Dec. 25, 1945. F. TOTZEK 2,391,491

REGENERATIVE GAS HEATER

Filed May 14, 1940

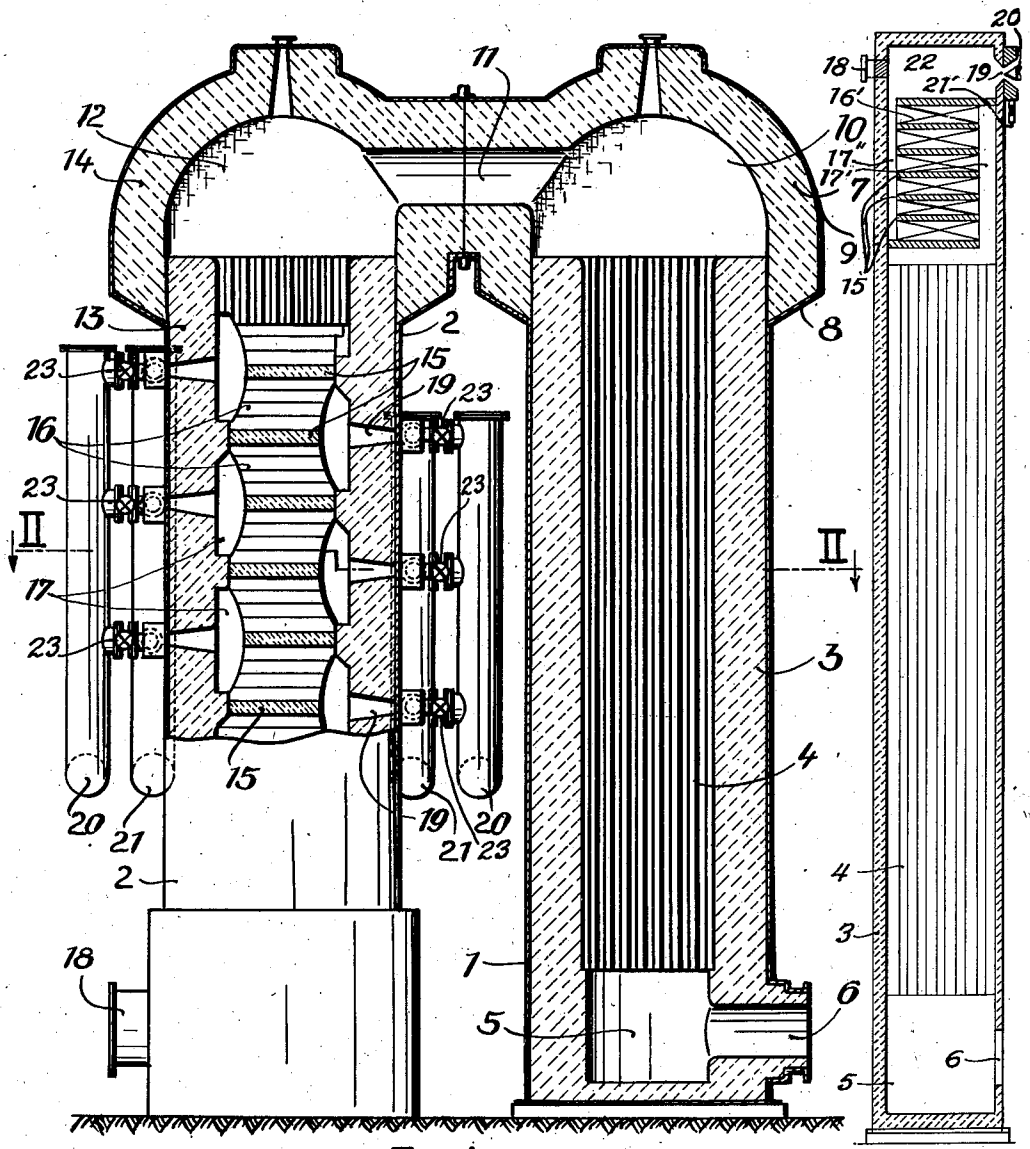


Fig. 1

Fig. 3

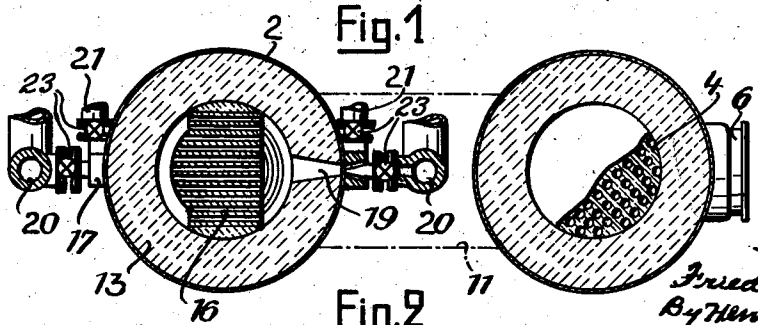


Fig. 2

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Patented Dec. 25, 1945 2,391,491

