July 22, 1941. J. FERGUSON 2,250,155

ROTARY ELECTRIC FURNACE

Filed May 13, 1940

FIG. 1

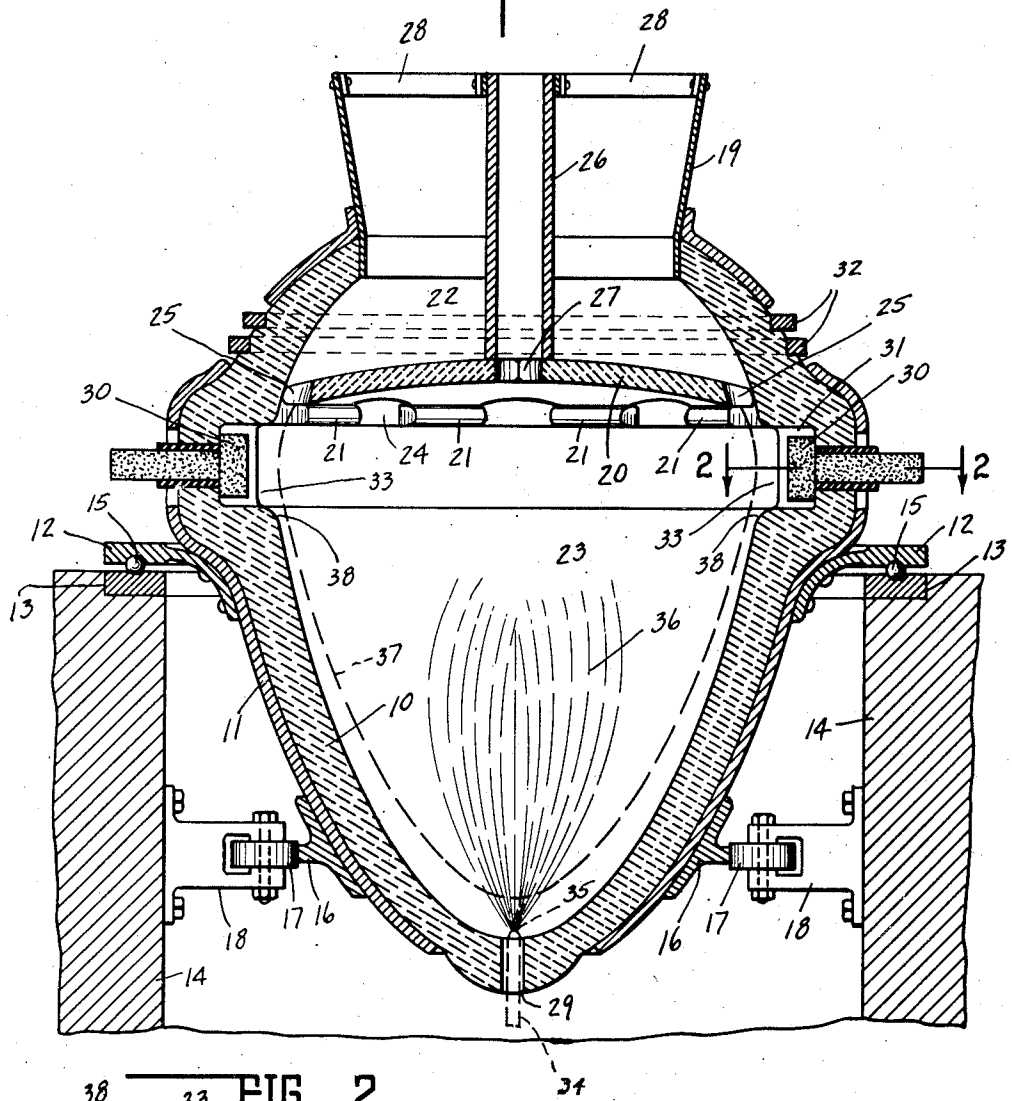
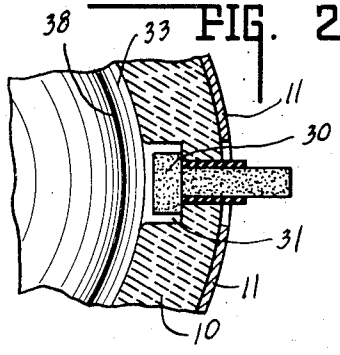


FIG. 2



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ROTARY ELECTRIC FURNACE

John Ferguson, Cleveland, Ohio

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5 Claims. (Cl. 13—6)

