Jan. 7, 1936. L. J. HOUZE, SR 2,026,737

LEER

Filed June 2, 1934 2 Sheets-Sheet 1

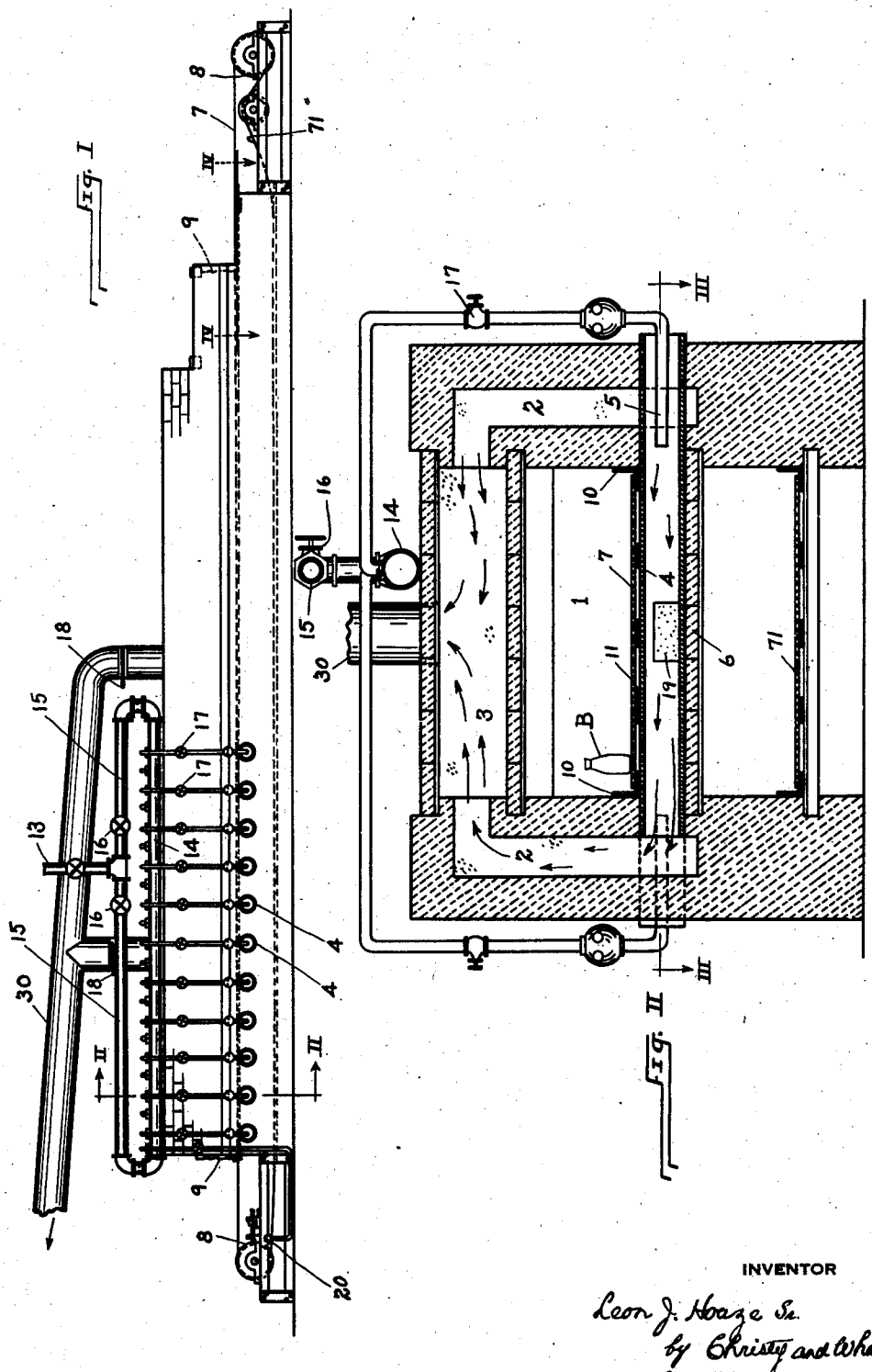


Fig. I

Fig. II

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Leon J. Houze Sr.

