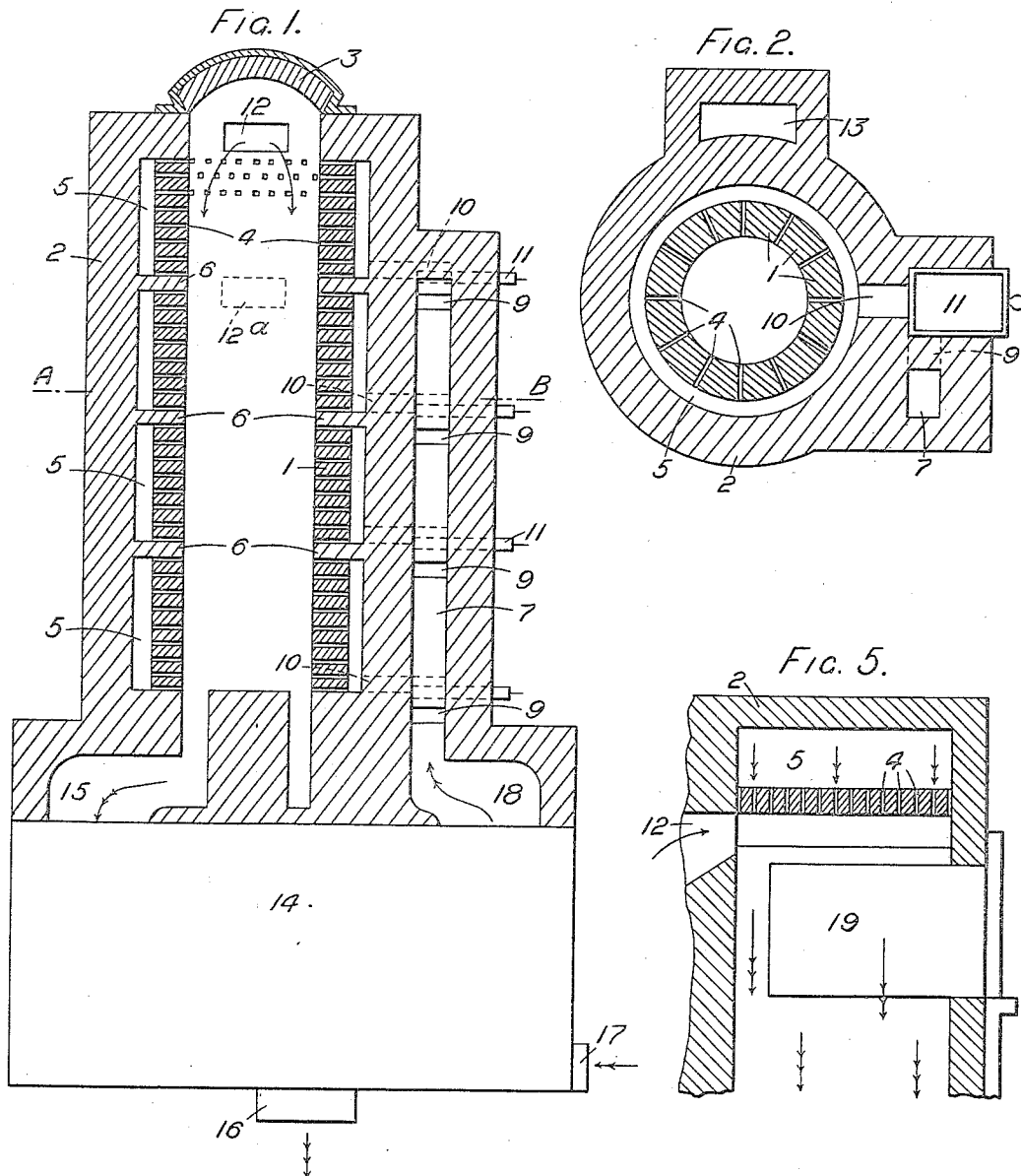


A. B. CHANTRAINE.
HEATING APPARATUS.
APPLICATION FILED AUG. 18, 1914.

1,265,746.