This invention relates to a rotary electric furnace. The invention is particularly applicable to the type of rotary electric furnaces for glass melting disclosed in my prior Patents No. 2,006,947, issued July 2, 1935; No. 2,007,755, issued July 9, 1935; and No. 2,008,495, issued July 16, 1935. In the operation of the furnaces shown in the two prior patents last mentioned, glass making materials are fed to a hollow rotating furnace in which said materials are melted by electric current passing through molten glass and between electrodes spaced about the walls of said furnace. The centrifugal action of the rotating furnace causes the molten material therein to form a layer on the walls of the furnace in contact with the electrodes. In these prior patents the layer of molten glass on the walls of the furnace is of fairly uniform thickness and the electric current passing therethrough is thus distributed fairly uniformly through the entire mass of molten glass. The available cross sectional area of current path is thus much greater than the possible electrode area and there is a large concentration of current in the immediate vicinity of the electrodes tending to overheat the electrodes.

One object of the present invention is to prevent overheating of electrodes. This object is accomplished by shaping the walls of the furnace in such manner that the current passing between the electrodes is substantially confined to the zone of the electrodes. The melting temperature is developed in this zone only and the proportions of the melting zone are such that concentrations of the currents at the electrodes are prevented. Another factor contributing to the attainment of this object is the fact that the walls are shaped to provide a relatively thin layer of molten glass immediately adjacent the melting zone. The electrical resistance of this thin layer minimizes flow of current from the electrodes to portions of the molten glass outside of the melting zone where additional heating of the glass is not needed.

Another object of the invention is to provide a new and novel method and apparatus for starting the operation of an electric furnace of this type.

Other objects and features of the invention will be understood from the accompanying drawing and the following description and claims:

Fig. 1 is a vertical sectional view through a rotary glass furnace constructed in accordance with the invention showing in broken lines an element which is used only in starting the operation and which is then withdrawn. Fig. 2 is a fragmentary horizontal sectional view taken on the line 2—2 of Fig. 1.

In the form of the invention shown in the drawing the furnace comprises a hollow body 10 of refractory material inclosed in a casing 11 to which there is secured a ball race 12. A mating ball race 13 is mounted on a suitable stationary support 14. Ball bearings 15 cooperate with the races 12 and 13 and form a thrust bearing on which the furnace may be rotated and which supports the weight of said furnace. A guide ring 16 secured to the outer casing 11 cooperates with a plurality of rollers 17 mounted in brackets 18 on the stationary support 14 and serves to steady the lower end of the furnace in its rotation. The furnace may be rotated about a vertical axis by any suitable power means, such as those shown in the prior patents before mentioned.

At the upper end of the furnace there is provided a hopper 19 into which glass making batch material may be fed. Within the furnace there is provided a partition 20 resting on lugs 21 projecting from the wall of the furnace, and dividing the interior thereof into an upper chamber 22 and a lower chamber 23. Spaces 24 between the lugs 21 mate with openings 25 in the outer edge of the partition 20 to provide passageways for the entrance of material to the chamber 23 from the chamber 22. A stack 26 communicates with an opening 27 in the partition 20 and extends upwardly through the hopper 19. Said stack may be supported in place by any suitable means such as cross braces 28 secured to the hopper 19. At the lower end of the chamber 23 there is provided a discharge opening 29.

A plurality of electrodes 30, herein shown as two in number, are set in pockets 31 spaced about the wall of the refractory body 10 immediately beneath the partition 20. Each of said electrodes is electrically connected by any well known means, not shown, to one of a pair of slip rings 32 which may in turn be engaged by suitable brushes connected to a source of electric current. The pockets 31 are formed in the base of an annular recess or channel 33 extending completely around the walls of the chamber 23.

In starting the operation of the furnace just described there is preferably employed a method different from that described in my prior patents. In this method a quantity of scrap glass or "cullet" is first charged into the chamber 23 through

the stack 26. The furnace is then rotated at a sufficiently high rate of speed to force the bits of cullet to accumulate in the channel 33 by centrifugal action. The speed of rotation required for this purpose is somewhat greater than the normal speed of rotation of the furnace. The amount of cullet charged into the furnace in the starting operation need be only sufficient to form a continuous layer within the channel 33 when said cullet has been melted.

Since solid glass is not a satisfactory conductor of electricity the next step in the starting operation is to insert through the discharge openings 29 a burner 34 adapted to burn a liquid or gaseous fuel which may be supplied to said burner in any well known manner. The flame from sad burner heats the entire interior of the furnace to a temperature sufficient to melt the cullet which, when melted, forms a continuous current path between the electrodes 30. Said electrodes may then be connected to their source of current supply to pass an electric current passed through said path. Sufficient heat may thus be generated in the molten glass to maintain the same in the molten condition and the burner 34 may be withdrawn. During the use of the burner 34 the stack 26 serves as a means of escape for the gaseous products of combustion. When the burner 34 has been withdraw said stack may be capped by any suitable form of closure.

