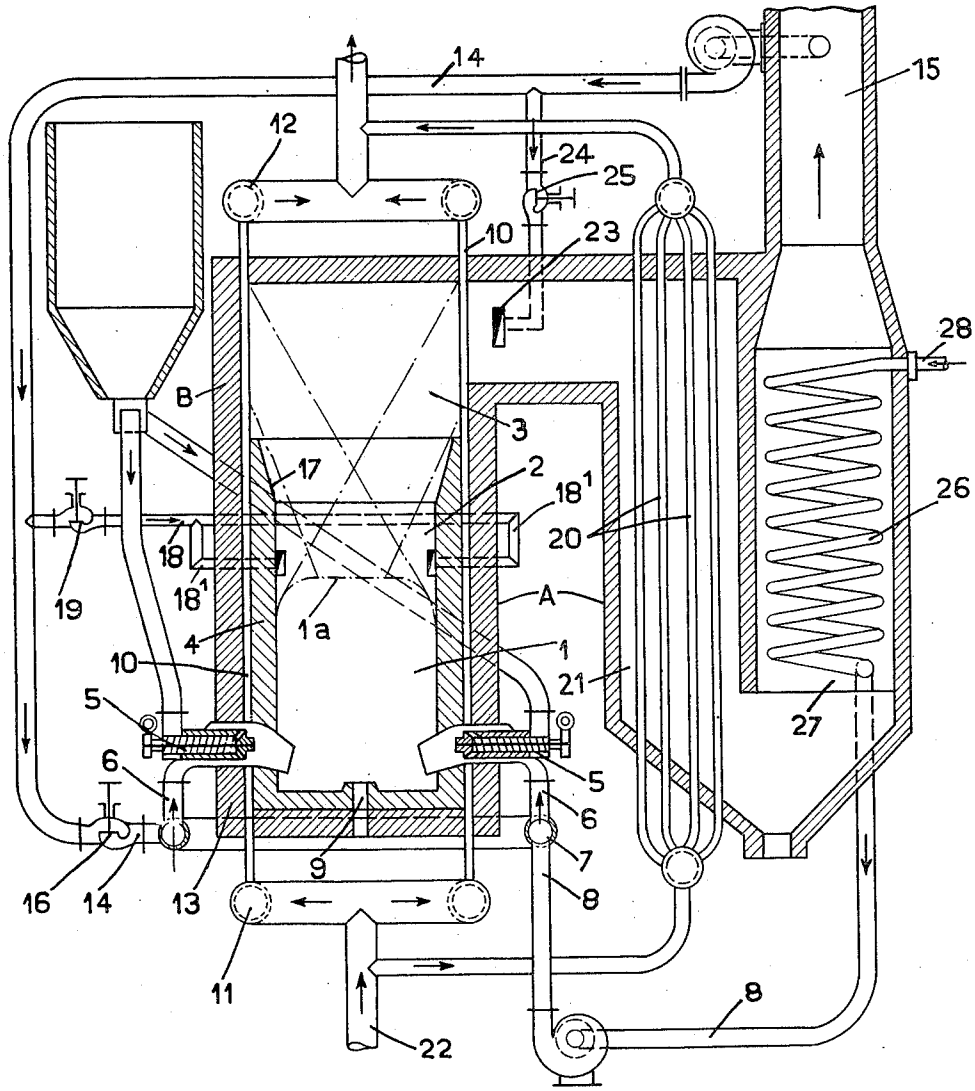
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GAS HEATER

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Inventor

Hans Gygi

By Dodge and Dunn

Attorneys

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GAS HEATER

Hans Gygi, Wildegg, Switzerland, assignor to Aktiengesellschaft Fuer Technische Studien, Zurich, Switzerland, a corporation of Switzerland

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5 Claims. (Cl. 110—28)

This invention relates to pulverized-fuel-fired gas heaters with removal of the ash in liquid form.

If in such gas heaters air, for example, has to be heated, certain difficulties are encountered, on the one hand in adopting such a high temperature for the fusing chamber that the ash can with certainty be removed in liquid form, and, on the other hand, in abstracting the heat transmitted to the tubes by radiation to such an extent that excessively high temperatures in the tube walls are prevented.

