May 13, 1941. V. MULHOLLAND 2,241,611

METHOD OF AND APPARATUS FOR FIRING AND FEEDING BATCH TO GLASS MELTING FURNACE

Filed June 9, 1938 2 Sheets-Sheet 1

Fig. 1.

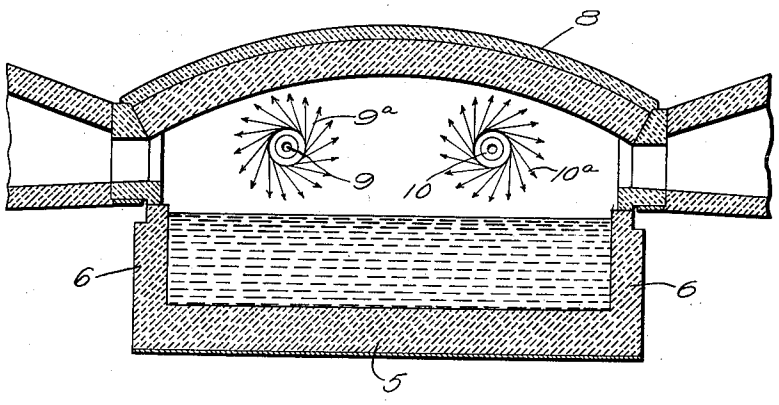
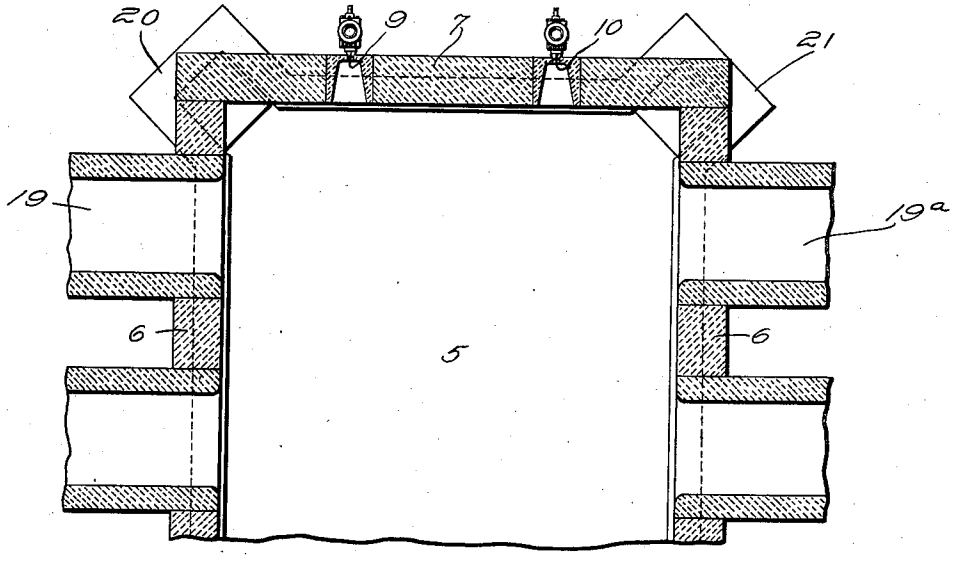


Fig. 2.



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Fig. 3.