When the channel 33 is filled with molten glass, the batch materials may be supplied to the chamber 22 above the partition 20. The heat generated in the molten glass within the channel 33 is sufficient to heat the partition 20 to a high temperature. By radiation and conduction, heat is transmitted from said partition to the batch material and such material is reduced to a viscous or partially melted condition. The partially melted material is thrown by centrifugal action through the openings 25 into the annular channel 33 and thus increases the accumulation of material in said channel. When sufficient material has accumulated and has become completely molten the speed of rotation may be reduced to the normal operating speed of the furnace. When this normal operating condition is reached, a layer of molten glass is formed on the wall of the chamber 23, the approximate outer limits of said layer being indicated in the drawing by the broken line 37. Molten glass from said layer is discharged through the opening 29, from which the burner 34 has been removed, and may be fabricated in any well known manner.

It will be apparent that in the normal operation of the furnace the annular channel 33 provides the shortest path between the electrodes 30 and that said path is of relatively large cross sectional area. It will also be seen that the shoulder 38 defining the lower limit of said channel provides for a minimum thickness of the layer of molten glass at that point. Because of the increased resistance in the thin layer of glass at the shoulder 38 and the lower resistance of the current path in the channel 33 the electric current is largely confined to the molten glass in said channel. Since the electrodes 30 have an area exposed to the glass which is commensurate with the cross sectional area of this current path there is little concentration of current at the electrode face and it is not necessary to overheat the electrodes in order to provide the desired melting temperatures in the molten glass itself. This fact makes possible the use of electrodes formed of materials which are not suited for use in the constructions shown in my prior patents. It also serves to localize the highest temperature within the furnace in the melting zone in which it is most needed. In the refining zone below the shoulder 38 little or no additional heat is required. In this zone the fining of the glass takes place aided by centrifugal forces caused by the rotation of the furnace as described in my prior patents.

The present invention has been described in one of its preferred forms, the details of which may be varied by those skilled in the art without departing from the scope of the invention as defined by the appended claims.

The invention claimed is:

1. In a rotary furnace for glass melting, a hollow body adapted to contain molten glass, means for supporting said body for rotation, a plurality of electrodes between which electric currents may be passed to melt said glass, said electrodes being spaced about the walls of said hollow body and lying in a common plane, and said walls having an annular channel formed therein in the plane of said electrodes, said channel being filled with molten glass by rotation of said hollow body to provide a current path between said electrodes.

2. In a rotary furnace for glass melting, a hollow body adapted to contain molten glass, means for supporting said body for rotation, said body having walls on which a layer of molten glass may be formed by the rotation thereof, said walls having an annular channel formed therein to provide a greater thickness of said molten glass layer in the plane of said channels than on other parts of said walls, and a plurality of electrodes between which electric currents may be passed to melt said glass, said electrodes being spaced about said walls and in contact with the molten glass in said channel.

3. In a rotary furnace for glass melting, a hollow body adapted to contain molten glass, means for supporting said body for rotation, said body having walls on which a layer of molten glass may be formed by the rotation thereof, said walls having an annular channel formed therein to provide a greater thickness of said molten glass layer in the plane of said channels than on other parts of said walls, and a plurality of electrodes between which electric currents may be passed to melt said glass, said electrodes being set in spaced pockets in said walls in contact with the molten glass in said channel.

4. In a rotary furnace for glass melting, a hollow body adapted to contain molten glass, means for supporting said body for rotation, said body having walls on which a layer of molten glass may be formed by the rotation thereof, said walls being formed to provide an annular channel having a molten glass layer therein of greater thickness than on other parts of said walls and a shoulder immediately adjacent said channel having a minimum thickness of molten glass layer thereon, and a plurality of electrodes between which electric currents may be passed to melt said glass, said electrodes being spaced about said walls and in contact with the molten glass in said channel.

5. A rotary furnace for glass melting including a hollow body adapted to contain molten glass and having a discharge opening in the bottom thereof, means for mounting said body for rotation about a vertical axis, a partition within said body dividing the same into upper and lower chambers, openings being provided adjacent the periphery of said partition for passage of ma-

terials from the upper to the lower chamber, and the walls of the lower chamber beneath said partition having an annular channel in which material passing through said openings may be received and collected by centrifugal action of the rotation of said body, and a plurality of electrodes between which electric currents may be passed to melt said glass, said electrodes being spaced about said walls and in contact with the molten glass in said channel.

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