July 7, 1925. 1,545,008

T. H. O'BRIEN

INDUSTRIAL FURNACE

Filed April 18, 1923 2 Sheets-Sheet 1

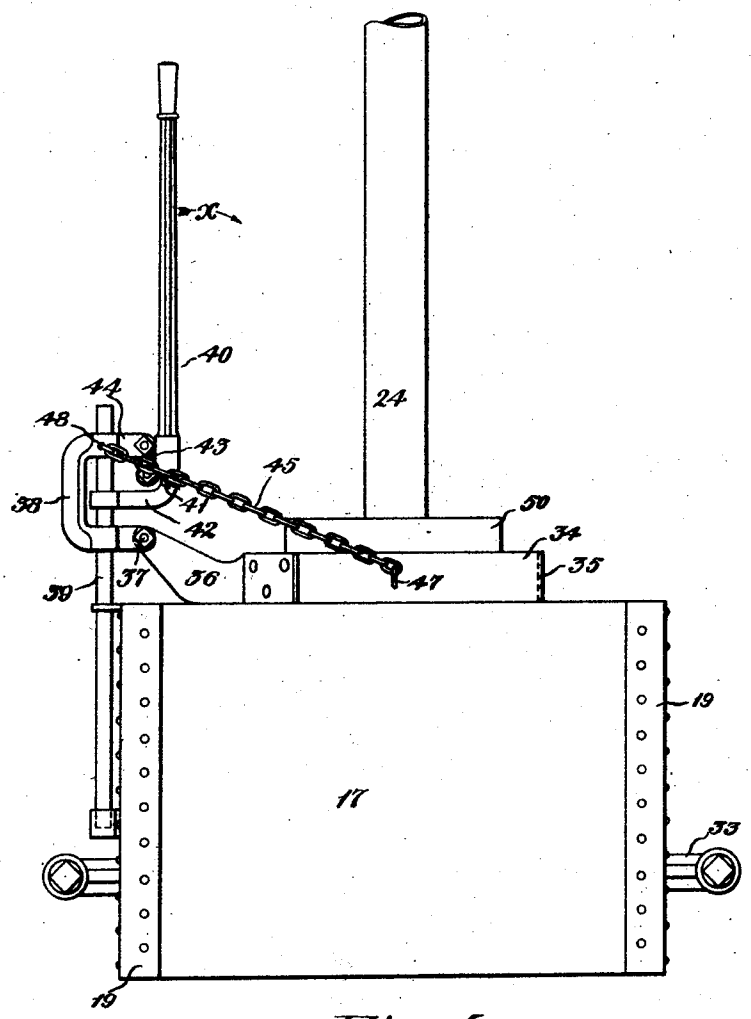

Fig. 1.

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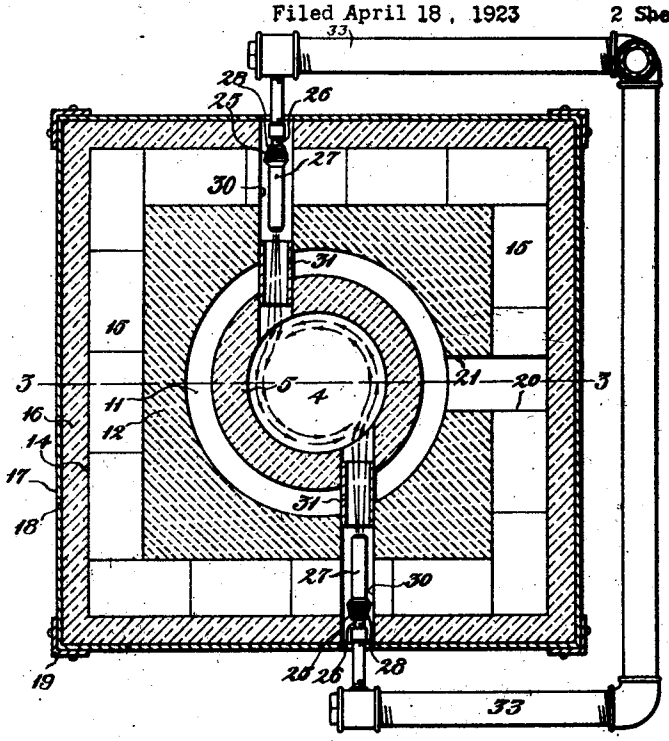

Fig. 2.

