

May 12, 1953

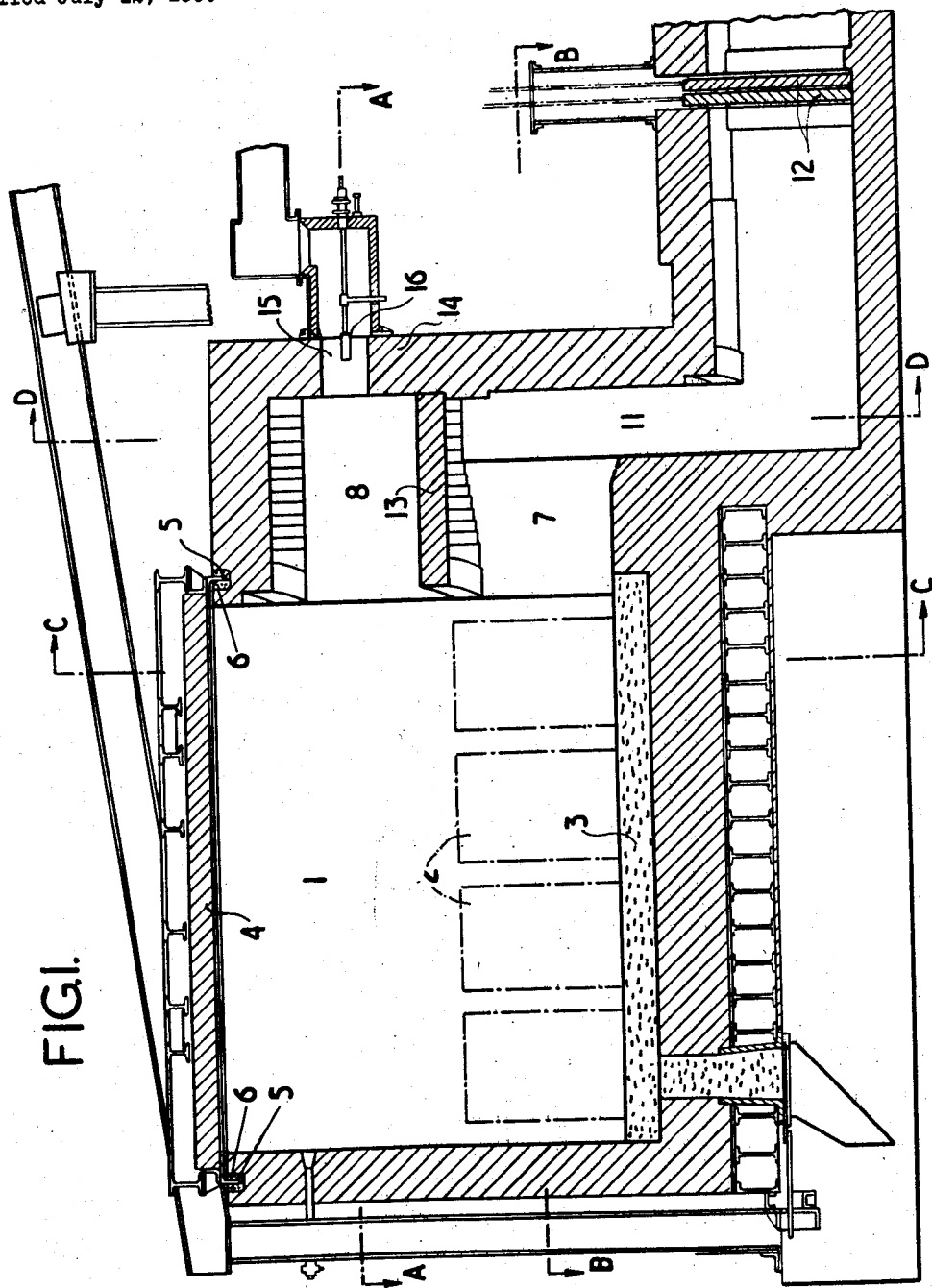
J. F. R. JONES

2,638,334

FURNACE FOR THE HEAT TREATMENT OF MATERIALS

Filed July 12, 1950

4 Sheets-Sheet 1



INVENTOR

JOHN FREDERICK ROBERT JONES

BY

Francis J. Klempfner
ATTORNEY

ATTORNEY

May 12, 1953

J. F. R. JONES

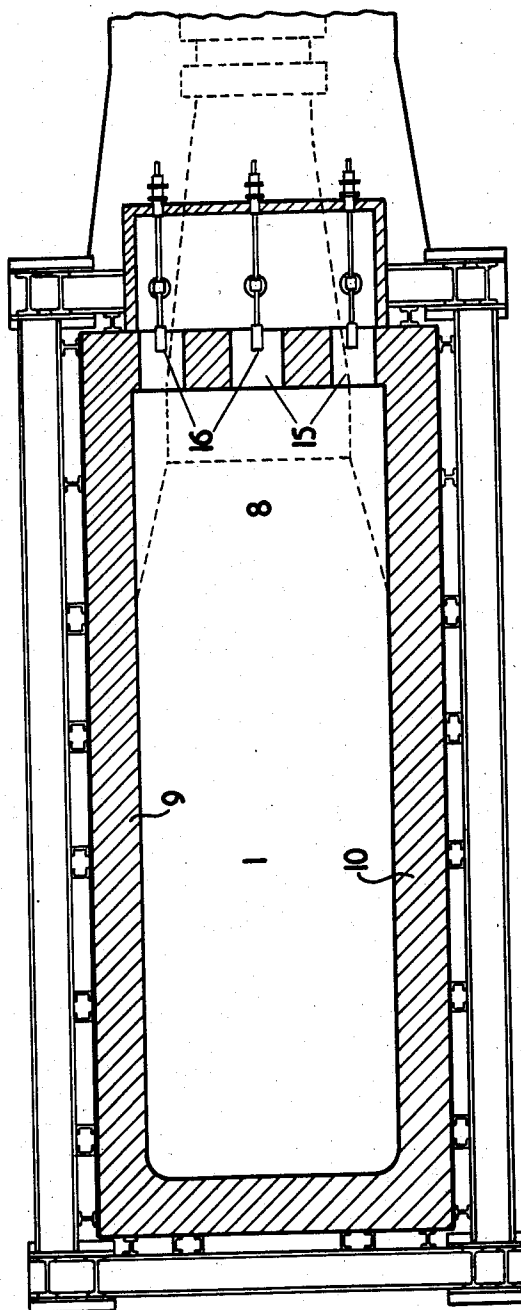
