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PREHEATING PROCESS AND APPARATUS FOR VITRIFIABLE COMPOSITION

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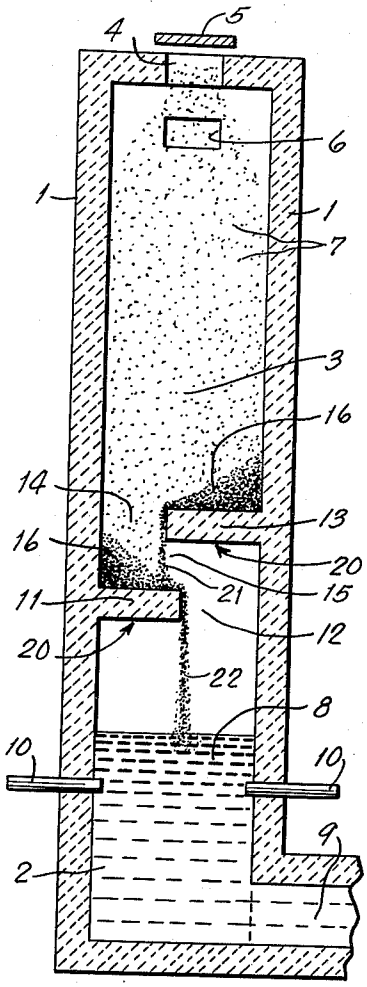

Fig. 1

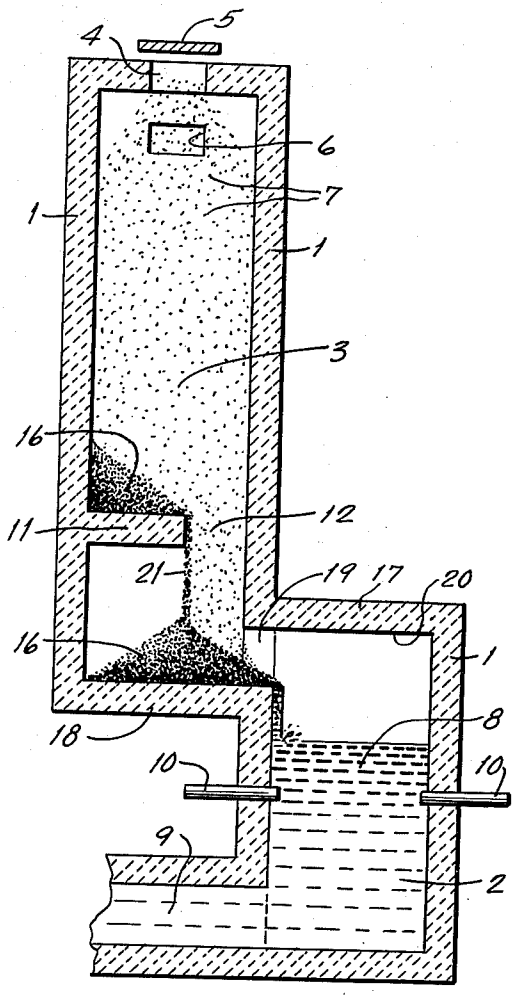

Fig. 2

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PREHEATING PROCESS AND APPARATUS FOR VITRIFIABLE COMPOSITION

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12 Claims. (Cl. 263—11)

This application is a continuation-in-part of application Ser. No. 166,312 filed January 16, 1962, now abandoned.

The present invention relates to a new and useful process and apparatus for the preheating of a composition serving for working glass and similar vitrifiable products, and it relates more particularly to furnaces in which the composition is preheated in a special zone while falling freely in dispersed form countercurrently to a flow of hot fumes emanating from the melting zone of the furnace but while preventing radiation to the preheating zone.

In furnaces of this type, it is advantageous to preheat the vitrifiable composition by the fumes to the exclusion of any other source of heat. Thus, a maximum temperature difference is maintained between the fumes and the grains of composition and a good heat transfer from the first to the second is insured. However, it is found that the vitrifiable materials are appreciably heated by other sources, mainly by the radiation from the molten materials contained in the furnace. Consequently, the grains of vitrifiable mixture which are partially heated by these secondary sources extract relatively less heat from the fumes than they could if they were heated only by the fumes.

