PUBLISHED	Y. PEYCHES	Serial No.
APRIL 27, 1943.	METHOD AND MEANS FOR MANUFACTURING GLASS	295.028
BY A. P. C.	Filed Sept. 15, 1939	2 Sheets-Sheet 1

Fig. 1

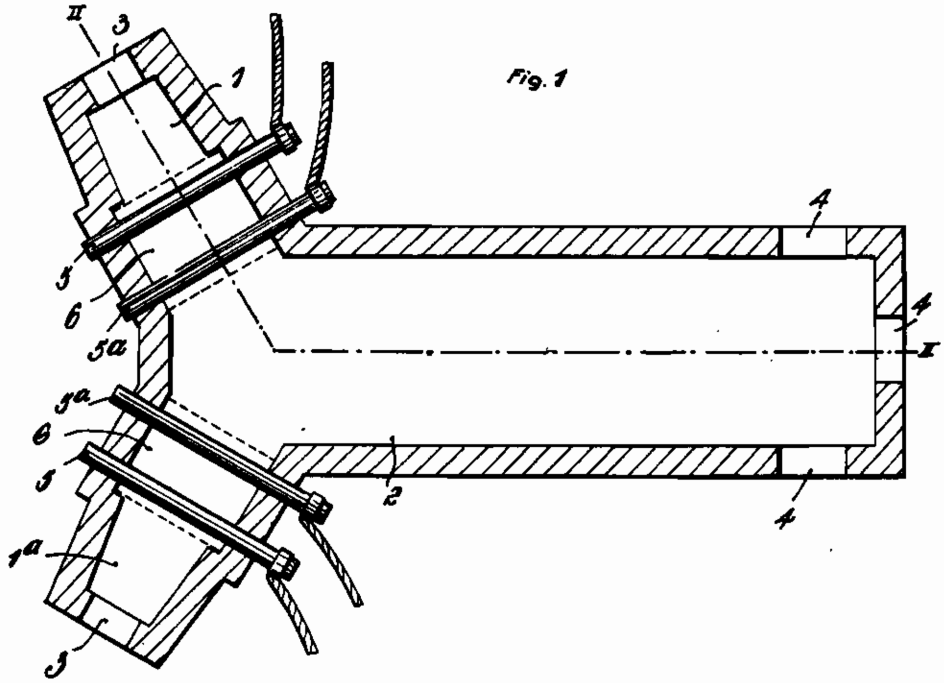

Fig. 2

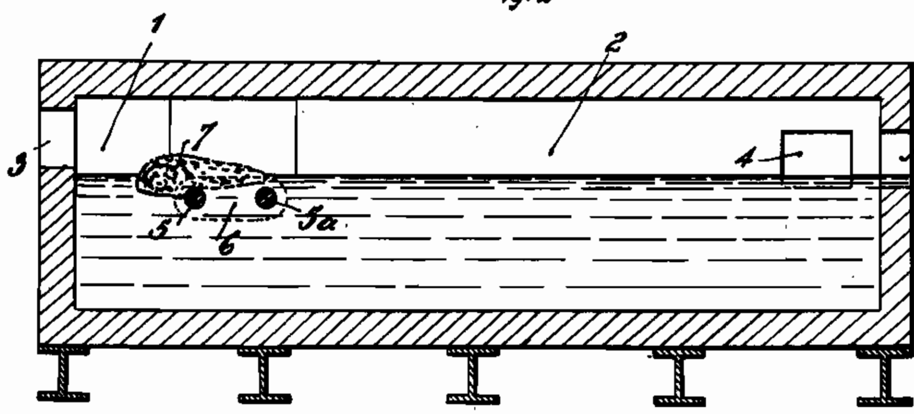

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Fig. 3

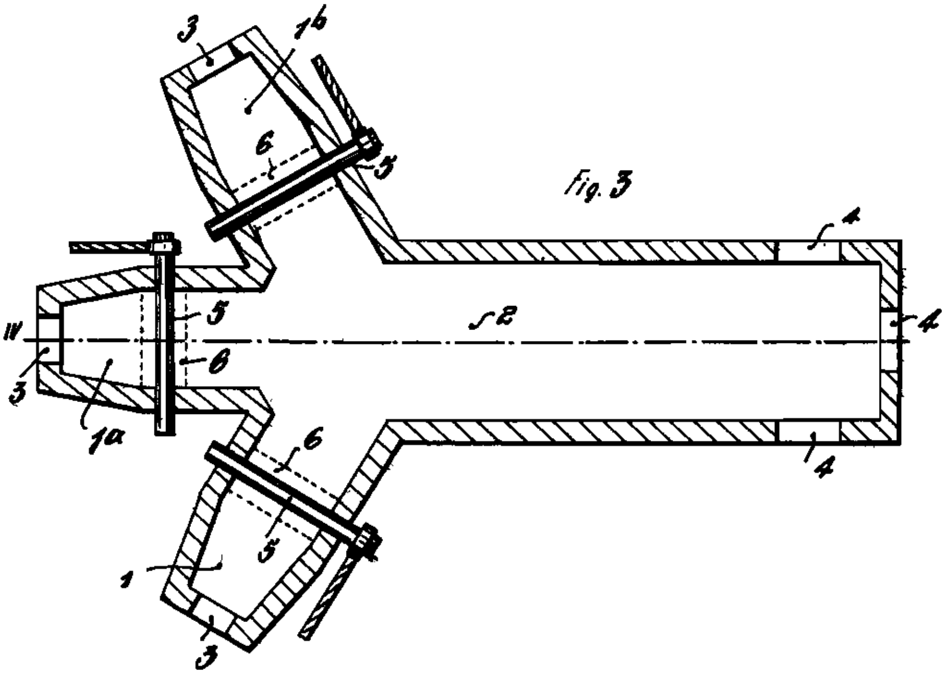
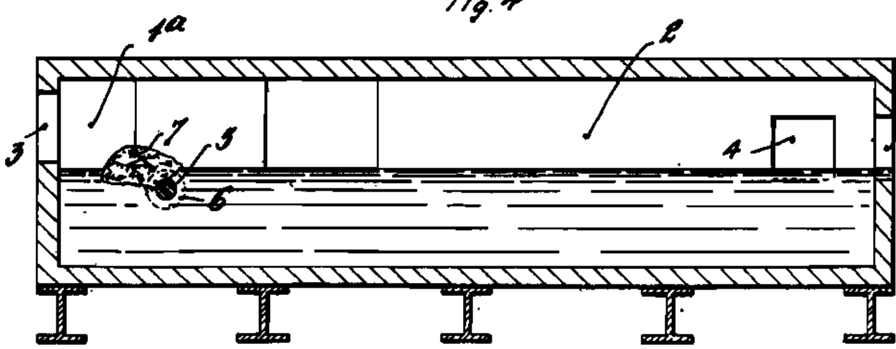


Fig. 4



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ALIEN PROPERTY CUSTODIAN

METHOD AND MEANS FOR MANUFACTURING GLASS

Yvan Peyches, Paris, France; vested in the Alien Property Custodian

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The present invention relates to furnaces for the production of glass of the type including a tank for the molten glass and in which the heating is obtained by the flow of electric current through the mass of molten glass.

The invention is applicable to the electric furnaces of the type above referred to in which the electrodes are located in the mass of glass between the inlet or chamber into which the raw material is introduced and the chamber from which glass is extracted, these electrodes creating hot zones which extend transversely to the path of the glass, substantially across the whole width of the furnace.

In the manufacture of glass, the treatment of the matter consists in a series of operations which take place in successive order and which are, as a rule, the melting operation, the refining operation and the bringing of the mass of glass to a temperature adapted to its utilization.

