

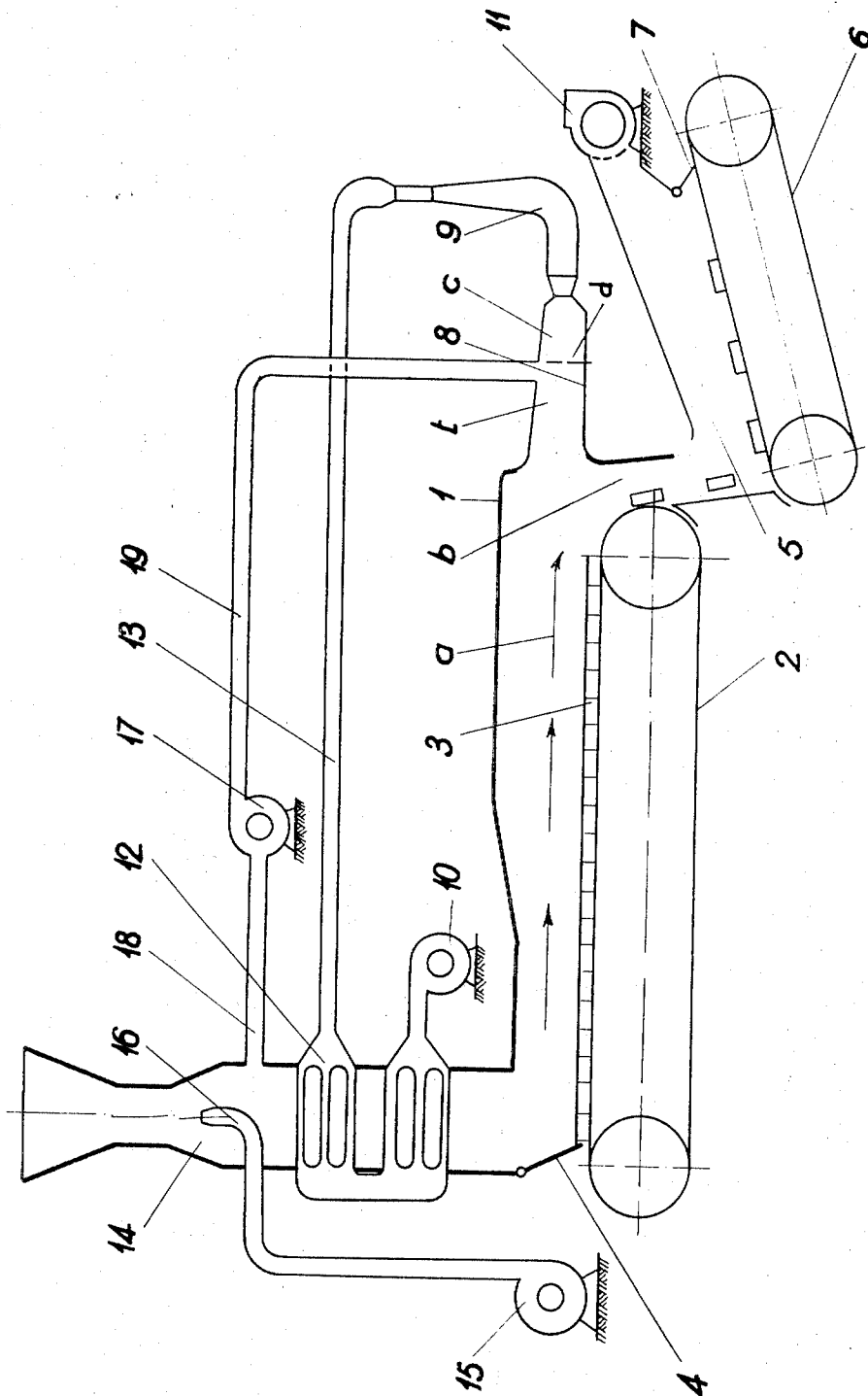
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INSTALLATION FOR HEATING METAL PARTS

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INSTALLATION FOR HEATING METAL PARTS
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ABSTRACT OF THE DISCLOSURE

A heat treating furnace containing a heating chamber, a conveyor for continuously feeding articles into the heating chamber to be heated therein and for continuously removing the articles from the heating chamber, a two-stage burner for burning fuel to produce hot gases within the heating chamber and for mixing the hot gases with recirculated exhaust gases, a blower for providing input air to the burner and for moving hot gases from the burner across the conveyor in the direction opposite to the movement of the conveyor, an exhaust stack coupled to the heating chamber for removing exhaust gases therefrom, a recirculator coupled between the exhaust stack and the second stage of the two-stage burner for recirculating at least a portion of the exhaust gases, and a heat exchanger adjacent to the exhaust stack and coupled between the blower and the burner for preheating the air input to the burner.