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FIG.2.



INVENTOR

JOHN FREDERICK ROBERT JONES

BY

Francis J. Klempf

ATTORNEY

May 12, 1953

J. F. R. JONES

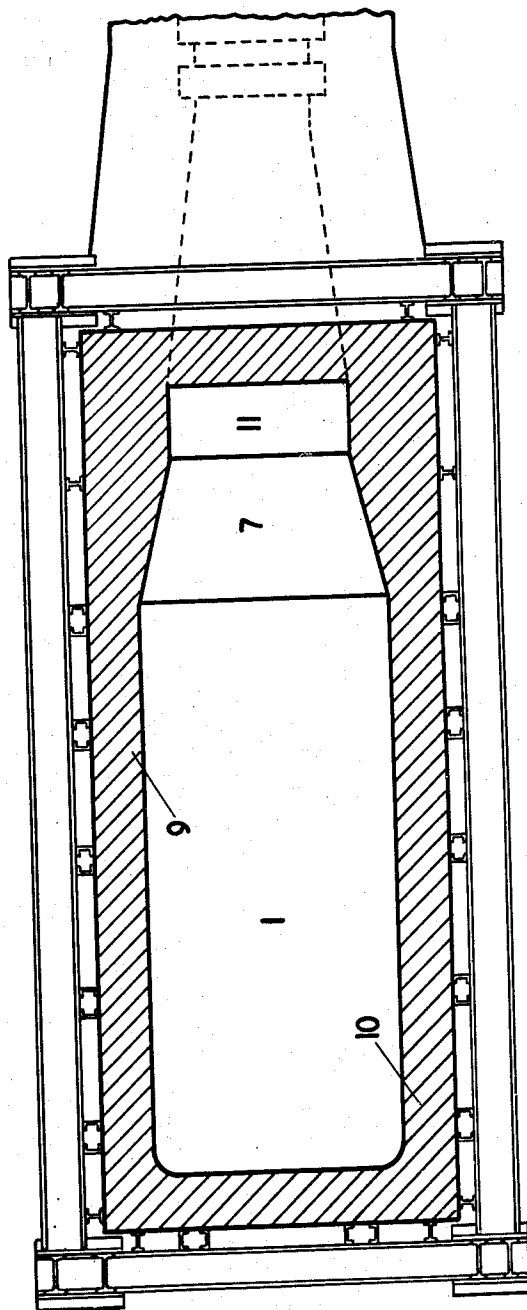
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FURNACE FOR THE HEAT TREATMENT OF MATERIALS

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FIG. 3.