UNITED STATES PATENT OFFICE

2,391,491

REGENERATIVE GAS HEATER

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Application May 14, 1940, Serial No. 335,043
In Germany May 19, 1939

3 Claims. (Cl. 263—19)

The present invention relates to regenerators for the heating of gases or vapours up to high temperatures, said regenerators being provided with chequerwork which stores the heat of hot combustion gases.

My invention has for its object to provide improvements in such a gas heater or regenerator whereby it is possible to attain very high heating-temperatures in the regenerators which temperatures could not be arrived at up to now.

The temperatures to which the gases or vapours may be raised in a regenerative gas heater depends upon the temperature to which the refractory chequerwork is heated. This latter temperature is in turn limited by the nature of the refractory material which has the tendency to soften and to loosen its texture when it is heated above a certain temperature. The most favourable efficiency is arrived at with a regenerative gas heater when the refractory chequerwork is uniformly heated to that temperature which lies only little below the softening point of the refractory material.

In the regenerative gas heaters, as known heretofore, it is however impossible to raise the temperature of the chequerwork to a considerable extent, i. e. near to the softening point. Such high heating-up temperatures require very high flame temperatures of the heating media which flame temperatures lie far above the softening point aforesaid. If it is desired to heat several parts of the refractory chequerwork to a high temperature near but not above the aforesaid softening point, then it is necessary to equalize the temperature within the hot combustion gases which serve for the heating up operation before the hot combustion gases impinge upon the refractory chequerwork. In practical operation this necessitates the provision of comparatively large combustion chambers in front of the chequerwork. The heat losses resulting from such large combustion chambers are, however, considerable.

If it is attempted to compensate these heat losses, for example by a higher preheating of the heating media, it may happen that dangerous overheatings occur in the combustion chamber, as the walls of same only participate in the heat exchange to a small extent and consequently heat accumulations may take place there. It is therefore practically impossible to heat an extensive zone of the chequerwork near the combustion gas inlet hot end of the heretofore known gas regenerative heaters uniformly to a high temperature, for instance to near to the softening point of the refractory material.

My invention has for an object the heating of the chequerwork near the hot end of the regenerative gas heater to the highest permissible temperature over a larger area than was possible up to now, so as to allow the gases and vapours, which are to be led thereover in the next phase to be heated up, to impinge upon a larger area of the chequerwork bricks which are kept at the highest temperature, and thereby increase the efficiency of the gas heater to a considerable extent without fear that the chequerwork of the gas heater or regenerator is damaged.

According to the principal feature of my present invention, the chequerwork of the gas heater is subdivided at the hot end into several superimposed horizontal gas flow sections which are each directly heated separately, or in groups, by combustion of fuel while the hot waste gases of combustion from the various directly heated sections of the hot end of the chequerwork flow on through the remaining part of the refractory chequerwork of the gas heater.

My invention further contemplates to interconnecting the directly heated subdivided refractory chequerwork sections at the hot end of the gas heater or regenerator with each other or gas flow in series and providing, one, preferably short-flamed, gas and air burner between each pair of such sections. In utilizing this feature of the present invention, the directly heated sections of the chequerwork at the hot end of the gas heater may be disposed in chambers connected at the opposite ends with one another, such chambers being heated by gas and air burners arranged at the connecting point of the adjacent chambers.

The present invention permits of an increase in the temperature of the combustion gases serving for heating up the chequerwork of the gas heater to a temperature far beyond that point which was considered permissible heretofore. Due to the fact that the heating media are divided into several individual streams, there is obtained a uniform heating of the refractory chequerwork at the hot end of the gas heater or regenerator over a considerably larger area of refractory filling than was possible up to now when a single combustion chamber was provided in front of the chequerwork. It is now possible to increase the temperature of the chequerwork up to a degree lying just below the aforesaid softening point, because the good distribution of the heating media eliminates local superheatings. The gas heater or regenerator when carried out according to my present invention

permits the apparatus to be used to heat the gases and vapours up to extremely high temperatures which could not be arrived at before.