The thermal yield of the furnace is thereby reduced because a greater quantity of heat is carried away by the fumes. In addition, the molten materials contained in the melting zone of the furnace radiate their heat to the walls of the preheating zone and thus increase the heat losses through these walls. The invention has the object of improving the thermal yield of these furnaces.

For this purpose, the preheating zone is shielded from the radiation of the molten materials and this radiation is reflected by means of a substantially horizontal screen situated between the melting zone and the preheating zone. By this means, the heat radiated by the molten products to the preheating zone is intercepted and is returned to the crucible containing the molten materials. Multiple advantages are thus obtained. On the one hand, the temperature of the walls of the preheating zone is reduced, and consequently also the heat losses through these walls. On the other hand, the preheating of the composition is effected almost exclusively by means of the heat contained in the fumes, and an optimum recovery of this heat is thus obtained. Finally, the quantity of heat lost by the molten materials is reduced and, correlatively, the quantity of heat which must be supplied thereto in order to maintain the temperature required for the working of the products.

In accordance with the invention, the furnace includes above the crucible containing the molten materials a substantially horizontal screen intended to intercept the radiation from the mass of molten materials and to reflect the heat radiated by the crucible. The said screen is preferably situated between the crucible and the heat exchange column in which the transfer of heat takes place between the fumes and the grains of composition. The reflecting screen performs a double function. It intercepts the radiation of heat from the crucible to the exchanger column and consequently prevents heating of the walls of the column thereby. On the other hand, it reduces the heat losses of the mass of molten products by reflecting a considerable proportion of the heat which they radiate.

Although the screen may be made in one piece formed with an orifice for the passage of the fumes and the composition, it advantageously consists of a number of separate parts which partially overlap one another. A baffle passage is provided between the various parts to enable the fumes and the composition to pass through the screen while preventing the passage of the radiation emitted by the molten materials in the crucible.

In a particular embodiment of the invention, the crucible containing the molten products and having the screen mounted thereon is staggered in relation to the heat exchange column and is situated eccentrically at the base of this column. The crucible and the column intercommunicate through a lateral passage situated in the upper part of the crucible and in the lower part of the column. In addition, a screen may be disposed in the heat exchange column as previously described for the purpose of intercepting the indirect radiation coming from the crucible. In this arrangement, as in the preceding arrangement, the orifice of the connection between the two parts of the furnace permits the passage of the fumes and of the composition, but it is so positioned that the radiation from the mass of molten products cannot pass therethrough so as to heat the composition falling through the heat exchange column.

The screen preferably consists of a refractory material and may advantageously be covered with a layer having high reflecting power, such as, for example, a noble metal such as platinum. These arrangements make it possible to increase further the quantity of heat returned to the molten products and they avoid excessive overheating of the reflecting screen.

In the drawings:

FIG. 1 is a diagrammatic vertical section through a furnace constructed in accordance with this invention, and

FIG. 2 is a diagrammatic vertical section through a modified furnace.

The furnace according to FIG. 1 is composed of an envelope 1 of refractory material forming the crucible 2 at the base and, above the latter, the heat exchange column 3. There opens at the top of the heat exchange column 3 the orifice 4 for charging the furnace, the said orifice being closed by a flap 5. There opens slightly below the orifice 4 the orifice 6 through which the fumes emanating from the furnace are discharged to the chimney. The raw materials constituting the vitrifiable composition 16 are introduced into the furnace through the orifice 4 in such a manner to fall freely in scattered or dispersed form throughout the vertical and horizontal extent of column 3 without obstruction until reaching screen 13 which serves with screen 11 to separate the melting zone therebelow from the heat exchange column thereabove. As shown in the drawings, the free-dispersed fall of composition 7 is analogous to rain fall, thus permitting the most effective exchange with the rising hot gases, until forming banks 16 of composition on the screens 11 and 13. Thereafter, the composition flows in streams 21 from the first screen 13 to second screen 11 and stream 22 to the surface above the molten glass 8 in the crucible 2, the molten glass being discharged through the connection 9.

The crucible 2 is provided with burners 10 which inject burning gases into the molten glass 8. The gases thereafter rise through the column 3, thus heating the grains of composition falling therethrough, and the gases finally escape through the orifice 6 to the chimney.

