effectively transfers heat to the batch for liquefaction because more of the batch surface 38 is directly exposed to the flames 36 but does not effect the stability of the batch 34.

FIG. 7 shows a cross-section of a burner 32 that is similar to FIG. 4, but shows a second nozzle 86 along with nozzle 42. The nozzles 42 and 86 are shown to be approximately at right angles to one another but can be at any appropriate angle required to get the desired burner configuration. Casing 46 encloses conduits 52, 54 and 56 along with an additional gas conduit 88. Opening 90 in gas conduit 88 and additional opening 92 and fuel conduit 56 feed tube section 94 of the nozzle 86. It is obvious that as an alternative, conduits 54 and 88 could be the fuel conduits and conduit 56 could be the gas conduit. The nozzles can be positioned in groups of pairs as shown in the left hand portion of FIG. 8 or staggered as shown in the right hand portion of FIG. 8. This multiple nozzle arrangement can be used in any desired burner configuration.

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With continued reference to FIG. 11, in a melting arrangement where layer stability is an important consideration, the flame size at each nozzle of the burner 32 may be varied to provide a smaller directly impacting flame at the upper portions of the batch wall, and larger sweeping flames along its lower portions, thus maintaining wall stability.

It should be appreciated that other burner configurations using the burner and nozzle design of the

present invention can be adapted for use in any heating and/or melting operation. Since the nozzles 42 are located along a generally longitudinally extending portion of the burner 32, such as leg portion 44 shown in FIG. 2, the extending portion can be of any configuration required to provide efficient and effective heating. For example, in a melting process as previously discussed, a complete ring burner within the vessel 10 could be used to provide a continuous curtain of sweeping flames along the batch surface. Alternatively, the burner 32 could have a plurality of extending portions as shown in FIG. 12. Portions 96 extend outwardly from a common hub 98 at one end of main member 100 to heat additional area from a single central gas and fuel source. In addition, the portions 96 can extend outwardly from hub 98 at different levels to form a multi-nozzle, multi-level burner.

According to the preferred use of the burner in the melter known from US-A 4 381 934 glass batch material is heated by using an oxygen containing gas as combustion gas. Fuel and combustion gas are passed through a stationary lid positioned above the rotating cavity of the melter. The nozzle portion of the burner according to the invention is preferably oriented generally parallel with the material surface in the melter. The flames may be swept over the material surface. The heating of the material surface liquefies said material on a sloped surface. Additional material is fed onto the material surface and liquefied material is drawn from said surface.

Claims

1. A burner (32) comprising an elongated outer casing (46) enclosing a first conduit (56) and a second conduit (54), said conduits (54, 56) extending essentially along the whole length of said outer casing (46), and a coolant outlet conduit (52) which fills said casing (46) with coolant, and a coolant outlet (62), wherein said first conduit (56) generally parallels and is adjacent to said second conduit (54) and each one of the first and second conduits (54, 56) has a plurality of first and second openings (72, 74) spaced along said first and second conduits (54, 56), said openings (72, 74) being connected to each other by means of a plurality of mixing chambers (76) spaced along said first and second conduits (56, 54), characterized in that said mixing chambers (76) include tube portions extending from said conduits (54, 56) forming combustion nozzles (42) directing flames (36) resulting from the combustion of fuel and gas in each of said mixing chambers (76) in a predetermined direction.

2. The burner as in claim 1, characterized by including a third conduit (77) having a third opening (90) and said second conduit (54) having a fourth opening (92) and further including an additional tube section (94) connecting said third and fourth openings (90, 92).

3. The burner as in claim 1, characterized in that the size and/or shape of said first and second openings (72, 74) vary.

4. The burner of claims 1 to 3, characterized in that said mixing chambers (76, 94) are circumferen-



tially spaced along said burner (32).

5. The burner as in claims 1 to 4, characterized in that, said first and second conduits (54, 56) each include a first and second portion wherein said second portion of each of said conduits (54, 56) is angularly offset from said first portion of said respective conduits and further wherein said mixing chambers (76) are positioned along said second portions of said conduits (54, 56).

6. The burner as in claims 2 to 4, characterized in that said burner (32) includes a plurality of first conduits (56, 256) and a plurality of second conduits (54, 254) and further includes a fuel supply conduit and a gas supply conduit wherein an end of each of said first conduits (56, 256) and said second conduits (54, 254) is connected to one of said fuel supply conduits or said gas supply conduits, respectively, so as to supply fuel or gas to each of said first conduits (56, 256) or second conduits (54, 254) from said fuel supply conduit or said gas supply conduit.