In order that my invention may be clearly set forth and understood, I now describe with reference to the accompanying drawing a preferred manner in which it may be carried out and practiced.

In the drawing:

Fig. 1 is a vertical section through a regenerator constructed according to my invention.

Fig. 2 is a horizontal section on line II—II of Fig. 1.

Fig. 3 is a diagrammatic view of another embodiment of the invention.

Referring to the drawing, there is illustrated a regenerative gas heater of the double tower-type which consists of two essentially cylindrical vertical housings 1, 2. The housing 1 is lined with refractory bricks 3 which form in the interior of the tower a shaft-like space which is filled in the ordinary way with a chequerwork 4 consisting of suitable refractory bricks, e. g. perforated bricks. The space 5 underneath the chequerwork is built with a connection 6 to which is connected the pipe line for leading in the gases to be heated up and the pipe line for outflow of the hot waste combustion gases which have served for the previous heating up of the regenerator or gas heater.

The top of the chequerwork space is closed by a refractory arch roof 7 which rests upon an inclined ring-like base 8 formed as an upper edge projection of the housing 1. The arch roof 7 is enclosed by the dome-like casing 9.

From the dome space 10 a connecting duct 11 leads to the dome space 12 of the second tower-like regenerator or gas heater housing 2.

The housing 2 is likewise equipped with a refractory brick lining 13 similar to the housing 1. The arch roof 14 consisting of refractory material is constructed similar to the arch roof 7.

In the vertical shaft formed in the housing 2 by the brickwork 13 there is provided a series of horizontal partitions 15 which are spaced a certain distance from one another to form individual superimposed sections 16. The intervening space of the respective sections 16 between the partitions 15 is occupied by a horizontally extending refractory filling. The intervening spaces between the partitions 15 are furthermore interconnected in a zigzag way by connecting chambers as at 17 on the drawing. The space underneath the upmost partition 15 is connected with the dome space 12 and the space delimited by the lowest partition 15 is connected with the pipe connecting piece 18 through which the heated gases or vapours are withdrawn.

The connecting chambers 17 between the spaces 16 that are occupied with the filling are somewhat enlarged as may be seen from the drawing and are not occupied by a refractory filling. One short-flamed gas-air burner 19 is provided for each of the connecting chambers 17. These burners each consist of a preferably conical firing channel 19 into which the combustion media are suitably introduced separately and horizontally with a good whirling effect. Thus an extremely short flamed combustion is attained so that the flames from the burners 19 burn practically within the firing channels 19 or within the adjacent connecting channels 17. In this way, surface combustion of the filling in the spaces 16 is avoided.

Fuel gas and air are supplied to the burners 19 through the pipe lines 20 and 21, in an adjustable manner by valves 23.

With the mode of construction illustrated on the drawing, the filling spaces or sections 16 are interconnected in a zigzag way so that the combustion gases serving to heat up the lower spaces or sections 16 are carried along and flow in series through the upper filling spaces or sections 16. Consequently the upper burners 19 have to evolve so much heat that the combustion gases are constantly maintained at the maximum temperature permissible which the filling 16 can withstand. From this it will be seen that each of the superimposed sections 16 receives a separate stream of hot combustion gases directly from a gas and air fed combustion burner 19. In this way a greater part of the length of the chequerwork of the gas heater in the direction of the path of flow of the gases therethrough is brought to a higher temperature contrary to the method of working the heretofore known gas heaters which are provided with a combustion chamber in front of the same and in which only one layer of the chequerwork, the chequerwork at the extremity of the filler, takes up the permissible maximum temperature.

The hot combustion gases which have transferred their sensible heat of increased temperature onto the filling in the sections 16, which possibly may likewise be constructed of special highly refractory and resisting material, enter the dome space 12 and from there they flow through the channel 11 into the dome space 10. They thence flow through the ordinarily built chequerwork 4 and transfer their heat of lower temperature thereto so as to be finally withdrawn through the pipe connection 6 in a cooled state, reduced in temperature to the most favourable degree.

As soon as the directly heated sections 16 of the regenerator filling are brought to the desired high temperature, the supply of gas and air to the burners 19 is stopped, and the gas heater is then used for heating up the gases, or vapours, or gas-steam mixtures, to be treated after a previous purging out of the gas heater. The gas to be treated is then introduced through the pipe connection 6 into the regenerator filler 4 in the gas heater housing 1, where it is first of all preheated to a moderate temperature and, after being thus preheated, it then passes on through the filling of the directly heated sections 16 where the gas takes up the maximum temperature. The outlet for the highly heated medium is at 18.