Patented May 14, 1918.
2 SHEETS—SHEET 1.



Alphonse Baudouin Chantraine

WITNESSES.

Karl S. Witz
Oliver Williams

BY

INVENTOR,

Seward Davis

HIS ATTORNEY.

A. B. CHANTRAINE.
HEATING APPARATUS.
APPLICATION FILED AUG. 18, 1914.

1,265,746.

Patented May 14, 1918.

2 SHEETS—SHEET 2.

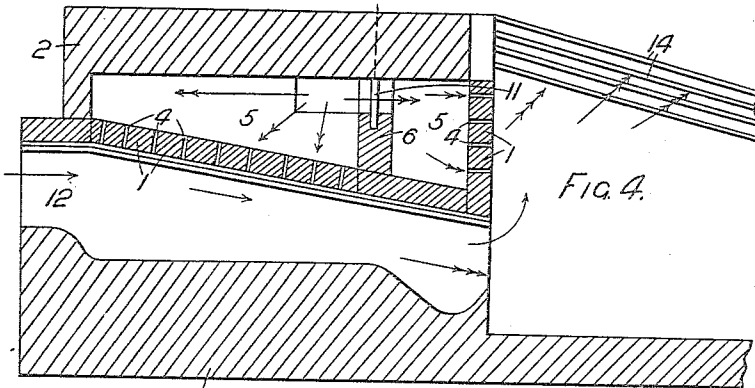


FIG. 4.

2 FIG. 6.

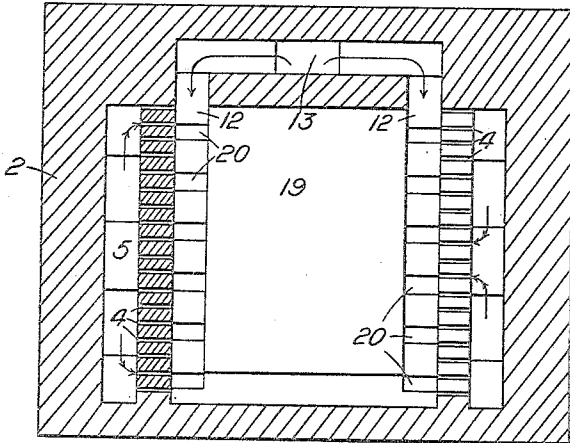
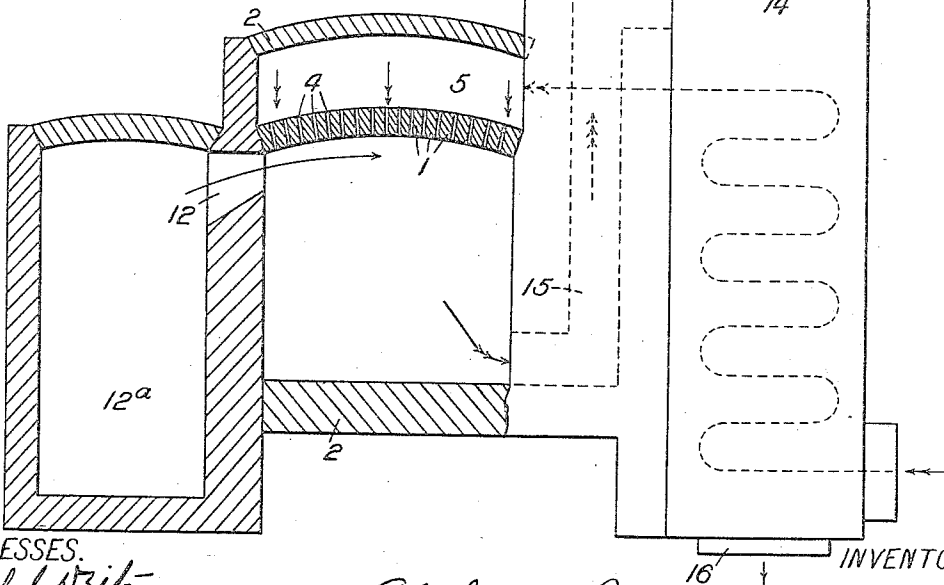


FIG. 3.