To eliminate these difficulties, in a gas heater according to the present invention the furnace chamber is subdivided into a fusing section, a mixing section and a section in which heat is transmitted by direct radiation. Furthermore, means are provided which permit of returning a portion of relatively cool flue gases into the mixing section where they mix with combustion gases. In such a gas heater it is possible, in spite of the high temperatures required for the removal of ash in liquid form, to reliably control the amount of heat transmitted by radiation, since the heat radiating from the flame must pass through a layer of flue gases having a relatively low temperature and also because the heat radiating from the flame impinges at an inclined angle upon the tubes.

To permit of the temperature in the fusing section being also influenced, it is advisable to provide further means to allow of returned, cool gases being likewise mixed with the combustion gases in this section, so that just that temperature can be obtained in the latter which is required for liquefaction of the ash.

The accompanying drawing shows by way of example and in a simplified mode of representation a preferred embodiment of the subject matter of the invention.

In the figure, A denotes an air heater and B its furnace chamber. The latter is subdivided into a fusing section 1, a mixing section 2 and a section 3 in which heat is transmitted by direct radiation. The latter section is hereinafter referred to as "radiation section." The walls 4 of the fusing section 1 are of refractory material and in the lower part of this section 1, burners 5 for pulverized fuel are arranged. To the latter air for combustion flows through a pipe 6 connected to an annular pipe 7 which in its turn is connected to a pipe 8. The numeral 9 denotes an opening in the bottom of the fusing section 1 for tapping liquid ash. Behind the wall 4, vertical tubes 10 are arranged through which flows air to be heated; these tubes 10 are connected at the bottom to an annular distributor 11 and at the top to a corresponding collector 12. The tubes 10 are protected against external losses of heat by an insulation 13. The numeral 14 denotes a pipe through which cool flue gases from a chamber 15 can be returned to the fusing section 1, it being possible to regulate this supply with the aid of a control member 16.

The walls 4, which are of refractory material, also surround the mixing section 2. The upper part of the latter is limited by surfaces 17 of said walls 4, which surfaces are directed slantingly upwards. From the pipe 14 a further pipe 18 branches off; through this pipe and the further pipes 18^1 cool flue gases can also be introduced into the mixing section 2. The quantity of such reintroduced gases can be regulated with the aid of a control member 19.

Whereas the lower part of the tubes 10 serves for cooling the furnace chamber B, their upper part is directly exposed to the radiation heat of the radiation section 3. Behind the latter a heating surface 20 arranged in a flue 21 is provided, in which air is likewise heated. The air to be heated, which is supplied through a pipe 22, flows through the tubes 10 and the heating surface 20 in two parallel currents, that in tubes 10 being parallel to the flow of the flue gases and that in the heating surface 20 being a counter-current to said gases. At a point 23 between the radiation section 3 and the heating surface 20 further returned cool flue gases can be mixed with the combustion gases, said point 23 being connected by a pipe 24, in which a control member 25 is fitted, to the pipe 14.

For the sake of completeness it is to be remarked that the numeral 26 denotes a heat exchanger arranged in the last flue 27; to this heat exchanger 26 the fresh air required for the burners 5 is supplied through a pipe 28, the heated air passing into the above mentioned pipe 8.

From the flame 1*a* in the fusing section 1 radiation heat (see hyphenated lines) is transmitted to the uncovered part of the tubes 10, i. e. heat radiating from the flame and heat radiating from the gas contained in the radiation section 3. Due to the fact that the heat radiating from the flame has to pass through a layer of cooler flue gases in the mixing section 2 and that the part of the tubes 10 exposed to radiation is impinged upon at an inclined angle by the heat transmitted by radiation, the latter can be controlled even when high temperatures prevail in the fusing section 1.

In this regard it is, however, only possible to influence the amount of heat transmitted by gas radiation, but not the quantity of heat radiating from the flame proper, since the necessary flame temperature is determined by the characteristics of the ash. Such a control is, as ascertained in actual practice, entirely sufficient if the heating surfaces are correctly dimensioned.

Due to the fact that returned cool flue gases are mixed with the combustion gases in the mixing section 2 and, in case of need, also at point 23, it can further be ensured that the flue gases already have such a low temperature, when contacting the heating surface 20 arranged after the radiation section 3, that cinder accumulation and clinker trouble on this heating surface 20 are entirely prevented. For the same reason it is also possible to maintain a much higher temperature in the radiation section 3 than the one which, with due consideration of the danger of clinker formation, is admissible at the inlet to the subsequent heating surface 20.