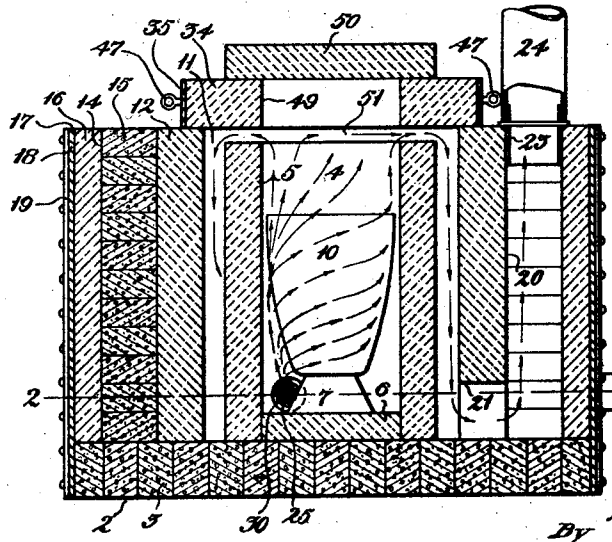

Fig. 3.

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Patented July 7, 1925. 1,545,008

UNITED STATES PATENT OFFICE.

THOMAS H. O'BRIEN, OF CRANSTON, RHODE ISLAND.

INDUSTRIAL FURNACE.

Application filed April 18, 1923. Serial No. 632,858.

To all whom it may concern:

Be it known that I, THOMAS H. O'BRIEN, of Cranston, in the county of Providence, State of Rhode Island, a citizen of the United States, have invented certain new and useful Improvements in Industrial Furnaces, of which the following is a specification.

This invention relates to industrial furnaces for melting enamel, glass, metal and other materials employed in various arts of manufacture.

One object of the invention is to provide a furnace adapted to be heated to the required high degree of temperature by means of atmospheric burners.

Another object of the invention is to provide a furnace heated by gas-burners to which the fuel is supplied under normal pressure and without the use of a forced blast.

Another object of the invention is to provide a furnace having its walls insulated to effectually retain the heat and prevent the escape of the combustion gases, so as not to unduly raise the temperature of the surrounding atmosphere.

Another object of the invention is to provide a furnace which is more economical to operate and more efficient in use than similar devices heretofore employed for like purposes.

Further objects of the improvement are set forth in the following specification which describes a preferred embodiment of the invention as illustrated by the accompanying drawings. In the drawings:

Fig. 1 is a general view in side elevation of the complete furnace;

Fig. 2, a plan view of the furnace showing its walls in section on the line 2—2 of Fig. 3; and

Fig. 3, a vertical sectional view of the furnace taken on the line 3—3 of Fig. 2.

Referring to the drawings, the improved furnace is preferably of rectangular shape in plan and elevation in order that its walls may be built up of conventional fire-brick and enclosed by a suitable sheet-metal sheathing. As shown more particularly in Fig. 3, a flat base or foundation 2 is first laid by standing the bricks 3 on their sides in closely adjacent relation. Above the center of the base is erected a combustion-chamber 4 which preferably consists of a vertical cylinder 5 having relatively thick walls of fire clay or other suitable refractory material. The bottom of the cylinder 5 rests on the base 2 and within its walls is a false bottom 6 of refractory material surmounted by a tapered pedestal or stool 7 which serves as a support for the crucible or pot 10 to raise the latter above the floor of the combustion-chamber.

Surrounding the walls 5 of the combustion-chamber 4 is a cylindrical air space or exhaust-chamber 11 formed by a circular wall of fire clay or other suitable refractory material built up in the shape of a hollow block 12 as shown in Fig. 2. The mass or block 12 is enclosed within a rectangular, walled structure 14 built up of fire-brick 15, the top of the walls surrounding the inner combustion-chamber being slightly above the top of the cylinder 5.

Enclosing the fire-brick wall 14 is a layer of suitable material 16 forming a heat-insulating medium or lining between the furnace proper and the outer shell or sheathing 17. The shell or casing 17 may be constructed of sheet-iron or steel plates 18 set down against the sides of the base 2 and held together at the corners by angle-irons 19 riveted to the edges of the plates.

In one or more of the side-walls 14 of the furnace is a vertical draft-passage or flue 20 communicating with the cylindrical exhaust-chamber 11 at the bottom thereof through a duct 21. In most cases it has been determined that the single flue shown in Figs. 2 and 3 is sufficient for the purpose intended, but if more draft is required I may employ one or more additional flues in the other walls of the furnace. Inserted into the top of the flue 20 is a sleeve or thimble 23 to which is connected a draft-pipe 24 leading to a stack or chimney, not herein shown. In some cases the usual check-damper or air opening is employed in the draft-pipe 24 to regulate the draft therethrough, but the use of such draft-regulating means being well known in the art the arrangement thereof is not herein shown.