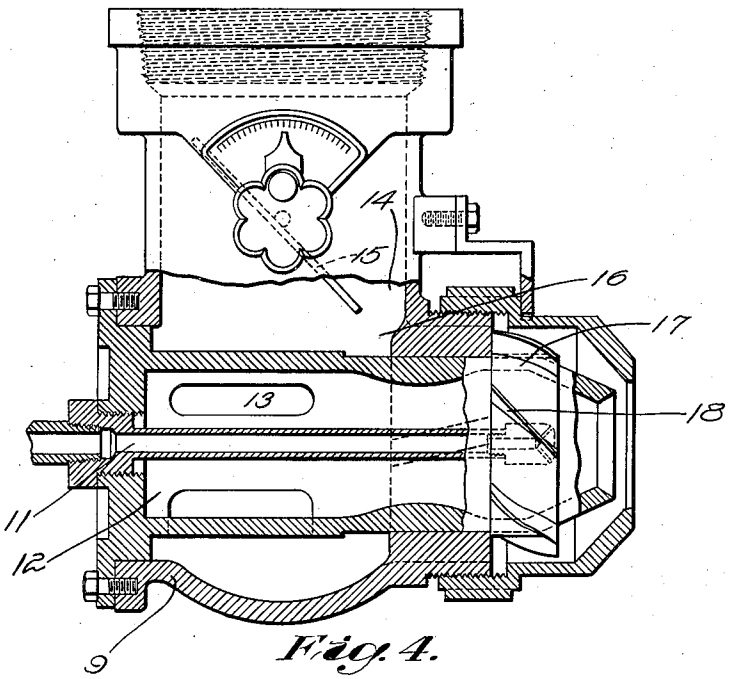
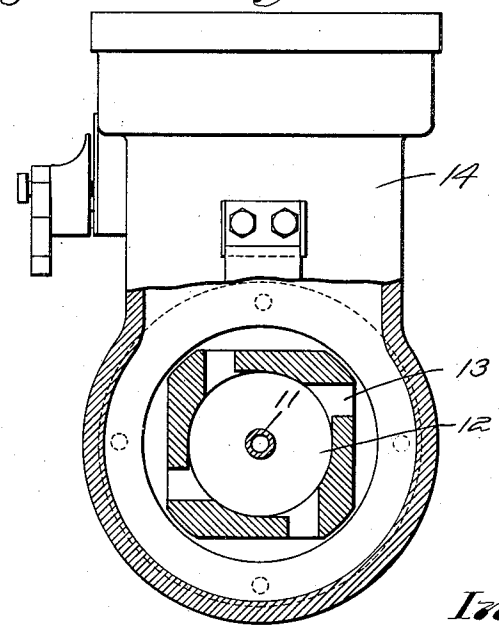


Fig. 4.



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UNITED STATES PATENT OFFICE

2,241,611

METHOD OF AND APPARATUS FOR FIRING AND FEEDING BATCH TO GLASS MELTING FURNACES

Vergil Mulholland, West Hartford, Conn., assignor to Hartford-Empire Company, Hartford, Conn., a corporation of Delaware

Application June 9, 1938, Serial No. 212,705

9 Claims. (Cl. 49—54)

This invention relates to method of and apparatus for firing and feeding batch to glass melting furnaces.

In a certain type of continuous regenerative glass melting furnace, the fuel is supplied by a pair of burners projecting through the rear wall of the furnace, while the air to support combustion is supplied from regenerators communicating with ports spaced along the side walls. The burners are designed to be fired alternately upon reversal of the regenerators. In the past the firing of such furnaces has not been satisfactorily uniform, but has varied in application and effect when the furnace is reversed. This is particularly true when the burners are of the type in which the atomizing air is given a swirling motion, as is done in certain commercial burners, for the purpose of shortening the flame and obtaining more complete mixture of the air and fuel.

The principal object of the invention, therefore, is to provide a method of and means for symmetrically firing such a furnace.

Heretofore the batch has been fed to such furnaces from one or more doghouses located at the rear or side of the tank, the batch being usually supplied constantly from all doghouses. This feeding, coupled with a lack of symmetry of firing during the several periods of reversal, has rendered haphazard and uncertain the distribution of batch over the firing area of the furnace and has rendered maintenance of a proper "batch line" difficult. Such a condition tends to the production of glass of non-uniform quality.

Therefore, a further object of the present invention is to provide a novel arrangement of doghouses and a novel method of feeding batch in proper relation to the firing of the furnace, whereby symmetry of feeding and firing is assured.

More specifically, objects of the invention are to provide in the above type of furnace a pair of burners of similar characteristics, but provided with opposite but symmetrical means for introducing atomizing air moving tangentially of the center lines of the burners in opposite directions; and to provide means for feeding batch at or near the rear corners of the furnace and which are preferably controlled to supply batch only at the corner more distant from the burner which is in operation.

In the accompanying drawings, Figures 1 and 2 respectively are vertical and horizontal cross-sectional views of a furnace embodying this invention; and

Figs. 3 and 4 respectively are enlarged views, partly in section, showing details of a burner adapted for use in such furnaces.