By regulating the quantity of flue gas returned to the fusing section 1, the temperature in this section can be maintained at a constant level even at part loads, thus preventing difficulties which are otherwise experienced during part load operation in conjunction with the removal of ash in liquid form.

In view of the fact that the heat passing through the walls 4 made of refractory material, is taken up by the gas flowing through the tubes 10 for the purpose of raising its temperature, the heat insulation 13 can be made relatively thin. Since only the upper part of the tubes 10 is uncovered whilst, on the other hand, the interior of the fusing section 1 is not lined with cooling tubes, the average flame temperature in this section is not forced down to a too great extent by the action of cooling tubes. This is important in as far as the combustion takes place quicker, the higher the temperature prevailing in section 1. With high furnace chamber temperatures, high furnace chamber loads are admissible, which is in so far of importance as for a given thermal output the furnace chamber becomes smaller, the higher the temperature prevailing in said chamber.

What is claimed is:

1. In a high temperature gas heating furnace, the combination of means forming a furnace chamber including a combustion space at one end, a radiation space at the other end and an intermediate mixing passage; surface heat-exchange means arranged for the passage therethrough of the gas to the be heated and located at least in part in the radiation space in the path of radiant heat passing through the mixing passage from the combustion space; at least one pulverized fuel burner directed into said combustion space and arranged to develop therein temperatures such as to fuse the ash of the fuel; and means for limiting the transfer of heat from the combustion space to the radiation space, comprising means for delivering relatively cool products of combustion to said mixing passage.

2. In a high temperature gas heating furnace, the combination of means forming a furnace chamber including a combustion space at one end, a radiation space at the other end and an intermediate mixing passage; surface heat-exchange means arranged for the passage therethrough of the gas to be heated and located at least in part in the radiation space in the path of radiant heat passing through the mixing passage from the combustion space; at least one pulverized fuel burner directed into said combustion space and arranged to develop therein temperatures such as to fuse the ash of the fuel; and means for delivering relatively cool products of combustion to said mixing passage and to said combustion space.

3. In a high temperature gas heating furnace, the combination of means forming a furnace chamber including a combustion space at one end, a radiation space at the other end and an intermediate mixing passage; surface heat-exchange means arranged for the passage therethrough of the gas to be heated and located at least in part in the radiation space in the path of radiant heat passing through the mixing passage from the combustion space; at least one pulverized fuel burner directed into said combustion space and arranged to develop therein temperatures such as to fuse the ash of the fuel; means for delivering relatively cool products of combustion to said mixing passage and to said combustion space; and independently adjustable means for regulating respectively the rate of supply of said products to the mixing passage and to the combustion space.

4. In a high temperature gas heating furnace, the combination of means forming a furnace chamber including a combustion space at one end and a radiation space at the other end; a refractory lining enclosing the combustion space and having an open end directed toward the radiation space, said open end forming a mixing throat; surface heat-exchange means extending between said refractory lining and the furnace walls so as to receive heat from said refractory lining and extending across and exposed within the radiation space; at least one pulverized fuel burner directed into said combustion space and arranged to develop therein temperatures such as to fuse ash of the fuel; and means for limiting the transfer of heat from the combustion space through the mixing throat to the radiation space, comprising means for delivering relatively cool products of combustion to said mixing throat.

5. In a high temperature gas heating furnace, the combination of means forming a furnace chamber including a combustion space at one end, a radiation space at the other end and an intermediate mixing passage; surface heat-exchange means arranged for the passage therethrough of the gas to be heated and located at least in part in the radiation space in the path of radiant heat passing through the mixing passage from the combustion space; a second surface heat-exchange means located in the path of products of combustion flowing from said radiation space; at least one pulverized fuel burner directed into said combustion space and arranged to develop therein temperatures such as to fuse the ash of the fuel; means for delivering relatively cool products of combustion to said mixing passage; and means for delivering relatively cool products of combustion to the off-flowing gases between said radiation space and the second named heat-exchange means.

HANS GYGI.

CERTIFICATE OF CORRECTION.

Patent No. 2,380,169. July 10, 1945.

HANS GYGI.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 2, first column, line 56, claim 1, before the words "be heated" strike out "the"; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 9th day of October, A. D. 1945.

Leslie Frazer

(Seal) First Assistant Commissioner of Patents.