WITNESSES.

Karl S. Witz
Oliver Williams

Alphonse Baudouin Chautraime
BY Edward Davis HIS ATTORNEY.

UNITED STATES PATENT OFFICE.

ALPHONSE BAUDOUIN CHANTRAINE, OF MARCINELLE, BELGIUM.

HEATING APPARATUS.

1,265,746.

Specification of Letters Patent.

Patented May 14, 1918.

Application filed August 18, 1914. Serial No. 857,322.

To all whom it may concern:

Be it known that I, ALPHONSE BAUDOUIN CHANTRAINE, a subject of the King of Belgium, residing at 26 Rue de l'Ange, Marcinelle, Belgium, honorary mining engineer, have invented new and useful Improvements in Heating Apparatus, of which the following is a specification.

This invention relates to an improved heating apparatus of the kind in which gaseous fuel is employed.

In regenerative furnaces, the flames pass over or across the material to be heated, from the inlet to the outlet, in the form of a stream. There is a considerable difference in temperature between the inlet and outlet sides of the furnace, and consequently, in order to heat the contents of the furnace uniformly, the direction of flow of the burning gases is reversed at frequent short intervals of time. This reversal of the flow of burning gases results in large variations in temperature with consequent expansion and contraction of the vault of the furnace and of the regenerator brickwork, with the result that deterioration and disintegration of the brickwork soon takes place, and permits of leakage in the regenerator.

This invention has for some of its objects to protect the refractory lining of the furnace from excessive heat: to avoid excessive expansion and contraction of the brickwork: to avoid the deposition of carbon or soot: to uniformly or otherwise symmetrically distribute the heat: to control the distribution of heat in different zones: to oxidize the fuel gas with a minimum of air or oxygen admitted through small air ports and to utilize the heat in an economic manner for heating auxiliary apparatus such as a recuperator or boiler. Further objects will transpire in the following description.

This invention comprises, a furnace in which the fuel gas forms an athermanous blanket which absorbs the heat radiated by the hot contents of the furnace and protects the refractory lining from heat radiations: means for uniformly symmetrically or otherwise distributing the heat: means for producing a multiplicity of small flames of uniform or predetermined temperature impinging upon the material to be heated: a plurality of independently regulatable sections: means for regulating the amount of heat in predetermined sections of the combustion chamber of the furnace: the admission of an

insufficient quantity of preheated air to oxidize a first portion of the fuel gas in one section of the furnace and the injection of a further quantity of air to complete the combustion of a second portion of the fuel gas in another section of the furnace, and other features which will be hereinafter described.

Several embodiments of the invention are indicated in the accompanying drawings in which:—

Figure 1 is a section partly in elevation of a vertical type of furnace associated with a recuperator.

Fig. 2 is a section on the line A—B of Fig. 1.

Fig. 3 is a vertical section partly in elevation of a horizontal type of furnace associated with a recuperator.

Fig. 4 is a vertical fragmentary section of a horizontal furnace associated with a steam generator.

Fig. 5 is a vertical fragmentary section of a muffle furnace, and

Fig. 6 is a horizontal section of a modification.

Like reference numerals designate like parts throughout the several figures of the drawings, and the flow of gas, air and burnt gases is indicated by single, double and triple headed arrows, respectively.

Referring to Figs. 1 and 2 of the drawings, 1 designates a lining of brickwork or other refractory material located within a jacket 2, of brickwork, provided with a removable cover 3. The lining is perforated with a large number of holes 4, uniformly symmetrically or otherwise distributed and establishing communication between the interior of the furnace and an annular chamber 5. This chamber is divided into a number of independent sections by means of the annular partitions 6 to which sections air is admitted from the duct 7 through passages 9 and 10. The admission of air to each individual chamber 5 is controlled by a series of dampers 11, there being one for each chamber. The fuel gas is admitted at the top of the furnace through the opening 12 after passing up the duct 13 formed in the jacket. The fuel gas passes down the interior of the furnace in the form of a vertical tubular cone adjacent the lining and forms a blanket into which jets of preheated air are admitted.