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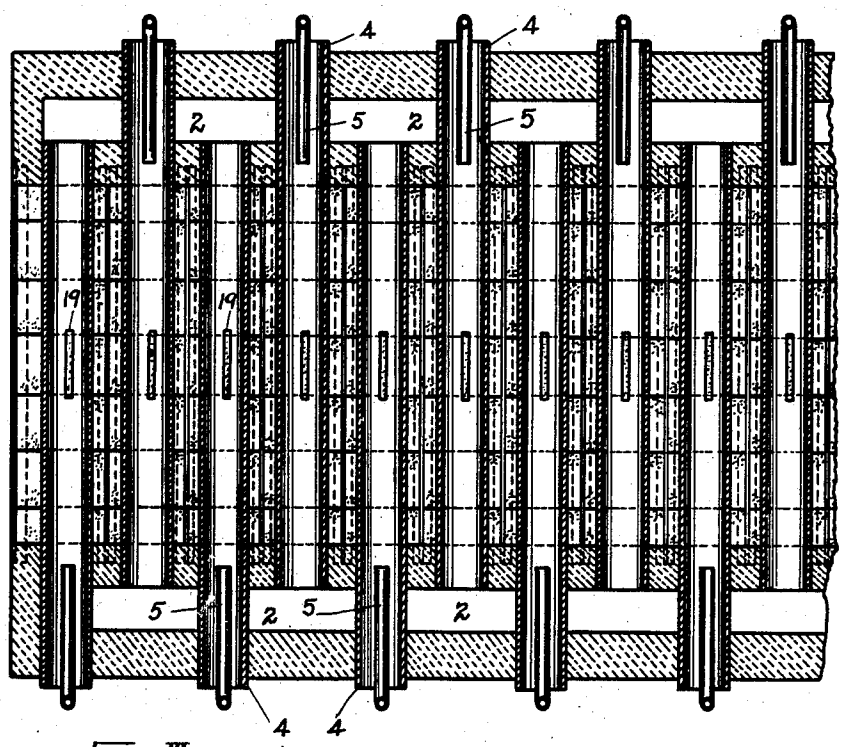


Fig. III

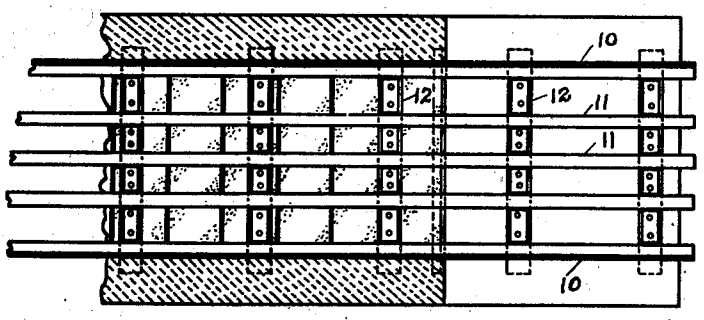


Fig. IV

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UNITED STATES PATENT OFFICE

2,026,737

LEER

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Application June 2, 1934, Serial No. 728,739

5 Claims. (Cl. 49—47)

This invention relates to annealing and consists in furnace structure. The objects of invention are, primarily, efficiency; and, incidentally, simplicity in structure and consequent economy in operation and in maintenance. The invention has been developed in the annealing of articles of glassware, and in such development it will be illustrated and described. Its applicability to the general art of annealing will be manifest.

In the accompanying drawings Fig. I is a view in side elevation of an annealing furnace for glassware,—in industrial parlance, a leer,—in which and in the operation of which the invention is realized. Fig. II is a view to larger scale, showing the leer in cross-section, on the plane indicated in Fig. I by the line II—II. Fig. III is a fragmentary view in horizontal section, on the plane indicated at III—III, Fig. II; and Fig. IV is a fragmentary view to somewhat smaller scale, on the plane indicated at IV—IV, Fig. I.