In furnaces of the type including a tank for the molten matters, as above mentioned, these various operations take place by the passage of the matter through a series of compartments or chambers corresponding to these respective perations and which are arranged in horizontal succession to one another. On passing from one chamber to the next one the state of the matter changes, that is to say the matter arrives in different states into the successive chambers. For instance, in the inlet or introduction zone, the raw materials, which are generally in the powdery state, are lighter than the mass of molten glass and, as a rule, they are more or less opaque to thermic rays. In the melting zone, the powdery matters melt, but as the molten mass contains a high proportion of gas imprisoned therein and therefore remains of lighter density than the fully treated matter, a freshly molten glass keeps floating at the top. Finally, in the refining zone, the molten matter is freed from its gaseous bubbles and therefore given a homogeneous state, becoming nearly transparent, while its density increases. Finally, in the zone where the mass is given the proper temperature, the last gas bubbles are driven off from the glass mass, while the latter gradually cools down from the refining temperature to the temperature of utilization.

As it is well known, it is possible to produce zones at particularly high temperature in the mass of the bath by means of electrodes transverse to the stream of glass flowing through the tank, said electrodes extending substantially across the whole width of the tank, between the inlet and the outlet thereof. These hot zones may be produced either by a pair of electrodes of opposite polarities, located at a short distance from each other, so that practically the whole of the energy supplied by the electrodes is utilized for heating a mass of glass of reduced volume. Or again a hot zone may be produced by a single electrode provided in the zone to be heated and the surface of contact of which with the surrounding glass is sufficiently small for ensuring a particularly high density of current in the vicinity of this surface whereby a considerable portion of the energy supplied by the electrode is spent in a zone of reduced volume surrounding said electrode.

In the embodiments of this kind of furnace which have been used in practice, the electrodes have been employed by distributing them in the melting and refining chambers, respectively.

The object of the present invention is to provide a furnace of the type above referred to which is more advantageous for practical purposes and, in particular, ensures a better efficiency.

With this purpose in view, an essential feature of the invention consists in localizing the whole of the electrodes in a zone of limited length in the longitudinal direction, this zone coming immediately after the introduction zone into which the raw materials are fed.

Owing to this arrangement, the whole of the heat given off by the electrodes, in the immediate vicinity thereof serves to the melting of the raw material introduced into the furnace. Said raw material therefore receives the benefit of the heat generated in all the glass zones which are in contact with the electrodes, said zones being those, as above indicated, in which the energy of the electric current produces the highest temperature.

I have found that by applying these high temperature zones wholly to the melting of the mass of glass, instead of distributing them in various portions of the furnace, I obtain, for a given consumption of power, a more active melting, owing to which the refining proper can take place in the zone following the melting zone, this result being obtained despite the absence of electrodes in the refining zone.

In some cases, it is possible, for a given consumption of electric power, to obtain, with the furnace according to the invention, better results concerning the quantity of matter treated, or the quality of the final product that is obtained than with the plants used up to this time, which included electrodes both in the melting zone and in the refining zone.

When carrying out the invention, it is advantageous to place the electrodes in the vicinity of the free surface of the bath, in such manner that said electrodes, and therefore the very hot zones that they produce around them, are placed inside the mass of matter to be molten. Furthermore, this arrangement has the advantage that the effect of the obstacle constituted by the electrodes across the path of travel of said mass of matter is added to that of the high temperature, in that it retains the raw materials in the hot zone as long as they are not molten, then ensures the disintegration of the mass of raw materials as said mass is melting.

As the zone of contact between the matters to be molten and the hot melting surface is very shallow, it is advantageous, in order to ensure a sufficient value of this area of contact, to give the furnace, in the melting zone, a width as great as possible, greater than the width of the furnace in the regions of the furnace located behind said melting zone. This arrangement permits of reducing heat losses in the portions of the furnace located behind the melting zone and therefore contribute in increasing the thermic efficiency of the plant.

In order to obtain a melting zone of great size in the direction transverse to the direction of flow of the glass stream, the furnace, in the portion thereof that includes the inlet and the melting section is preferably, according to the invention, divided into a plurality of chambers, for instance convergent and opening all into a common chamber, or main section of the furnace. In each of these elementary sections or chambers, I may provide one or several electrodes each constituted by a horizontal rod of a length corresponding to the maximum length acceptable for the type of electrode employed. I can multiply at will the number of these elementary sections or chambers in order to obtain any desired dimension of the melting zone.