INVENTOR

JOHN FREDERICK ROBERT JONES

BY

Francis J. Klemfay
ATTORNEY

May 12, 1953

J. F. R. JONES

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FIG. 5.

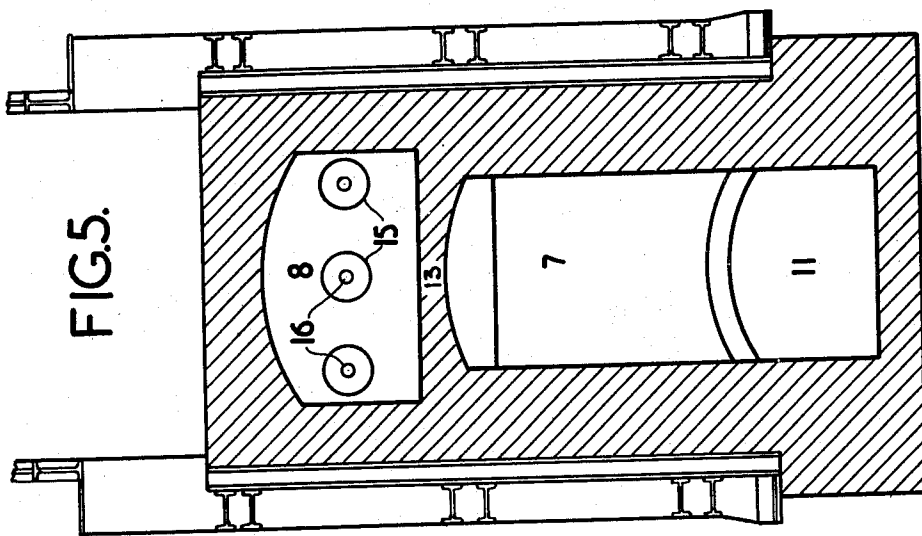
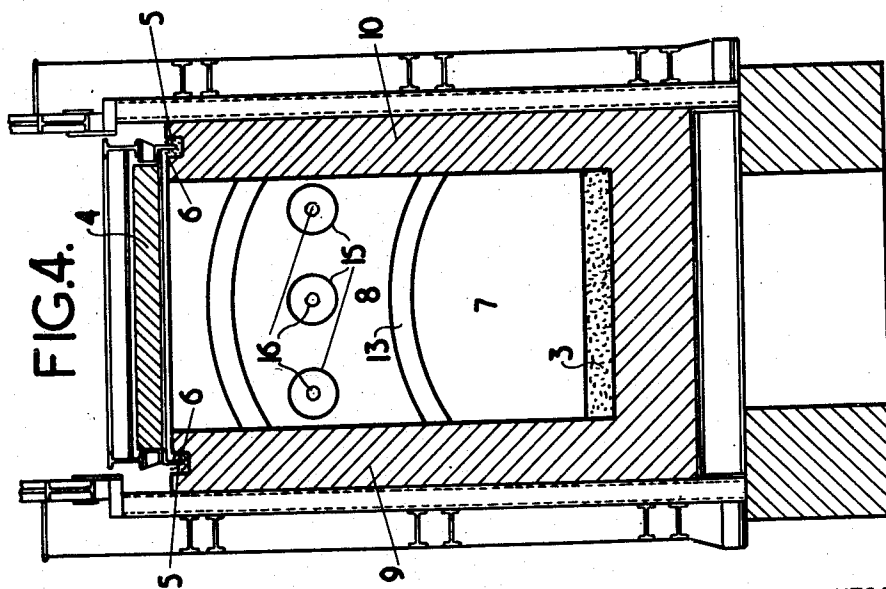


FIG. 4.



INVENTOR

JOHN FREDERICK ROBERT JONES

BY

Francis J. Klempf

ATTORNEY

UNITED STATES PATENT OFFICE

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FURNACE FOR THE HEAT TREATMENT OF MATERIALS

John Frederick Robert Jones, Shotton, England

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4 Claims. (Cl. 263—40)

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This invention has reference to furnaces for the heat treatment of materials and is more particularly concerned with those of the soaking pit or like type wherein metal ingots or other work pieces to be heat treated are inserted into a treatment chamber through a charging aperture in the top of the furnace on to the hearth of the said chamber, the charging aperture then being closed by a removable cover.

The principal object of the present invention is to enable the whole of any batch of work undergoing treatment to be heated uniformly to a predetermined temperature in a minimum period of time by minimizing the velocity of the flow of hot gases within the treatment chamber and rendering such flow uniform throughout the chamber.