When jets of fuel gas are injected into a furnace, soot or carbon is deposited in con-

siderable quantities and after a short time, fill or choke the gas ports. When, however, as in the present invention, jets of air are injected into the fuel gas, a minimum
 5 amount of air is required for complete combustion. Moreover, the combustion of fuel gas when supported by the injected air is pyrometrically hotter than the combustion resultant when the same fuel gas is injected
 10 into air and burned therein and does not deposit soot or carbon at all. Again when gas jets are injected into air, the contents of the furnace when heated, reflect or radiate heat on to the furnace lining. This radiant
 15 heat readily passes through the air which is diathermanous and ultimately destroys the lining. On the other hand, according to this invention, the heat produced by the flame of air is readily transmitted to the contents of the furnace but when reflected or radiated
 20 by the contents this heat is absorbed by the blanket of gas which is athermanous. Consequently, not only is the radiated heat usefully employed in raising the temperature of the fuel gas, but the lining of the furnace, being protected by the blanket of gas,
 25 has a much longer life. This is a great advantage in the case of brick lined furnaces which it is not only difficult, but expensive to re-line.

The air ports 4 are so proportioned that each one passes the same quantity of air and consequently the temperature of each flame produced is substantially equal. These
 35 flames impinge on the article to be heated, with the result that the maximum of heat calories is imparted to the article. Moreover, a minimum of fuel gas escapes combustion. Alternatively, the air ports
 40 may be symmetrically disposed in any desired manner and proportioned so as to produce flames of varying temperature.

Another advantage of the furnace above described resides in the fact that the temperature in different zones can be regulated
 45 at will. For instance, of the four sections shown in Fig. 1, any one, two or three or all of the sections may be used. Stated another way, the top and bottom sections may be provided with the maximum quantity of
 50 air to generate a maximum heat, while the middle sections may be provided with a lesser quantity of air to generate a lesser heat. In this manner the heat applied to
 55 long articles such as gun barrels may be locally controlled to heat any one particular part or parts to a greater extent than the other part or parts. For instance in the case of a tapering gun barrel a greater
 60 amount of heat is required at the large end than is required at the small end in order to heat the barrel uniformly throughout its length. In the arrangement above described it will be observed that when two or more
 65 sections are in use the amount of air ad-

mitted to the first section is insufficient to oxidize all the fuel gas and that a further quantity of air is admitted in succeeding sections to complete the combustion.

Independent inlets may be provided for
 70 each furnace section, as shown in dotted lines at 12^a, these inlets being controlled by dampers such as 11. In this case the athermanous blanket may be considered as consisting of a plurality of tubular blankets. 75

The furnace is shown associated with an auxiliary heating apparatus such as a recuperator indicated at 14, and adapted for utilizing the waste heat passing out of the furnace. When the auxiliary apparatus
 80 takes the form of a recuperator, the products of combustion enter the recuperator through a flue 15, and pass away to the chimney at 16. The air to be heated enters at 17 and when heated passes through a duct
 85 18 into the duct 7 and thence to the furnace.

In the horizontal furnace of Fig. 3, the gas passes from a reservoir or producer 12^a through the inlet 12 and across the perforated vault. The jets of air, passing through
 90 the blanket of gas, produce flames which impinge upon the material in the furnace. As above described the burnt gases pass through the flue 15 to the recuperator. The path of air on its way through the recuperator to
 95 chamber 5 is indicated by a dotted line.

In the modification shown in Fig. 4 the auxiliary apparatus is in the form of a water tube boiler. In this case the amount
 100 of air admitted vertically downward through the arch of the furnace is not sufficient to consume all the gas admitted at 12 but the excess fuel gas is burnt by the jets of air admitted through the vertical part
 105 of the lining so as to produce additional heat if required for the boiler. Here, again, the blanket or sheet of athermanous gas, protects the furnace lining.