As before stated, my improved furnace is heated by means of one or more atmospheric burners which are operated without the use of pressure or forced blast. Fig. 2 illustrates two burners of the Bunsen type adapted for operation with ordinary illuminating-gas such as supplied for household purposes. It is to be understood, however, that other forms of gaseous or liquid fuel may

be used in the furnace with different types of atomizing burners, if desired. The Bunsen burners 25 herein shown are of a well known construction and consist of the usual arrangement of tubes or nozzles 26 having their ends enclosed by outer shells or sleeves 27 provided with air-inlets 28 through which the air is drawn to supply oxygen to the flame at the tip of the burners. The burners 25 are inserted at the sides of the furnace through lateral openings 30 reaching through its several walls. The openings 30 lead into the combustion-chamber 4 near its bottom and are preferably arranged in tangential relation with its inner curved walls. Suitable tubes or sleeves 31 are inserted in the openings 30 to bridge the gap at the air space 11 whereby to provide a continuous air-passage from the outer atmosphere to the inner combustion-chamber 4. It will be observed that the openings 30 are of sufficient size to provide an air-space completely surrounding the burners 25, so that besides the air admitted through the outer sleeves 27 of the burners, a secondary air-supply is drawn in around the burners.

The burners 25 are supplied with gas from a suitable system of piping 33 connected with the city mains or with any other source of fuel such as an industrial gas-generating plant. It is to be understood, however, that if preferred I may use suitable atomizing burners for fuel-oil which will operate with the same effect as the gas-burners shown. The supply of fuel may be regulated from suitable cocks or valves of usual arrangement, not herein shown.

Adapted to seat across the opening in the top of the furnace is a circular cover 34 formed of a thick slab of refractory material protected by a metal hoop or ring 35 surrounding its periphery. The cover 34 carries a hinge-arm 36 pivoted at 37 to a yoke 38 mounted to slide on a vertical rod or post 39. A hand-lever 40 is pivoted at 41 to an arm 42 on the post 39 and connected by a toggle-link 43 to the upper arm 44 of the yoke 38. A pair of chains 45 connected to eye-bolts 47 on the sides of the cover 34 are fastened to the yoke 38 at 48 to stay the cover therefrom when it is lifted by sliding the yoke upwardly on the post 39. The cover is lifted away from the top of the furnace by moving the lever 40 in the direction indicated by the arrow *x* in Fig. 1, the link 43 acting to slide the yoke upwardly to raise the cover by means of the hinge-arm 36 and chains 45. After the cover is raised a slight distance off from the top of the furnace it may be swung to one side of the opening to give access to the combustion-chamber 4 in placing the crucible 10 in the furnace or removing it therefrom. The arrangement of the cover and its operating-means as herein shown is common to other types of furnaces and no claim is made for this construction.

As shown in Fig. 3, the main cover 34 is provided with a central opening 49 which is normally closed by a lighter, secondary cover or slab 50. The slab 50 may be lifted off by hand or slid to one side to allow the material to be poured into the crucible 10, or to permit the operator to inspect the progress of the melting operation. It is to be noted that the cover 34 does not fit down against the top of the walls 5 of the combustion-chamber 4, but on the contrary a space 51 is left beneath the cover for the egress of the combustion-gases from the chamber 4 into the exhaust-chamber 11, whence they are scavenged or drawn out through the flue passages 20 and 21. The complete method of operation of the improved furnace is as follows:

The enamel, glass, metal or other material to be melted or otherwise heat-treated is placed in the combustion-chamber 4, being usually contained in a crucible 10 when in powdered or broken form. The cover 34 is then placed on the top of the furnace to close the opening above the combustion-chamber 4, the crucible or cannon-pot 10 being held above the floor of the chamber by its pedestal or stool 7. The gas or other fuel is then turned on and the burners 25 lighted at their tips by inserting a taper in the openings 30. The egress of fuel under normal pressure at the tip of the burners 25 causes air to be drawn in through the inlets 28 to supply the flame with oxygen; and a further supply of air enters through the openings or ducts 30, is heated by the burners, and fed to the flame to cause a maximum degree of combustion of the fuel. The ingress of the air through the ducts 30 is effected by the draft set up in the furnace through its flue-passages leading from the top of the combustion-chamber 4 down through the exhaust chamber 11, and thence through the duct 21 and flue 20 connected to the stack or chimney.

The flame from the burners is injected into the combustion-chamber 4 in a tangential direction with respect to the inner cylindrical surface of its walls 5, and this action causes a whirling motion of the combustion-gases to circulate them around the sides of the crucible 10 as they rise to the top thereof to escape through the space 51 into the exhaust-chamber 11. From the opening or space 51 the gases are drawn down to the bottom of the exhaust-chamber 11 to concentrate their heat against the outer walls of the combustion-chamber 4; and finally the gases escape through the duct 21 and are drawn out through the flue 20 and pipe 24.