The furnace shown in the drawings comprises a bottom 5, side walls 6, a rear wall 7 and a crown 8. Burners 9 and 10, mounted in the rear wall 7 equidistant from the center line of the furnace, are intended and adapted for alternate firing. While other types of burners may be employed, those shown in the drawings are oil burners in which the oil is conducted by a central pipe 11 (Figs. 3 and 4) within an air chamber 12, into which chamber atomizing air may be drawn or forced through ports 13 from a chamber 14 provided with a damper 15.

The particular burner illustrated in Fig. 4 corresponds to the burner 9 of Fig. 1, in which the atomizing air is given a counterclockwise movement by suitable arrangement of the passages 13, so that the air and fuel from that burner mix thoroughly and swirl in a counterclockwise direction, as indicated by the arrows 9^a of Fig. 1. Additional air is introduced by the burner from the chamber 14 through an outer annular passage 16 at the inner end of which passage is a ring 17 provided with vanes 18 which cause this air to swirl, and in the particular burner shown in Fig. 3, to move in a counterclockwise direction. It is understood that the burner 10 of Fig. 1 is similarly constructed, except that the arrangement of the passages thereof corresponding to the passages 13, and/or the passages between the vanes of the ring 17 are such as to cause the air to swirl in a clockwise direction, as is illustrated by the arrows 10^a in Fig. 1.

Air to support combustion is introduced alternately from one side of the furnace and then the other through the regenerator ports 19—19^a, the ports acting to introduce preheated air on that side of the furnace on which the burner then in operation discharges, the waste gases passing through the opposite ports in the usual manner.

Doghouses 20—21 are provided respectively at the rear corners of the tank, the center lines of these doghouses preferably making an angle of approximately 45° with the center line of the tank. Batch is supplied to and through these doghouses in any known way, but preferably by continuous automatic batch feeders, such, for example, as that shown in U. S. patent to E. O. Hiller, No. 1,941,897.

Preferably and in order to assure symmetry of operation of the tank, the batch is fed, at any particular time, into the tank from the doghouse more distant from the burner then in operation.

By supplying batch in this manner objectionable dynamic effects of the flame and burning gases upon the batch are greatly reduced, and such effects as are present tend to maintain the batch floating on the bath of molten glass adjacent to the rear wall of the furnace and to prevent its movement into the refining circulation of the tank until it has been completely reduced to molten glass.

It will be understood that by the provision of oppositely disposed means creating symmetrical but opposite swirling movement of the atomizing air and fuel, as well as the symmetrical relationship of the burners to the center line of the tank, symmetrical firing effects may be obtained during the several periods of firing. I have found by actual trial that the application of this invention creates a marked improvement in the operation of the furnace over the methods previously employed in which this opposite but symmetrical swirling movement of the gases was not employed. The provisions for symmetrical firing may be employed with or without the particular batch feeding arrangements, and may be accomplished by burners of other types than that particularly described herein. My invention is not to be limited by the particular disclosure, but the appended claims are to be construed broadly in accordance with their terms.

Having described my invention, what I claim is:

1. The method of firing glass-making furnaces which comprises introducing fuel into the furnace through the rear wall and at one side of the longitudinal center line of the furnace, introducing preheated air for combustion through regenerator ports in the side wall of the furnace on the same side of the center line, causing the fuel as introduced to swirl in a given direction of rotation, and periodically reversing the firing to introduce the fuel and air alternately on opposite sides of the center line and to cause the fuel to swirl alternately in opposite directions of rotation, whereby the firing from the opposing sides of the center line is symmetrical.

2. The method of firing a glass-making furnace which comprises introducing a combustible fuel mixture into the melting end of the furnace alternately at opposite sides of the longitudinal center line thereof, and imparting to the fuel mixture thus introduced into the furnace swirling movements in directions of rotation which are opposite at opposite sides of the center line.

3. The method of firing and feeding a glass-making furnace, which comprises maintaining a bath of molten glass in the furnace, supplying fuel through the rear wall to a combustion space above the bath for alternating periods, during which respectively the fuel enters the combustion space from the rear of the furnace and on opposite sides of the longitudinal center line of the furnace, creating swirling movement of the fuel introduced on the two sides respectively in opposite directions of rotation, feeding batch into the furnace from the rear corners thereof respectively during the respective alternating periods, the batch being fed from each of the said corners while the fuel is being introduced on the opposite side of the center line of the furnace, and supplying air for combustion from regenerators communicating with the furnace through the side walls thereof.