In the muffle furnace shown in Fig. 5, the brick vault is protected by the gas blanket,
 110 while the heat is readily transmitted to the refractory vessel 19 shown in elevation.

Another type of furnace is shown in Fig. 6 in which the gas blanket passes along the sides of the refractory vessel 19, while the
 115 burnt gases pass out through the openings 20 which are distributed uniformly.

Although several forms of the invention have been described by way of example, the invention is not limited to the arrangements
 120 described, but may be carried out in a variety of ways to suit different requirements without departing from the characteristic features. Furnaces may be constructed in
 125 accordance with this invention for heating, melting and annealing purposes, and for continuous kilns for burning bricks.

What I claim is:—

1. A furnace comprising a plurality of superimposed hollow sections, each section 130

provided with means for regulating an air supply about a central combustion chamber within said sections and one or more gas supply openings communicating with said combustion chamber.

2. A furnace comprising a plurality of superimposed hollow sections, each section provided with means for regulating an air supply about a central combustion chamber within said sections, one or more gas supply openings communicating with said combustion chamber and a recuperative air preheating means in communication with said combustion chamber and with said air supply means.

3. A vertical furnace comprising a central combustion chamber, a gas inlet communicating with the upper end of said chamber, a cover for said chamber, a distributed air inlet means arranged symmetrically about said central combustion chamber and an outlet means communicating with the bottom of said chamber.

4. A vertical furnace comprising a central combustion chamber, a gas inlet communicating with the upper end of said chamber, a cover for said chamber, a distributed air inlet means arranged about the central chamber an outlet means and a recuperative air preheating device in communication with said outlet and with said air inlet means.

5. A vertical furnace comprising a central combustion chamber, a gas inlet communicating with the upper end of said chamber, a cover for said chamber, a distributed and regulatable air means arranged about said central combustion chamber, an outlet means and a recuperative air preheating device for supplying preheated air to the air supply means.

6. A vertical furnace comprising a central combustion chamber, partitions dividing the chamber into sections, one or more gas inlets communicating with the sections of said chamber, and independently regulatable distributed air supply means communicating with the sections of said chamber.

7. A furnace comprising a cylindrical chamber, partitions dividing the chamber in sections, air distributing means comprising perforated annuli and disposed within the

chamber to provide annular ducts for the ingress of air, one or more gas inlets for said chamber, a cover for the top of the cylindrical chamber, an air inlet communicating with the sectional annular air ducts and provided with dampers for controlling the ingress of air to the annular ducts and an outlet for the consumed gases at the bottom of the chamber.

8. A furnace comprising a combustion chamber, a gas inlet to said chamber, an air chamber, a multiplicity of ducts establishing communication between said air chamber and said combustion chamber to produce a multiplicity of heating flames, said ducts being disposed so as to cause the flames to impinge upon the material to be heated and means for controlling the temperatures at different points of the combustion chamber.

9. A furnace comprising a combustion chamber, a gas inlet to said chamber, an air chamber, means for supplying preheated air to said air chamber, a refractory partition between said air and combustion chambers, a multiplicity of symmetrically distributed ports, in said refractory partition, said ports of different dimensions in said refractory partition, said ports being disposed so as to direct the multiplicity of flames of different temperatures produced to impinge upon the article to be heated and an outlet for the burnt gases.

10. A furnace comprising a combustion chamber, a gas inlet to said chamber, an air chamber formed in a plurality of independent sections, means for supplying preheated air to said air chamber, a refractory partition between said air and combustion chambers, a multiplicity of uniformly distributed ports, in said refractory partition, said ports being disposed so as to direct the multiplicity of flames produced to impinge upon the article to be heated and an outlet for the burnt gases and a means for regulating the temperatures in different sections of the furnace.

Signed at Brussels this first day of August, 1914.

ALPHONSE BAUDOUIN CHANTRAINE.

In the presence of—

ARMAND JOSEPH LABAUX,
EMIL VOM WOMREELE.