It will thus be seen that the crucible 10 is subjected first to the direct blast of the hot gases, and afterward, as the process of

combustion continues in the unburnt particles of fuel, the heat therefrom is applied to the outer walls of the combustion-chamber 4 to further raise the temperature therein. As the gases are drawn down through the exhaust-chamber or passage 11 and around the outer walls of the combustion-chamber 4 their heat will finally become dissipated so that as they pass out through the flue 20 they will be cooled to a very considerable degree. In this way the maximum effect of combustion is maintained in and around the combustion-chamber 4 and concentrated on the crucible 10 so that little or no heat is lost, the gases having given off substantially their full capacity of heat units before passing out through the flue 20.

It is to be noted that my improved furnace may be operated without the use of blowers, fans or other forced-blast appliances, and also that the burners do not require pressure-means for feeding the fuel. Nevertheless, it has been demonstrated that owing to the peculiar arrangement and method of operation of my improved furnace it may be heated to a temperature equal to or in excess of that produced in furnaces using a forced-blast, and with less consumption of fuel. Moreover, owing to the efficient arrangement of the burners the furnace can be brought to the required temperature very quickly without the usual delay necessary for preheating furnaces of other types. My improved furnace is therefore more economical to operate and more efficient in use while also being more convenient to install on account of its adaptability for use with the gas-supply generally available in industrial plants.

The improved method of insulating the furnace not only serves to retain the heat within the combustion-chamber to provide for the maximum effect of combustion, but further prevents overheating the air in the room or building in which the furnace is operated.

Another advantage of my improved furnace is that it is practically noiseless in operation. That is to say, the usual roar from the forced blast is eliminated so that where several furnaces are operated in a single room or adjacent an office there is no objectionable noise heard.

It will thus be seen that my improvement provides for greater economy in the cost of operation of the furnace; an increased efficiency of operation for the purpose intended; and greater convenience and facility of installation and operation.

While only one preferred embodiment of the invention is herein shown and described, it will be obvious that various modifications may be made in the structure and arrangement of the device without departing from the spirit or scope of the invention. Therefore, without limiting myself in this respect I claim:

1. An improved furnace for industrial uses comprising an inner walled combustion-chamber, outer walls enclosing the walls of the combustion-chamber with an air-space therebetween forming an exhaust-chamber, a draft-flue leading from the exhaust-chamber through the outer walls, a duct leading from the atmosphere through the outer and inner walls and closed to the exhaust-chamber, and an atmospheric burner arranged to direct its flame through said duct and in a direction tangential to the walls of the combustion-chamber.

2. An improved furnace for use in the manufacturing arts comprising a central walled combustion-chamber, outer walls enclosing the walls of the combustion-chamber and spaced at a distance therefrom to provide a continuous surrounding exhaust-chamber, a draft-flue leading from the bottom of the exhaust-chamber, a duct leading from the atmosphere through the outer and inner walls and closed from the exhaust-chamber, and an atmospheric burner arranged to direct its flame through said duct in a direction tangential to the interior of the combustion-chamber.

3. An improved furnace for use in the manufacturing arts comprising an inner cylindrically-walled combustion-chamber, outer heat-retaining walls enclosing the walls of the combustion-chamber with a continuous surrounding air space constituting an exhaust-chamber therebetween, a flue leading from the bottom of the exhaust-chamber, an air duct leading through the outer and inner walls and closed from the exhaust-chamber, and an atmospheric burner inserted in said air duct and arranged to direct the flame in a tangential direction with respect to the inner cylindrical wall of the combustion-chamber.

4. An improved industrial furnace comprising an inner cylindrically-walled combustion-chamber, outer laminated heat-insulating walls enclosing the walls of the combustion-chamber with a surrounding air-space therebetween constituting a continuous exhaust-chamber therefor, a flue leading from the bottom of the exhaust-chamber, a continuous air-passage leading through the outer and inner walls into the interior of the combustion-chamber and closed to the exhaust chamber, an atmospheric burner disposed within the air-passage to leave an air-space therearound and arranged to direct the flame therefrom tangentially of the walls of the combustion-chamber, and a fuel feed-pipe connected to supply the burner.

5. An improved industrial furnace comprising a base, a central cylindrically-walled combustion-chamber surmounting the base, a hollow mass of refractory material sur-

rounding the sides of the combustion-chamber with a continuous air-space between the walls of said chamber and the interior of the mass constituting an exhaust-chamber, a wall of fire-brick surrounding the mass of refractory material, a metal sheathing enclosing said wall, heat-insulating-material between the brick wall and the sheathing, a flue leading from the exhaust-chamber through the outer walls, a duct leading from the atmosphere through the outer and inner walls and closed to the exhaust-chamber, and an atmospheric burner arranged to direct its flame through said duct tangentially of the inner walls of the combustion-chamber.

In testimony whereof I affix my signature.

THOMAS H. O'BRIEN.