The leer is a continuous leer of muffle type and consists essentially of a double tunnel structure, ordinarily of masonry, having an inner chamber 1 and enveloping passageways 2 in the side-walls and 3 in the roof, these passageways 2 being in communication with the passageway 3. Through the inner chamber 1 of this double-walled tunnel the material under treatment advances; and as it advances it is first heated to the desired relatively high temperature and then allowed to cool again, until at the discharge end of the chamber it may safely emerge into the open air. Accordingly, from its intake end throughout a portion of its extent the chamber is heated; in order that the material under treatment may be brought to the desired high temperature. Throughout the remainder of its extent, the chamber is not heated; in order that the material within, giving up its heat, may grow cool again. Throughout that portion of the extent of chamber 1 within which the material is to be heated, a succession of metallic tubes 4, formed conveniently of lengths of cast-iron pipe, is arranged in a common horizontal plane at the base of the tunnel. The pipes extend in parallelism transversely of the tunnel and open in succession, alternately to the passageways 2, 2 in the opposite sidewalls of the structure. From the passageway 3 in the roof a stack 30 leads to a suitable chimney. Means are provided for causing flames to stream through the tubes 4 and the products of combustion to flow thence to and through the passageways 2, 2 and 3; the relatively cool gases passing at length through the stack 30 to the chimney.

The pipes 4, as will be seen on comparing Figs. II and III, exteriorly open ended, lead through the structure, across the muffle chamber 1, and into the passageways 2. Into these tubes are projected flames from nozzles 5, essentially of Bunsen-burner type.

It will ordinarily be found advantageous to close the inner tunnel at the bottom with a horizontally extending screen 6 of masonry; and to arrange the succession of tubes 4 above and adjacent to this screen. Conveniently the tubes are spaced apart at narrow intervals, as shown in Fig. III. The screen 6 and the tubes 4 together constitute the floor of the muffle chamber. Beyond the tubes, in the cooling portion of the chamber, the screen 6 alone constitutes the floor.

An endless conveyor 7, formed preferably of woven wire, is arranged in usual assembly with the muffle chamber. It extends in continuous horizontal plane longitudinally through the muffle chamber; it is trained on suitable wheels or drums 8, and its return reach 71 is disposed beneath the floor of the muffle chamber and within the heat-insulating protection of the masonry. Flexible curtains 9 of asbestos hang in the ends of the muffle chamber, to prevent draft through the tunnel; the heated condition of the air within sufficing to prevent harmful penetration of cold air through smaller apertures.

The long reaches of conveyor, and particularly the ware-carrying reach within the chamber 1, rest upon rails. These rails conveniently include rolled steel angles 10 at the sides, and rolled steel strips 11 at intermediate intervals. These rails extend longitudinally through the tunnel, in continuous length, or, as ordinarily will be the case, in sections, and throughout the portion of the tunnel in which the tubes 4 are found they may conveniently rest immediately upon the tubes. Elsewhere they rest upon beams 12 provided to sustain them. These beams, as is indicated in Fig. IV, may by means of applied blocks be formed with channels for the reception of the rails. The rails rest upon the support, unrestrained by bolt, rivet, or weld, but freely responsive in elongation and contraction to temperature variations incident to heating the furnace and maintaining it in operation. Thus the smooth progress of the conveyor is insured.

It has been found advantageous in a furnace built in the manner described to throttle somewhat the flow of flame from the tubes 4 into the passageways 2, by placing in the tubes split bricks 19. These bricks, becoming incandescent, will be further effective to prevent accidental puffing out of the flame.

A burner 20 may be provided to play upon the conveyor and raise its temperature (that has decreased in its return travel) just before it receives the ware and advances again with its burden into chamber 1.

Certain refinements of structure and of operation may be noted. Gas is supplied to the burners from a supply pipe 13 through a header or manifold 14. Communication from the supply pipe to the manifold is through connections 15 to the two ends of the manifold, such two lines of connection being severally controlled by valves 16. The supply of gas to the burners is subject to several control, by means of valves 17. The stack exit is multiple, leading from the passageway 3 at a point intermediate the heating portion of the tunnel and at a second point beyond the heating portion of the tunnel, and the two exits are severally subject to dampers 18. By such means, manifestly, the temperature conditions within chamber 1 may be controlled and varied, and the gradient of rise of temperature of the articles under treatment may be minutely varied and brought to optimum value.