A further object of the invention, when applied to gaseous or liquid fuel fired furnaces, is to obviate burning the work by flame impingement, and to ensure that the fuel is completely combusted, so that all potential heat is converted into sensible heat, before the hot combustion products reach the work.

In accordance with the said invention, an exhaust chamber is formed within the furnace structure between the treatment chamber and the inlet to a flue through which the waste gaseous products are discharged, one end, which is of generous cross-sectional dimensions, of the said exhaust chamber opening wholly and directly to the interior of the treatment chamber, whereas its opposite end is closed except for the said flue inlet, the arrangement being such that the rate of flow of the hot gases within the work receiving zone of the treatment chamber is substantially equal to the natural speed of convection, and that no local increases in the velocity of the hot gases are created within the said zone under the influence of the suction existing at the flue inlet.

Preferably the open end of the exhaust chamber extends between the opposite sides of the treatment chamber and from the furnace hearth to a position substantially midway between the said hearth and the charging orifice of the treatment chamber; the depth of the said exhaust chamber may be substantially uniform from its open end to its closed end, whereas its width may decrease gradually.

The work heating gases may be fed to and transversely of the treatment chamber through an orifice formed in the treatment chamber wall directly above the open end of the exhaust chamber, the said gas orifice forming the open

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end of a combustion chamber in the opposite closed end of which burners are located. The said combustion chamber may be of substantially uniform area between its open and closed ends, which area may be equal to the area of the open end of the exhaust chamber.

In order that the invention may be more readily understood and carried into practice, reference will now be made to the accompanying drawings, wherein:

Figure 1 is a sectional elevation of a rectangular soaking pit, and

Figures 2, 3, 4 and 5 are sections taken along the lines A—A, B—B, C—C and D—D, respectively, shown in Figure 1.

The soaking pit consists of a treatment chamber 1 of rectangular cross section and having an open upper end which serves as the charging and discharging orifice for ingots 2 (indicated in chain dotted lines in Figure 1); the floor or bed of the said chamber is covered with a layer 3 of coke breeze which serves as a removable hearth on which the ingots are seated on end when charged into the furnace.

When a batch of ingots is undergoing heat treatment, the open upper end of the treatment chamber is closed by a flat removable cover 4 which seats upon the rim of the chamber orifice and is provided along the underside of its four edges, with a continuous depending flange or skirt 5 which extends into a sand or liquid filled trough 6 in the furnace structure to provide a gas tight seal between the cover and furnace structure.

Two superimposed chambers 7 and 8 open into the treatment chamber 1 at one end of the latter.

The lower chamber 7, at its open end, extends across the width of the treatment chamber between the side walls 9 and 10, whereas, at its closed end, a flue 11 opens into the said lower chamber through the floor thereof, the said flue communicating with a stack, chimney or equivalent discharge outlet for waste gaseous products and being controlled by an adjustable damper 12. The chamber 7 thus serves as an exhaust chamber.

The floor of the exhaust chamber is flush with the removable hearth 3 and its arched roof 13 is located at a position which is more or less midway between the said hearth and the top or mouth of the treatment chamber. The exhaust chamber is substantially uniform in height from its open end to its opposite closed end but its width gradually decreases from the said open end

to the gas inlet end of the flue 11 (see Figure 3).

The open end of the upper chamber 8, hereinafter referred to as the combustion chamber, has an area equal to the area of the open end of the exhaust chamber; the said combustion chamber end also extends transversely of the treatment chamber between the side walls 9 and 10 and, therefore, its height is also more or less equal to half the height of the treatment chamber 1. However, the combustion chamber differs from the exhaust chamber in that it is of uniform area between its open and closed ends and in that the end wall 14 thereof is formed with three holes 15 through each of which a burner 16 fires into the combustion chamber.

The height of the treatment chamber is considerably greater than that of the ingots 2 to be subjected to heat treatment and, as can readily be seen from Figure 1, the dimensions of the three chambers are such that, when a charge of ingots is positioned upon the hearth 3, their upper extremities do not project above the roof 13 of the exhaust chamber.

Hence, when a charge of ingots is being heated, a space of considerable depth exists between the tops of the ingots and the underside of the cover 4; this space and the interior of the combustion chamber 8 forms a single large combustion zone wherein complete combustion of the fuel takes place, and all potential heat available in the fuel is converted into sensible heat. In this manner, burning of the ingots by the direct impingement of flames, is prevented and, moreover, when the hot products of combustion flow downwardly of the treatment chamber into the lower work containing zone of the said chamber, they are at their maximum temperature.