BACKGROUND OF THE INVENTION

The present invention relates to an installation for heating metal parts up to temperatures of 650°–900° C. in view for heat treatments.

Installations for heat treatment are known in which the metal parts are heated by means of a fuel-air mixture which is adjusted so as to have the combustion process produce hot, oxygen-less combustion gases, or gases with a minimum of oxygen, the combustion being so directed, in most cases, as to achieve inside the furnace an atmosphere with a high enough proportion of carbon oxide to avoid oxidation or decarburization during the process of heating the metal parts up to the required metal treatment temperature. In the latter case, the inflammable components of the hot gases, used for preheating, are burnt together with an addition of fresh fuel, with secondary air, within the furnace in which the final heating of the metal is performed, the secondary air being, in most cases, preheated in heat exchangers in which a part of the heat contained in the flue gases is thus recovered.

The drawback of these installations consists in that in preheating the secondary air inside the heat exchanger, only a small percentage of the available heat of the flue gas is employed. Therefore, in order to achieve a normal thermal regime, an increased amount of heat is consumed in the furnace. Another drawback of such heating installations, in which the combustion of the fuel is performed in two stages, is that the thermal stress on the masonry in the final stage heating zone of the furnace—where the secondary combustion air is let in—is increased, a fact which in most cases requires complicated and costly construction techniques and refractory materials for the furnace lining.

Installations for heating metal parts are also known in which the fuel is burnt with the help of cold or preheated air, mixed with re-circulated combustion gas, taken from the furnace exhaust. In spite of the fact that in this installation the heating seems more economical, the impossibility of constantly adjusting the re-circulated gases, as well as the impossibility of homogenizing these gaseous flows of different temperatures, especially in the case of furnaces working at relatively high temperatures, leads

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to a heterogeneous distribution of the heat within the working space of the furnace, and consequently, to a non-uniform heating of the parts submitted to heat treatment.

SUMMARY OF THE INVENTION

The installation according to the invention avoids the above mentioned drawbacks in that, in order to achieve a homogeneous and practically neutral atmosphere inside the heating chamber of a furnace, it is provided with heating means, consisting of combustion tunnels, situated between the heating chamber of the furnace and their respective burners with pre-mixture. The combustion tunnels are provided with a cylindrical part, in which the first stage of the combustion is performed, in the presence of a minimum of preheated air, while the second combustion stage takes place within a frustum shaped part of the combustion tunnel, in which, in order to dilute and homogenize the flue gases recirculated flue gases are let in, which are drawn in from the exhaust. A uniform and progressive heat distribution is maintained within the heating chamber of the furnace and the metal workpieces, which are achieved by directing the hot and diluted flue gases, in countercurrent with the flow of metal workpieces, continuously fed into the furnace. The installation is completed by a convective heat exchanger, placed on the exhaust path of the flue gases, in which the whole quantity of air employed for the combustion is preheated, and possibly also the gaseous fuel. The heat for preheating is taken from the flue gases, and from means for recovering the heat from the heated metal parts, whenever the specific character of the heat treatment allows it, as for instance in case of the normalizing process.

BRIEF DESCRIPTION OF THE DRAWING

The figure is a schematic diagram of one illustrative embodiment of the invention for heating metal parts.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawing, one embodiment of the invention consists of a furnace 1, the hearth of which is composed of a chain conveyor 2, continuously displacing some metal parts 3 which are to be heated for heat treatment. The direction of displacement of the conveyor is shown by arrow *a*, going from the charging opening, closed by means of a tightening device 4, towards a transfer opening *b*, communicating with a cooling chamber 5.

The furnace hearth 1 may be fixed, in which case the parts to be heated are conveyed in the same direction along the furnace 1, by any of the means known.

The metal parts 3, once in chamber 5, are taken over by a chain conveyor 6, which leaves the heating installation through a discharge opening, closed by means of a tightening device 7.