In the structure and operation of this furnace recognition is given to the truth, commonly disregarded, that articles to be annealed usually are of greater mass at the base than at the upper edges. And, whereas in many annealing furnaces the articles under treatment receive greater accessions of heat in their superior portions, in this furnace the articles receive the greater accessions of heat in their bases.

Considering the chamber 1 and an article such as a milk bottle B resting upon the conveyor within it, the facts will be perceived,—(1) that the bottle is isolated within a chamber through whose walls heat is transmitted to it from without; (2) that the floor wall (in this case the metal walls of the tubes 4) is more highly heat-penetrable than are the side-walls and roof; and that the access of heat to the article, not seriously obstructed by the woven wire (or pan) conveyor and the rails upon which the conveyor rests, is freest from beneath; and (3) that, considering the stream of flame and hot gas from the point of spring at nozzle 5 to the point of exit to stack 30, it will be manifest that the generation of heat is at a maximum in the tubes 4, precisely where penetrability to the ware is maximum, and that in the side-walls and roof of the chamber, where penetrability is less, there is less heat to penetrate. It will be remarked that, the maximum heat generation being within the tubes, the structure elsewhere, subject to less intense heat, may be constructed in simple manner. Specifically, the arches that constitute the floor and roof of the muffle chamber may be and conveniently are flat arches. And indeed it is entirely practicable to build the masonry portions of ordinary red brick, rather than of the more costly fire brick.

In other respects, construction and operation are familiar. The conveyor as it approaches the intake end of the tunnel is disposed in horizontal plane, and as the conveyor continues in endless travel, the ware to be annealed is there placed upon it. At the delivery end the conveyor continues in the same horizontal plane for a sufficient distance to allow the ware to grow cooler in the air, until it comes to a temperature proper for its removal.

I claim as my invention:

1. A muffle leer in which the bottom wall of the muffle chamber is of a material of relatively high heat penetrability and the side-walls and roof are of other material of relatively low heat penetrability, with means for causing flame to impinge upon the bottom wall and the products of combustion, flowing thence, to envelop the muffle chamber externally.

2. A muffle leer of continuous type including an inner chamber with side-walls and roof of refractory material, passageways for hot gases externally arranged and enclosing such side-walls and roof, a floor for said inner chamber including a succession of transversely extending metallic tubes leading to the side-wall-enclosing passageways and opening in alternation to the passageway on one side and the other, means for projecting flames into such tubes, and means for causing the articles to be annealed to advance through said chamber above said transversely extending tubes.

3. A leer structure of continuous type comprising a double tunnel of refractory material having an inner chamber and enveloping passageways in side-walls in communication with a passageway in the roof, a succession of metallic tubes arranged in a common plane at the base of the tunnel, extending in parallelism transversely of the tunnel constituting part of the floor of the inner chamber and opening in succession alternately to the passageways in the side-walls, means for causing flames to stream through the said tubes and the products of combustion to flow thence through the passageways in the side-walls, and the passageway in the roof, and means for causing articles to be annealed to advance through the inner chamber above the succession of tubes.

4. A leer structure of continuous type comprising a double tunnel of masonry having an inner chamber and enveloping passageways in side-walls in communication with a passageway in the roof, a horizontal screen of masonry closing the inner chamber at the bottom, a succession of metallic tubes arranged above the screen of the inner chamber, extending in parallelism transversely of the tunnel and with said horizontal screen constituting the floor of the inner chamber, said tubes opening in succession alternately to the passageways in the side-walls, a stack leading from the passageway in the roof, means for projecting flame into said tubes, and a conveyor advancing through the inner chamber in a plane above the succession of tubes.

5. A muffle leer of continuous type including an inner chamber with heat-insulating side-walls and roof, passageways for hot gases externally arranged and inclosing such side-walls and roof, a floor for said inner chamber including a succession of transversely extending tubes of heat-conducting material, a plurality of gas burners arranged in the said tubes, an elongate gas header, connections from said header at successive points in its longitudinal extent to the said burners severally, and two valve-controlled gas conduits leading to the said header at the ends thereof, whereby the succession of flames springing from the burners and within the tubes may be adjusted in relative intensity.

LEON J. HOUZE, Sr.