7. The burner as in Claims 1 to 4, characterized in that, the mixing chambers (76) are located at a selected position of a nozzle portion (44) of said elongated casing (46) and said nozzle portion (44) is angularly offset from a first portion of said elongated casing (46).

8. The burner as in claim 7, characterized in that said nozzle portion (44) is normal to said first portion of said elongated casing (46).

9. A method of heating a material surface (38) encircling a central cavity including a generally cylindrical vessel (12) with said material surface (38) being disposed along the walls of said vessel (2) a lid portion (26) and an outlet to allow said heated material to exit said cavity by providing a burner (32) within the cavity, characterized by using a burner (32) according to claims 1 to 8 wherein the elongated casing (46) including a positioning portion extending through said lid portion (26) and said nozzle portion (44) extending along said material surface (38) and directing a plurality of flames (36) from said longitudinally nozzle portion (44) towards said surface (38).

10. The method as in claim 9, characterized by orienting said nozzle portion (44) of said burner (32) generally parallel with said material surface (38).

11. The method as in claim 9, characterized by said directing of flames (36) includes sweeping said flames (36) over said surface (38).

12. The method as in claim 9, characterized by varying the size and/or direction of said flames (36).

13. The method as in claim 9, characterized by using an oxygen containing gas as combustion gas.

14. The method as in claims 9 to 13, characterized in that the heating of the material surface (38) liquefies said material and further wherein said material surface (38) is sloped.

15. The method as in claim 14, characterized by further including the steps of feeding additional material onto said surface (38) and draining liquefied material from said surface (38).

16. The method as in claims 9 to 15, characterized by rotating said cavity.

17. The method as in claims 9 to 16, characterized

by passing said fuel and combustion gas through a stationary lid positioned above said cavity.

18. The method as in claims 9 to 17, characterized in that said material is glass batch.

Patentansprüche

1. Brenner (32) mit einer langgestreckten Außenhülle (46), die ein erstes Rohr (56) und ein zweites Rohr (54) umgibt, wobei die Rohre (54, 56) sich im wesentlichen über die gesamte Länge der Außenhülle (46) erstrecken, und mit einer Kühlmittelleitung (52), durch die die Hülle (46) mit Kühlmittel gefüllt wird, und mit einem Kühlmittelauslaß (62), wobei das erste Rohr (56) im allgemeinen parallel und neben dem zweiten Rohr (54) angeordnet ist und jedes der ersten und zweiten Rohre (54, 56) eine Vielzahl von ersten und zweiten Öffnungen (72, 74) aufweist, die in Abstand voneinander in den ersten und zweiten Rohren (54, 56) angeordnet sind, wobei diese Öffnungen (72, 74) durch eine Vielzahl von in Abstand voneinander entlang der ersten und zweiten Rohre (54, 56) angeordneten Mischkammern (76) miteinander verbunden sind, dadurch gekennzeichnet, daß die Mischkammern (76) Rohrteile aufweisen, die sich von den Rohren (54, 56) aus erstrecken und Verbrennungsdüsen (42) bilden, die aus Verbrennung von Brennstoff und Gas in jeder der Mischkammern (76) herrührende Flammen in eine vorbestimmte Richtung richten.

2. Brenner nach Anspruch 1, dadurch gekennzeichnet, daß ein drittes Rohr (88) mit einer dritten Öffnung (90) vorhanden ist und das zweite Rohr (54) eine vierte Öffnung (92) aufweist und weiterhin ein zusätzliches Rohrteil (94) vorhanden ist, das die dritte und vierte Öffnung (90, 92) verbindet.

3. Brenner nach Anspruch 1, dadurch gekennzeichnet, daß die Größe und/oder Form der ersten und zweiten Öffnungen (72, 74) unterschiedlich sind.

4. Brenner nach Ansprüchen 1 bis 3, dadurch gekennzeichnet, daß die Mischkammern (76, 94) in Abstand voneinander über den Umfang des Brenners (32) angeordnet sind.

5. Brenner nach Ansprüchen 1 bis 4, dadurch gekennzeichnet, daß die ersten und zweiten Rohre (54, 56) jeweils ein erstes und zweites Teil aufweisen, wobei das zweite Teil jedes der Rohre (54, 56) unter einem Winkel zum ersten Teil der entsprechenden Rohre angeordnet ist, und weiterhin die Mischkammern (76) entlang der zweiten Teile der Rohre (54, 56) angeordnet sind.