While crossing the furnace 1, the metal parts 3 are heated by the hot flue gases resulting from burning a gaseous fuel such as methane in two stages in a combustion tunnel 8, situated between a premixture burner 9, and the heating chamber of furnace 1. The combustion tunnel 8 for the burner consists of two distinct parts, which however form a common body: a cylindrical part *c*, directly connected to the premixture burner 9, where the first stage of the combustion of gaseous fuel and air in slight excess takes place, and a frustum shaped part *t*, which is in direct communication with the heating chamber of furnace 1, and within which the second combustion stage of the mixture takes place.

In order to dilute the oxygen in the flue gases and to adjust the temperature in the heating chamber of furnace 1, a recirculating inlet is provided for the flue

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gases is connected to the portion *d* of the combustion tunnel 8, where the two parts of different cross-section meet.

The combustion air necessary for heating the furnace 1 is supplied by a fan 10, blowing cold air or—when the specific character of the heat treatment allows it—preheated air from the output of a fan 11, connected to the cooling chamber 5. The fan 11 activates the circulation of the cold air employed for cooling the parts 3, when the latter are on the conveyor chain 6. The air supplied by fan 10 absorbs the heat of the flue gases passing through furnace 1, in a convective heat exchanger 12, located in the path of the flue gases, and is then fed over a duct 13, together with the gaseous fuel, the source of which is not shown, to the pre-mixture burner 9.

The circulation of the flue gases employed for heating the furnace heating chamber and the metal parts therein is activated by means of an injector 14, the injection fluid being air blown by a fan 15 through a nozzle 16 which is properly positioned on the flue gas exhaust path.

The dilution of flue gases inside the combustion tunnel 8, and the adjustment of the gas temperature is performed by recirculated flue gases drawn off the exhaust stack by a fan 17, from the outlet of the heat exchanger 12, through a pipe 18, and then conveyed into the combustion tunnel 8 in the zone *d* through a pipe 19. Thus it is possible to adjust the oxygen content and temperature of the hot flue gases sent from the combustion tunnel 8 into the heating chamber of furnace 1 as required by varying the amount of recirculated flue gases sent to the combustion tunnel 8 through pipe 19.

In case the metal parts 3 are heated in preparation for being quenched, they will not go through the cooling chamber 5, but will rather be directed by suitable means, not shown in the drawing, after having gone beyond the transfer opening *b*, towards the cooling bath. In this case, the fan 11 will be stopped.

The installation according to this invention has the following advantages:

(a) An important reduction of the specific fuel consumption;

(b) A noticeable increase in the productivity of the heating furnace;

(c) A reduction of oxidation in the metal having passed through the furnace, as a consequence of the oxygen dilution in the flue gases;

(d) An improvement of the metal heating process, by adjusting the temperature of the flue gases employed for heating, by admixture of hot recirculated gases;

(e) A reduction of the refractory lining wear, by elimination of large temperature changes within the heating chamber.

I claim:

1. A heat treating furnace comprising, in combination:

(a) a heating chamber;

(b) means for feeding articles into said heating chamber to be heated therein and for removing said articles from said heating chamber;

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(c) burner means associated with said chamber for burning a fuel to produce hot gases within said heating chamber, said burner means comprising a two stage burner including a cylindrical combustion chamber and a frustum shaped combustion chamber, said cylindrical combustion chamber being attached to said burner means and constituting the first stage of said burner, and said frustum shaped combustion chamber being attached to said cylindrical combustion chamber and constituting the second stage of said burner;

(d) blower means arranged for moving hot gases from said burner means across said conveyor means in the direction opposite to the movement of said conveyor means;

(e) exhaust means coupled to said treating chamber for removing exhaust gases therefrom;

(f) recirculator means coupled between said exhaust means and said burner means for recirculating at least a portion of said exhaust gases;

(g) heat exchanger means adjacent to said exhaust means and coupled to said burner means delivering preheated combustion air thereto; and

(h) second blower means connected for delivering air to said heat exchanger means.

2. A heat treating furnace as defined in claim 1 in which said recirculator means is coupled between said exhaust means and the junction between the first and second stages of said burner.

3. A heat treating furnace as defined in claim 2 and further comprising a cooling chamber adjacent to the exit end of said conveyor means, second conveyor means for moving heated articles through said cooling chamber to be cooled thereby, and means for transferring articles from the first mentioned conveyor to said second conveyor.

4. A heat treating furnace as defined in claim 3 wherein said cooling chamber and said second conveyor means are located below the first mentioned conveyor means, and further comprising means for guiding articles from the end of the first mentioned conveyor means to said second conveyor means, and second blower means for moving cool air across said second conveyor means.

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