The cross sectional area of the treatment chamber is such that the velocity of the downwardly moving combusted gases is substantially equal to the natural speed of convection, namely in the region of three to four feet per second. Also, the provision of the exhaust chamber between the work containing zone of the treatment chamber and the inlet to the flue 11, ensures that the said downward gas flow is not influenced by the suction created at the said flue inlet; therefore the hot products of combustion flow at a uniform speed throughout the cross-sectional area of the treatment chamber and each and every portion of the exposed surfaces of the ingots is subjected to the same heat treatment since there is little or no tendency for the gaseous products to flow along other than a vertical path. Further, due to the low velocity of the combustion products within the work containing zone of the treatment chamber, the ingot temperature is the principal factor which determines the direction of flow within the said zone; therefore, should any part of the charge of ingots (for example, that part which is furthest from the open end of the combustion chamber) become heated to a lesser degree than the remainder of the charge, this temperature difference causes more of the hot products to flow over the said cooler part.

I claim:

1. In a soaking pit furnace or the like for the heat treatment of ingots and other work pieces, in combination, a treatment chamber having a hearth, an exhaust chamber contiguous to said treatment chamber and having an open end opening directly into said treatment chamber along one side thereof, said open end extending upwardly from adjacent said hearth to a height

generally as great normally as the height of the work-receiving portion of said treatment chamber, said open end further extending substantially across the full width of said side, a flue connected to the other end of said exhaust chamber, said open end having an area greater than the area of said flue, said exhaust chamber further decreasing in cross-sectional area in a direction toward said flue such that the velocity of the waste gases passing through said exhaust chamber is increased within said exhaust chamber, and means for combusting and reducing the velocity of the gases for heating said furnace substantially above said work-receiving portion.

2. In a soaking pit furnace or the like for the heat treatment of ingots and other work pieces, in combination, a treatment chamber having a hearth, an exhaust passage contiguous to said treatment chamber and having an open end opening directly into said treatment chamber along one side thereof, said open end extending upwardly from adjacent said hearth to a height generally midway of the height of said treatment chamber, said open end further extending substantially across the full width of said side, a flue connected to the other end of said exhaust passage for waste gases from said treatment chamber, said open end having an area greater than the area of said flue, said exhaust passage being reduced in cross-sectional area toward said flue as required for said connection with said flue, said reduction in cross-sectional area being a distance away from said open end such that the velocity of the waste gases passing through said exhaust passage is increased within said exhaust passage, and a chamber opening directly into said treatment chamber above the top of said exhaust passage to supply at least partially combusted heating gases transversely into said treatment chamber above the normal level of the tops of the ingots and other work pieces to be heated in said furnace.

3. A method for heat treating work pieces in a furnace having a flue, comprising, in combination, placing work pieces to be heated on a hearth in the lower part of a treatment zone, feeding combustible heating gases transversely into the upper part of said treatment zone through an area on a side thereof, substantially completing the combustion of said heating gases so fed within the upper part of said treatment zone above said work pieces, withdrawing waste gases from said treatment zone over an area substantially extending across the full width of a side of said treatment zone and generally upwardly from said hearth to the level of the bottom of the area over which said heating gases are fed into said treatment zone, and reducing the cross-sectional area of the flow of said waste gases so withdrawn after they are outside of said treatment zone, whereby relatively uniform generally slow descent and movement of fully combusted heating gases past said work pieces are obtained without localized velocity effects in said treatment zone due to the suction influence of said flue.

4. A method for heat treating work pieces in a furnace having a flue, comprising, in combination, placing work pieces to be heated on a hearth in the lower part of a treatment zone, feeding combustible heating gases transversely into the upper part of said treatment zone substantially across the width of a side thereof, beginning the combustion of said heating gases so fed outside of said treatment zone, substantially completing the combustion of said heating gases

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within the upper part of said treatment zone above said work pieces, withdrawing waste gases from said treatment zone substantially across the width of said side over an area extending substantially upwardly from said hearth to the normal level of the tops of said work pieces and across the full width of said side of said treatment zone, and reducing the cross-sectional area of the flow of said waste gases so withdrawn in a gradual manner when said waste gases are outside said treatment zone, whereby relatively uniform generally slow descent and movement of fully combusted heating gases past said work pieces are obtained without localized velocity effects in said treatment zone due to the suction influence of said flue.

JOHN FREDERICK ROBERT JONES.

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