6. Brenner nach Ansprüchen 2 bis 4, dadurch gekennzeichnet, daß der Brenner (32) eine Vielzahl von ersten Rohren (56, 256) und eine Vielzahl von zweiten Rohren (54, 254) und weiterhin eine Brennstoffzufuhrleitung und eine Gaszufuhrleitung aufweist, wobei ein Ende jedes der ersten Rohre (56, 256) und der zweiten Rohre (54, 254) mit einer der Brennstoffzufuhrleitungen oder Gaszufuhrleitungen verbunden ist, um Brennstoff oder Gas jedem der ersten Rohre (56, 256) oder zweiten Rohre (54, 254) aus der Brennstoffzufuhrleitung oder der Gaszufuhrleitung zuzuführen.

7. Brenner nach Ansprüchen 1 bis 4, dadurch ge-



kennzeichnet, daß die Mischkammern (76) an einer ausgewählten Stelle eines Düsentails (44) der langgestreckten Hülle (46) angeordnet sind und dieser Düsentail (44) unter einem Winkel zum ersten Teil der langgestreckten Hülle (46) angeordnet ist.

8. Brenner nach Anspruch 7, dadurch gekennzeichnet, daß das Düsentail (44) rechtwinklig zum ersten Teil der langgestreckten Hülle (46) verläuft.

9. Verfahren zum Erwärmen einer einen zentralen Hohlraum umgebenden Materialoberfläche (38) mit einem im allgemeinen zylindrischen Behälter (12), auf dessen Wänden die Materialoberfläche (38) angeordnet ist, mit einem Deckelteil (26) und einem Auslaß, um dem erwärmten Material das Verlassen des Hohlraumes zu ermöglichen durch Anordnen eines Brenners (32) in dem Hohlraum, gekennzeichnet durch Verwenden eines Brenners (32) nach Ansprüchen 1 bis 8, wobei die langgestreckte Hülle (46) ein sich durch das Deckelteil (26) erstreckendes, einstellendes Teil aufweist und wobei sich das Düsentail (44) über die Materialoberfläche (38) erstreckt und aus dem sich längs erstreckenden Düsentail (44) eine Vielzahl von Flammen (36) auf die Oberfläche (38) gerichtet wird.

10. Verfahren nach Anspruch 9, gekennzeichnet durch Ausrichten des Düsentails (44) des Brenners (32) im allgemeinen parallel zu der Materialoberfläche (38).

11. Verfahren nach Anspruch 9, dadurch gekennzeichnet, daß das Richten der Flammen (36) das Schwenken der Flammen (36) über die Oberfläche (38) einschließt.

12. Verfahren nach Anspruch 9, gekennzeichnet durch Variieren der Größe und/oder Richtung der Flammen (36).

13. Verfahren nach Anspruch 9, gekennzeichnet durch Verwenden eines Sauerstoff enthaltenden Gases als Verbrennungsgas.

14. Verfahren nach Ansprüchen 9 bis 13, dadurch gekennzeichnet, daß durch Erwärmen der Materialoberfläche (38) das Material verflüssigt wird und weiterhin die Materialoberfläche (38) geneigt ist.

15. Verfahren nach Anspruch 14, dadurch gekennzeichnet, daß auf die Materialoberfläche (38) weiterhin zusätzliches Material aufgebracht wird und von der Materialoberfläche verflüssigtes Material abgezogen wird.

16. Verfahren nach Ansprüchen 9 bis 15, gekennzeichnet durch Drehen des Hohlraumes.

17. Verfahren nach Ansprüchen 9 bis 16, dadurch gekennzeichnet, daß der Brennstoff und das Verbrennungsgas durch einen über dem Hohlraum fest angeordneten Deckel zugeführt wird.

18. Verfahren nach Ansprüchen 9 bis 17, dadurch gekennzeichnet, daß das Material Glasgemenge ist.

Revendications

1. Brûleur (32) comprenant un boîtier extérieur (46) contenant un premier conduit (56) et un second conduit (54), ces conduits (54, 56) s'étendant essentiellement sur toute la longueur du boîtier extérieur (46), et un conduit d'agent de refroidissement

(52) qui remplit ce boîtier (46) d'agent de refroidissement, et un orifice de sortie (62) d'agent de refroidissement, où le premier conduit (56) est de façon générale parallèle et adjacent au second conduit (54) et où chacun des premier et second conduits (54, 56) comporte une multiplicité de premiers et de seconds orifices (72, 74) répartis le long du premier et du second conduits, ces orifices (72, 74) étant reliés l'un à l'autre par une multiplicité de chambres de mélange (76) réparties le long des premier et second conduits, caractérisé en ce que ces chambres de mélange (76) comprennent des portions de tube s'étendant à partir desdits conduits (54, 56) formant des ajutages de combustion (42) dirigeant des flammes (36) résultant de la combustion du combustible liquide et du gaz dans chacune desdites chambres de mélange (76), dans une direction prédéterminée.

