

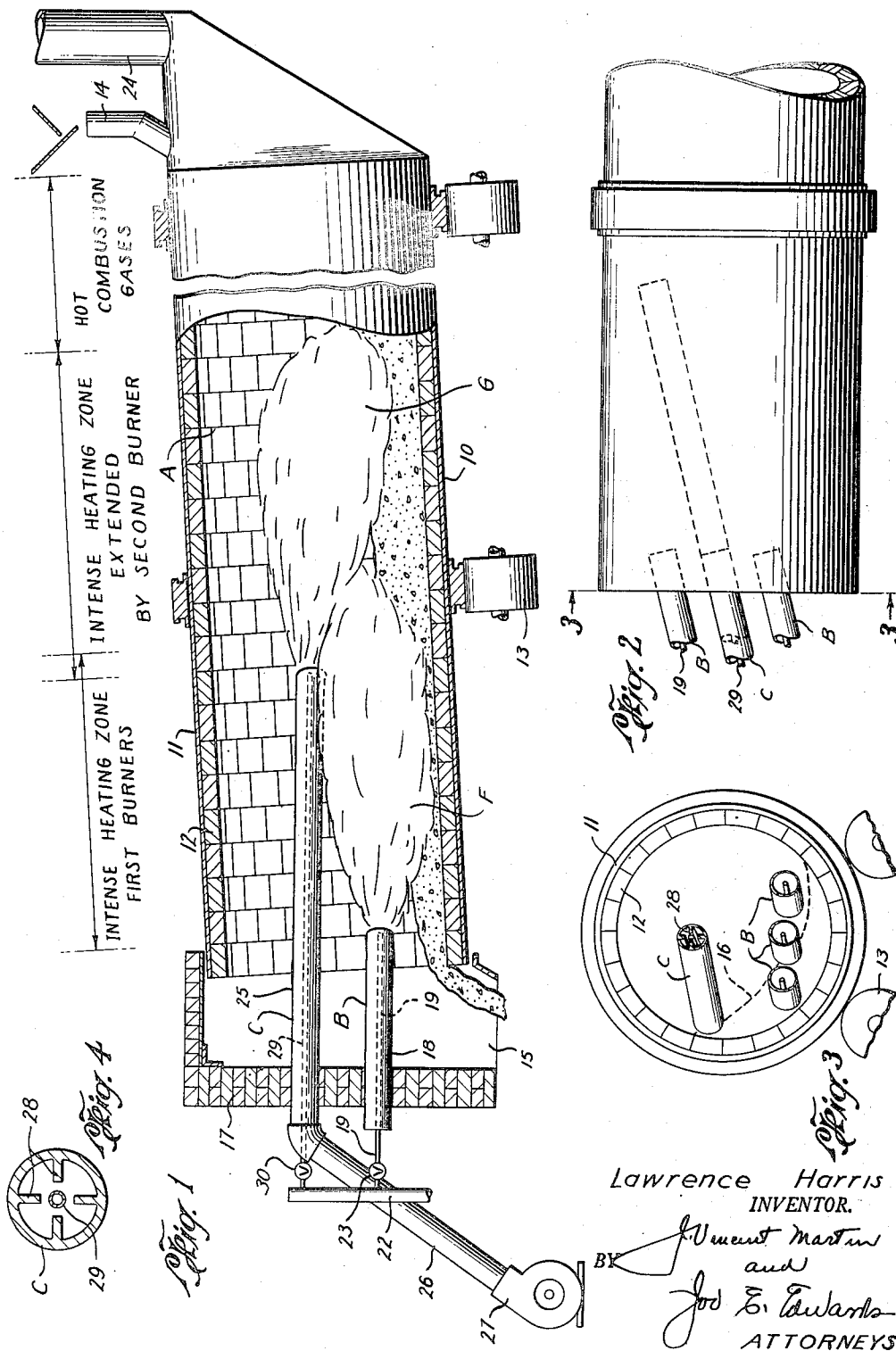
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FURNACE

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FURNACE

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¹ This invention relates to new and useful improvements in furnaces.

In the treatment of clay aggregate and similar materials the use of high temperature furnaces or kilns is quite common and the usual rotary kiln is constructed of a rotating heating chamber having a burner or burners at one end thereof. The invention herein will be described as applied to the ordinary rotary kiln. In such kiln, the material to be treated is ordinarily introduced into the chamber from that end which is remote from the burners so that the material traverses the chamber longitudinally thereof. Since the chamber is relatively long over an extended length the gases of combustion from the burner flame are depended upon to preheat the material prior to its entry or contact with the intense heating zone created by the burners; because the intense heating zone extends for only a relatively short space with respect to the over-all length of the burner chamber, the material being treated is not subjected to the intense heating zone for any great length of time with the result that the capacity of the burner is limited and the length of the intense heating zone is also limited; further, since the burner or burners are immediately adjacent one end of the kiln chamber a control of the oxygen within the flame area is somewhat difficult.