Other features of the present invention will result from the following detailed description of some specific embodiments thereof.

Preferred embodiments of the present invention will be hereinafter described, with reference to the accompanying drawings, given merely by way of example, and in which:

Fig. 1 is a horizontal sectional view of a furnace of the type above mentioned made according to a first embodiment of the invention;

Fig. 2 is a sectional view on the line II—II of Fig. 1;

Fig. 3 is a horizontal sectional view of another embodiment of a furnace made according to the invention;

Fig. 4 is a sectional view on the line IV—IV of Fig. 3.

The electric furnace shown by Figs. 1 and 2 includes two chambers 1 and 1a, opening both into a common furnace section 2. The raw materials to be treated are introduced into each of these chambers 1 and 1a through loading orifices 3, and the treated glass is extracted through outlets 4. In the course of its travel from orifices 3 to outlets 4, the matter is to undergo the various thermic treatments which are to take place successively for the treatment and production of glass.

For this purpose, I provide in each of the sections 1 and 1a, behind the loading orifices or inlets 3, two electrodes 5 and 5a, each of which is arranged transversely to the path of the matter through the furnace, said electrodes extending from one wall to the other of said sections or chambers. These electrodes constitute the only glass heating means of the furnace. In other words, there are no other electrodes in the furnace. The electrodes 5 and 5a of each couple of electrodes are of opposed polarities and the interval between them is sufficiently small for causing the electric energy fed through said electrodes into the furnace to produce a hot zone 6 which is of small length in the direction of the axis of the corresponding furnace section. This hot zone is constituted by annular spaces surrounding the electrodes, respectively, and the portion of the bath, of extremely short length, extending from one electrode to the other, the whole forming the melting zone above referred to.

A furnace such as above described will work in the following manner:

Upon being introduced into the furnace through an inlet 3, a mass of raw material 7 enters zone 6, where its melting takes place under excellent conditions, owing to the concentration of energy in said melting zone.

The refining operation takes place in a farther portion of the tank, in very favorable conditions, owing to the high temperature to which the matter has been brought by its passage through the melting zone, which temperature said matter keeps when leaving said zone.

Of course, instead of having couples of electrodes parallelly spaced apart from each other, I might make use of electrodes disposed in line with one another and electrically insulated from one another. In other words, according to this arrangement, I would use, for instance a single rod such as 5, but made of one or more pairs of electrodes arranged in line and end to end but with a suitable insulation between the adjacent ends thereof, these elements being alternately connected to the two respective terminals of a suitable source of current.

In the embodiment illustrated by Figs. 3 and 4, the furnace according to the invention includes three elementary sections or chambers 1, 1a and 1b, respectively provided with inlet orifices 3 and opening into a single main section 2 at the end of which are provided outlet orifices 4.

In each of the elementary sections, there is a single electrode, respectively designated by reference numerals 5, 5a and 5b. These electrodes are each connected to one of the phases of a source of three-phase currents. They are the only lectrodes present in the furnace.

The surface of contact of these electrodes with the mass of glass in which they are immersed is chosen of an area sufficiently low for obtaining a high density of current in their vicinity and thus producing a very hot zone around these electrodes.

With an arrangement of this kind, the matter to be treated in the furnace passes over a single electrode in the course of its travel through the tank. In other words, all the electrodes are in direct contact with the masses of raw materials before any melting of said materials. Now it has been found that the melting of the matter takes place under the best possible conditions when said matter is thus brought into contact with the electrode in the form of a coherent mass, whereas its melting is less complete when the matter in question arrives to the electrode in the form of lumps dispersed in molten glass.

Another advantage of this particular arrangement is that it permits of easily obtaining the balancing of the phases, since it suffices to act upon the position of the electrodes in their respective chambers or sections for modifying the mean distances between the electrodes, and in particular making these distances equal if necessary.

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