In accordance with the invention, there is disposed in the upper part of the crucible, above the glass mass 8, a screen 11 of refractory material limited to a portion of the cross-section of the furnace, so as to define a passage

12 for the circulation of the fumes and of the composition. Preferably, there is disposed at some distance above the screen 11 a similar screen 13 extending in the opposite direction thereto, so that the screen 13 covers the passage 12 and the passage 14 beside the screen 13 is situated vertically above the screen 11. With this arrangement, communication of the fumes and grains of composition between the crucible 10 and the column 3 is ensured by the passages 12 and 14 and the channel 15 situated between the screens 11 and 13. The radiation enamating from the glass mass 8 is completely intercepted and reflected towards the latter by the screens 11 and 13.

In the furnace according to FIGURE 2, in which the same references are used to denote the same parts as in FIGURE 1, the crucible 2 and the column 3 are not disposed in line with one another, but the crucible 2 is laterally offset in relation to the base of the column 3. Mounted on the crucible 2 is a roof 17 forming a reflecting screen, while the column 3 is closed at its base by a sole 18, the roof 17 and the sole 18 forming part of the envelope 1 of the furnace. The upper part of the crucible 2 is joined to the lower part of the column 3 by a passage 19 serving as a means of communication for the grains of composition and for the fumes. In this arrangement also, the radiation from the molten glass mass 8 is intercepted by the roof 17 and reflected to the mass 8. This arrangement is further improved by disposing a screen 11 towards the base of the heat exchange column 3. This screen intercepts a fraction of the indirect radiation emitted by the crucible 2 towards the column 3 and prevents obstruction of the passage 19 by the composition accumulating on the sole 18.

In a very advantageous arrangement, the lower faces 20 of the screens 11 and 13 or of the roof 17 are covered by a layer of a material having a high reflecting power. As such, there may be used, for example, a noble metal such as platinum. The quantity of heat reflected towards the mass 8 is thus increased, the heating of the screens or of the roof is reduced, and the quantity of heat lost by the roof 17 is decreased.

The heat exchange columns 3 are well known conventional structures to the glass art except for the screens 11, 13, and 17 and the offset passage 19. It is important that there be unobstructed and free fall above the screens which define the separation between melting zone and heat exchange column. Preferably this unobstructed column should be at least four inches in diameter and one foot in height.

Of course, the invention is not limited to the embodiments which have been described and illustrated by way of example, and modifications may be made thereto without departing from its scope.

We claim:

1. In a process for preheating a vitrifiable composition within a melting furnace by passing hot fumes emanating from a melting compartment including molten material countercurrently to said composition in a vertically-positioned, unobstructed, preheating shaft above said melting compartment, the improvement in combination therewith comprising feeding said composition at the top of said preheating shaft in such a manner that said fed composition falls freely in a dispersed condition through substantially the entire cross-section and length of said preheating shaft, separating and shielding said preheating shaft from radiation of said melting compartment with a substantially horizontal screen positioned therebetween and reflecting said radiation to said melting compartment from the lower surface of said screen.

2. The process of claim 1 wherein said composition is glass.

3. The process of claim 1 wherein the upper surface of said molten material is aligned directly below said preheating shaft.

4. The process of claim 1 wherein the upper surface of said molten material is offset below said preheating shaft.

5. In a furnace having a melting compartment including a crucible, and an unobstructed vertical feeding and heat exchange shaft mounted above the opening of said crucible for preheating a vitrifiable composition by passing hot fumes emanating from said crucible countercurrently to said composition falling freely in dispersed condition through substantially the entire cross-section and length of said heat exchange shaft, the improvement in combination therewith comprising a substantially horizontal reflecting screen in said shaft separating said melting compartment and said shaft, the under surface of said screen adapted to reflect back any radiation from said crucible.

6. The furnace of claim 5 wherein said screen includes a plurality of spaced members which partially overlap one another.

7. The furnace of claim 5 wherein the opening of said crucible is aligned directly below said shaft.

8. The furnace of claim 5 wherein the opening of said crucible is offset below said shaft.

9. The furnace of claim 5 wherein said shaft is at least four inches in diameter and one foot long.

10. The furnace of claim 5 wherein said screens are made of refractory material.

11. The furnace of claim 10 wherein said screen is covered by a highly reflective material facing said crucible.

12. The furnace of claim 11 wherein said reflective material is platinum.

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