It is one object of the present invention to provide an improved furnace or kiln for treating clay aggregate or similar material having means for increasing the intense heating zone within the treating chamber, whereby more efficient treatment with greater capacity and less fuel consumption per unit of material being treated may be obtained.

Another object of the invention is to provide a second elongate burner, in addition to the usual burner or burners heretofore provided within the heating chamber, which elongate burner projects beyond the intense heating zone created by the usual burner or burners to provide a second heating zone which increases the heating area to thereby subject the material being treated to intense heat for an extended period of time, whereby the efficiency of the treatment is enhanced.

A still further object is to provide a double burner in a furnace or kiln with the inner extended burner being so located that the outer or normal burner or burners consume the major portion of the oxygen which is admitted to the combustion chamber to thereby allow the burning which takes place in the second burner to

² occur in an area of reducing atmosphere which results in more efficient treatment of the material.

A particular object is to provide an elongate or extended burner within the usual furnace or kiln which is constructed of a heat resistant alloy material and which is formed with cooling fins within its bore whereby the air required for burning and directed through the burner will function to maintain said burner cool to prevent damage thereto by the intense heating zone of the normal burner of the furnace or kiln and through which zone said elongate burner extends.

The construction designed to carry out the invention will be hereinafter described, together with other features thereof.

The invention will be more readily understood from a reading of the following specification and by reference to the accompanying drawings forming a part thereof, wherein an example of the invention is shown and wherein:

Figure 1 is a view partly in section and partly in elevation of a kiln, constructed in accordance with the invention,

Figure 2 is a partial plan view of the kiln illustrating the disposition of the burners,

Figure 3 is a transverse sectional view, taken on the line 3—3 of Figure 2, and

Figure 4 is an enlarged cross-sectional view of the elongate burner.

In the drawings the numeral 10 designates an ordinary rotary kiln comprising a generally cylindrical housing or casing 11 having its interior suitably lined with fire brick 12 or similar fire resistant material. The casing or housing is disposed on an incline in a horizontal plane and is mounted upon suitable rollers 13 whereby said casing or housing is rotatable. The material to be treated is introduced into the casing at one end thereof through an inlet 14 and said material travels downwardly and longitudinally of the chamber A formed within the interior of the housing, the material escaping from the opposite end of the housing through an outlet 15. The housing 11 is constantly rotated and because it is disposed at an incline, it is apparent that the material will be moved longitudinally of the chamber A; because of the rotation the material will tend to be disposed higher on one side of the chamber as indicated by the dotted line 16 in Figure 3.

At the outlet end of the kiln a suitable wall structure 17 is formed and a series of burners B extend through this wall and into the end of the chamber A. Each burner B is illustrated as

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comprising an outer tubular conduit 18 having a gas or fuel pipe 19 disposed concentrically therein. A gas or fuel supply line 22 has connection with the pipe 19 and a hand valve 23 controls the flow of fuel into said pipe. Although this type of burner has been found satisfactory, it is pointed out that the burner B may be of any well known type now in general use.

The burners B are illustrated as three in number and are normally employed in kilns of this character so that the provision of the burners B in themselves form no particular part of the present invention. Because the material being treated tends to ride upwardly on the wall of the chamber A as indicated by the dotted line 16 (Figure 3), the burners B are disposed at an angle in a horizontal plane with respect to the axis of the chamber A, whereby the flame from each burner is directed against the material. When the burners B are operating each will form a flame indicated by F in Figure 1 which extends inwardly into the chamber A to form an intense heating zone. The gases of combustion flow through the chamber A in a direction toward the material inlet and escape through a suitable stack or chimney 24 provided for this purpose.

Because the chamber A is relatively long the provision of the first series of burners B forms the intense heating zone only adjacent to the outlet end of the chamber and therefore, the material being treated must travel through a relatively long path from the inlet 14 to the intense heating zone or flame F, during which path it is subjected only to the heat from the gases of combustion. In carrying out the present invention, a second elongate burner C is provided. This burner extends through the wall 17 and into the chamber A well beyond the end of the first series of burners B. It is preferable that the end of burner C be disposed near the end of the flame F or of the intense heating zone created by the first burners. The elongate burner C includes an outer conduit 25 which has connection with an air inlet pipe 26 to which a suitable blower 27 may be connected. The bore of conduit 25 is preferably formed with a plurality of the inwardly directed fin elements 28 which are disposed longitudinally of the conduit and which preferably extend throughout the entire length thereof. A gas or fuel pipe 29 extends axially within the conduit 25 and communicates with the fuel supply line 22. A suitable valve 30 in the pipe 29 controls the supply of fuel to the burner C.