2. Brûleur suivant la revendication 1, caractérisé en ce qu'il comprend un troisième conduit (88) ayant un troisième orifice (90) et en ce que le second conduit (54) a un quatrième orifice (92) et comprend en outre un tronçon de tube additionnel (94) reliant les troisième et quatrième orifices (90, 92).

3. Brûleur suivant la revendication 1, caractérisé en ce que les dimensions et/ou la forme du premier orifice et du second orifice (72, 74) varient.

4. Brûleur suivant les revendications 1 à 3, caractérisé en ce que lesdites chambres de mélange (76, 94) sont espacées sur une circonférence le long du brûleur (32).

5. Brûleur suivant les revendications 1 à 4, caractérisé en ce que les premier et second conduits (54, 56) comprennent chacun une première partie et une deuxième partie, où la deuxième partie de chacun desdits conduits (54, 56) est décalée angulairement par rapport à la première partie des conduits respectifs et où les chambres de mélange (76) sont positionnées le long des secondes parties desdits conduits (54, 56).

6. Brûleur suivant les revendications 2 à 4, caractérisé en ce que ledit brûleur (32) comprend une multiplicité de premiers conduits (56, 256), et une multiplicité de seconds conduits (54, 254) et en ce qu'il comprend en outre un conduit d'alimentation en combustible et un conduit d'alimentation en gaz, où une extrémité de chacun des premiers conduits (56, 256) et des seconds conduits (54, 254) est reliée à l'un des conduits d'alimentation en combustible ou desdits conduits d'alimentation en gaz, respectivement, en sorte de fournir du combustible ou du gaz à chacun desdits premiers conduits (56, 256) ou des seconds conduits (54, 254) à partir du conduit d'alimentation en combustible ou du conduit d'alimentation en gaz.

7. Brûleur suivant les revendications 1 à 4, caractérisé en ce que les chambres de mélange (76) sont situées en une position choisie d'une partie d'ajutage (44) du boîtier allongé (46) et où ladite partie d'ajutage (44) est décalée angulairement d'une première partie du boîtier allongé (46).

8. Brûleur suivant la revendication 7, caractérisé en ce que la partie d'ajutage (44) est normale à ladite première partie dudit boîtier allongé (46).

9. Procédé de chauffage d'une surface matériel-



le (38) entourant une cavité centrale, comprenant une enceinte (12) généralement cylindrique, la surface matérielle (38) étant disposée le long des parois de ladite enceinte (12) avec la surface matérielle (38) disposée le long des parois de l'enceinte (2), une partie de couverture (26) et un orifice de sortie pour permettre à la matière chauffée de sortir de ladite cavité en prévoyant un brûleur (32) à l'intérieur de la cavité, caractérisé en ce qu'on utilise un brûleur (32) suivant les revendications 1 à 8, où le boîtier allongé (46) comprend une partie de positionnement s'étendant à travers ladite partie de couvercle (26) et la partie d'ajutage (44) s'étendant le long de la surface matérielle (38) et dirigeant une multiplicité de flammes (36) de la partie d'ajutage longitudinale (44) vers ladite surface (38).

10. Procédé suivant la revendication 9, caractérisé en ce qu'on oriente la partie d'ajutage (44) dudit brûleur (32) de façon généralement parallèle à ladite surface matérielle (38).

11. Procédé suivant la revendication 9, caractérisé en ce que la direction des flammes (36) comprend le balayage desdites flammes (36) sur ladite surface (38).

12. Procédé suivant la revendication 9, caractérisé en ce qu'on fait varier les dimensions et/ou la direction desdites flammes (36).

13. Procédé suivant la revendication 9, caractérisé en ce qu'on utilise un gaz contenant de l'oxygène comme gaz de combustion.

14. Procédé suivant les revendications 9 à 13, caractérisé en ce que le chauffage de la surface matérielle (38) liquéfie ladite matière et où, en outre, ladite surface matérielle (38) est inclinée.

15. Procédé suivant la revendication 14, caractérisé en ce qu'il comprend en outre les étapes consistant à fournir de la matière additionnelle sur ladite surface (38) et en ce qu'on laisse s'écouler la matière liquéfiée à partir de ladite surface (38).

16. Procédé suivant les revendications 9 à 15, caractérisé en ce que l'on fait tourner ladite cavité.

17. Procédé suivant les revendications 9 à 16, caractérisé en ce qu'on fait passer le combustible et le gaz de combustion à travers un couvercle immobile positionné au-dessus de ladite cavité.

18. Procédé suivant les revendications 9 à 17, caractérisé en ce que ladite matière est une composition vitrifiable.

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