4. A glass-melting furnace comprising end and side walls, regenerator ports in the side walls, and a pair of burners mounted on either side of the center line of the furnace to project flame through the rear end wall, said burners being provided with similar but opposite means for imparting a swirling movement to the combustible mixture, whereby the mixtures projected into the furnace by the two burners are given opposite directions of rotation.

5. A glass-melting furnace, comprising end and side walls, regenerator ports in said side walls, and a pair of burners one mounted on either side of the center line of the furnace to project flame through the rear end wall, said burners being provided with similar but opposite means for imparting opposite swirling movements respectively to the combustible mixture and intended for alternate operation in synchronism with the reversal of flow through said regenerator ports, whereby the firing in opposite directions in the furnace may be effective to supply heat thereto similarly on each side of the longitudinal center line.

6. In a glass-melting furnace, a glass-melting basin, two diagonally disposed doghouses located at the rear corners of said basin for supplying batch to the furnace, burners in the rear wall, and regenerator ports in the side walls of the furnace, all of said means being so constructed and arranged that batch may be fed into the furnace alternately and the furnace fired alternately on either side of the center line, the said batch being fed from the side opposite the firing side.

7. The method of operating a glass making furnace, which comprises alternately introducing fuel into the furnace through the rear wall thereof respectively on opposite sides of the longitudinal center line of the furnace and symmetrically in respect thereto, causing the fuel as introduced to swirl in opposite directions of rotation on the opposite sides respectively of the longitudinal center line of the furnace, alternately introducing preheated air for combustion through regenerator ports in the side walls of the furnace, periodically reversing the direction of the introduction of the preheated air, and periodically and simultaneously with the reversal of flow of air stopping the introduction of fuel into the furnace on the side of the center line thereof through which the air was introduced prior to the reversal, and starting the introduction of fuel into the furnace on the side of the center line thereof into which air is introduced subsequent to the reversal as aforesaid from the regenerator ports, feeding batch into the furnace alternately adjacent to the rear corners thereof and in directions substantially diagonal of the furnace, and periodically stopping the introduction of batch at one of said rear corners while starting the introduction of batch at the other rear corner, the operations of reversing the batch feed as aforesaid taking place substantially simultaneously with the reversal of air and fuel flow into the furnace and such that batch is supplied to the furnace only on the opposite side of the longitudinal center line thereof from which air and fuel is introduced as aforesaid.

8. The method of operating a glass making furnace which comprises alternately introducing fuel into the furnace through the rear wall thereof on opposite sides of the longitudinal center line of the furnace and symmetrically in respect thereto, alternately introducing preheated air for combustion through regenerator ports in the side walls of the furnace, periodically revers-

ing the direction of the introduction of the preheated air and periodically and simultaneously with the reversal of flow of air stopping the introduction of fuel into the furnace on the side of the center line thereof through which the air was introduced prior to the reversal, and starting the introduction of fuel into the furnace on the side of the center line thereof into which air is introduced subsequent to the reversal as aforesaid from the regenerator ports, and causing the fuel as introduced to swirl in opposite directions on opposite sides respectively of the longitudinal center line of the furnace and in such directions as to cause the flame to impinge upon the surface of the glass irrespective of the reversals of the fuel and air as aforesaid and correspondingly to protect the crown of the furnace.

9. A glass making furnace, comprising end and side walls, regenerator ports in said side walls, a pair of burners, one mounted on each side of the longitudinal center line of the furnace and arranged to project fuel through the rear end wall in a direction substantially lonigtudinal of the furnace, said burners being provided with similar but opposite means for imparting swirling movements to the combustible mixture supplied therethrough, the means for imparting the swirling movements in said burners being arranged to cause these movements so that, from the point of view of an observer facing the end of the tank in which said burners are located, the burner on the right is arranged to cause a swirling movement of the combustible mixture in a clockwise direction, while the burner on the left has similar means for causing a swirling movement of the combustible mixture in a counterclockwise direction, whereby, when the burners are operated alternately and the operation is reversed in synchronism with the reversal of flow of air and products of combustion through the regenerator ports, the flames from the burners are respectively directed to impinge upon the glass in the furnace rather than upon the roof or crown thereof.

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