Because the end of the burner C is some distance inwardly of the ends of the burners B and is preferably adjacent the outer end of the flame F from the burners B, it will be apparent that the flame G formed by the second burner will project well in advance of the flame F. This flame G thereby forms a second intense heating zone which actually is a continuation of the first intense heating zone. The material traveling through the chamber A is therefore subjected to intense heat over an extended area and for an extended period of time whereby the efficiency of the treatment is increased.

The burner C projects through the intense heating zone created by the flame F and as has been noted is constructed of a heat resistant alloy so that the conduit 25 is not affected by this intense heat. To further protect the conduit 25 from damage by the heat, the internal fins are in contact with the incoming fresh air and thus it might be said that the conduit is air-cooled which assists in preventing damage thereto by

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excessive heat. By locating the second burner outlet at a distance spaced inwardly from the first burner, the flame F from each burner B is disposed between the flame G and the outlet end of the kiln which is open to atmosphere. The flames F thereby consume or burn the major portion of the oxygen so that the burning effected by the burner C will take place in a condition of reducing atmosphere which increases the efficiency of the treatment. In actual practice over an extended period of time, it has been found that the arrangement shown and described herein has reduced fuel consumption approximately twenty-five (25%) per cent. This is due to the fact that because the over-all capacity of the kiln is increased, the available heat within the unit is more effectively utilized.

The operation of the kiln is obvious. The material to be treated is introduced through the inlet and passes downwardly through the rotating casing toward the outlet 15. Because two intense heating zones are provided the heat from the gases of combustion are increased over the normal kiln so that a higher preheating of the material is carried out. The material is then subjected to the heating zone created by the flame G of the burner C after which it passes through the intense heating zone created by the flames F. Actually the two heating zones are in effect a single zone and thus the material being treated is subjected to intense heat over a longer period of time as compared with the normal type of kiln. Although only a single burner C is illustrated in the drawing to form the second or extended heating zone, it is obvious that any desired number of elongate burners C may be employed.

The invention has been shown and described as applied to a rotary kiln but it is noted that the improved burner arrangement is applicable to any type of kiln or furnace.

The foregoing disclosure and description of the invention is illustrative and explanatory thereof and various changes in the size, shape and materials, as well as in the details of the illustrated construction may be made, within the scope of the appended claims, without departing from the spirit of the invention.

Having described the invention, I claim:

1. A kiln including an elongate housing circular in cross-section forming a longitudinal chamber, an inlet at one end of the chamber and an outlet at the opposite end of said chamber, whereby material to be treated and introduced through the inlet travels longitudinally of the chamber to reach said outlet, a first elongate burner having its outlet end adjacent to the outlet end of the chamber for creating an intense heating zone which extends longitudinally within the chamber nearer its outlet end, means for mounting said first burner at an angle to the longitudinal axis of said chamber for directing the flame therefrom downwardly against the bottom wall surface of said chamber, a second elongate burner spaced vertically above said first burner and extending through the longitudinally heating zone created by the first burner and having its outlet end disposed within the extremity of the heating zone of the first burner whereby the intense heating zone created by the second burner forms an extension of said first heating zone, and means for mounting said second burner at substantially the same angle as said first burner whereby the material being treated is subjected to substantially the same intense heat by said second burner as by said first burner.

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2. A kiln as set forth in claim 1, wherein the elongate second burner comprises a tubular conduit having an axial fuel pipe therein, means for directing air through said conduit and fuel through the pipe to produce a combustible mixture, and longitudinal radially directed fin elements within and extending substantially the length of the bore of the conduit between which the introduced air flows, whereby said air cools the conduit of said second burner.

3. A furnace including, an elongate housing forming a longitudinal chamber and having an inlet at one end and being open at its opposite end to form an outlet, whereby material to be treated and introduced through the inlet travels longitudinally of the chamber and is discharged through the open outlet end, a first elongate pipe burner extending into the open discharge end of the chamber at an angle to the longitudinal axis of said housing to direct the flame therefrom downwardly against the bottom wall surface of the housing and having its outlet end adjacent said discharge end to project a longitudinal flame inwardly into the chamber and thereby create an intense heating zone, and a second pipe burner which is elongate and is directed at substantially

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the same angle as said first burner extending into the chamber through the open discharge end thereof and having a length sufficient to dispose its outlet end within the inner extremity of the heating zone created by the first burner, whereby the second burner projects a longitudinal flame inwardly of the chamber beyond the intense heating zone created by the first burner and thereby forms a second intense heating zone within the chamber which is an extension of said first heating zone.

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