Instead of providing the directly heated separate sections 16 in a separate tower-like housing 2 alongside the housing 1 so as to extend beyond the main portion of the chequerwork 4, as shown on the drawing, it is likewise possible to dispose the sections 16 above the chequerwork 4.

Finally, the invention may also be carried out in such a manner (as indicated in Fig. 3) that individual superimposed sections 16′ of refractory filling at the hot end of the gas heater are connected in parallel instead of in series that is, are connected separately or in groups to collecting or distributing channels 17′ at both sides which serve for the supply and withdrawal of the heating media. The distributing channel 17″ on one side then communicates with a chamber 22 in which hot gases of a very high temperature are produced by the combustion of gas and air from pipe lines 20, 21, through burner 19. These hot gases are then uniformly distributed in controlled single streams by means of the distributing chan-

nel 17'' into the refractory fillings of the individual sections 16' of the gas heater at the hot end thereof. On the other side of the sections 16' of refractory filling, the hot gases are collected in the other channel 17' and delivered by it through the remaining zones of the gas heater chequerwork 4. The operating method is similar when the media to be heated up are flown through the gas heater in the reverse direction to the direction of flow of heating media, as usual.

The apparatus built according to this invention may advantageously be used for the heating of gases or vapours of any kind up to high temperatures. The adoption of this invention is of special advantage for the heating up of gases or steam-gas mixtures which are used as flushing gas (heat carrier) for the production of water gas from solid fuels. Furthermore the gas heater when carried out in accordance with this invention may advantageously be applied to the conversion of gases containing hydrocarbons, for example a coal distillation gas, with steam or carbon dioxide into carbon monoxide and hydrogen mixtures.

I have now above described my present invention on the lines of a preferred embodiment thereof, but my invention is not limited in all its aspects to the mode of carrying it out as described and shown, since the invention may be variously embodied within the scope of the following claims.

I claim:

1. A gas heater regenerator comprising: heat accumulating checkerwork arranged to be heated-up by the flow of combustion gases over the checkerwork from one end of the same to the other; the combustion burner-means connected therewith for flow of combustion products thereto at said one end; and in which the checkerwork of the gas heater at said one end is subdivided into several superimposed separate horizontal gas flow sections of checkerwork, and are interconnected with each other for gas flow in series through the superimposed sections in a zigzag way; and in which the combustion burner-means comprises a short flamed gas and air fed burner at the connecting point between each pair of such superimposed sections for the direct heating thereof; and the subdivided superimposed sections of the checkerwork are connected with the remaining part of the checkerwork so that the waste gas products of such combustion for heating the sections, after traversing the subdivided sections, flow thence on through the remaining part of the checkerwork to the other end of the same.

2. A gas heater regenerator comprising: heat accumulating checkerwork arranged to be heated-up by the flow of combustion gases over the checkerwork from one end of the same to the other; and combustion burner-means connected therewith for flow of combustion products thereto at said one end; and in which the checkerwork of the gas heater at said one end is subdivided into several superimposed separate sections of checkerwork and are interconnected with each other for gas flow in series through the superimposed sections; and in which the combustion burner-means comprises a short flamed gas and air fed burner at the connection between each pair of such superimposed sections for the direct heating thereof; and the subdivided superimposed sections of the checkerwork are connected with the remaining part of the checkerwork so that the waste gas products of such combustion for heating the sections, after traversing the subdivided superimposed sections, flow thence on through the remaining part of the checkerwork to the other end of the same and in which the subdivided superimposed checkerwork sections of said one end and their short flamed gas and air fed burners are arranged one above the other in a shaft-like housing; and the remaining checkerwork is arranged in another shaft-like housing, and in which the housings are interconnected with each other at their upper ends, for flow of the products of combustion first upwardly through the directly heated part of the subdivided checkerwork sections in their housing and thence downwardly through the remaining part of the checkerwork in the other housing.

3. A gas heater regenerator comprising: heat accumulating checkerwork arranged to be heated-up by the flow of combustion gases over the checkerwork from one end of the same to the other; and combustion burner-means connected therewith for flow of combustion products thereto at said one end; and in which the checkerwork of the gas heater at said one end is subdivided into several superimposed separate horizontal gas flow sections of checkerwork, and are interconnected with each other for gas flow in series through the superimposed sections in a zigzag way; and in which the combustion burner-means comprises a short flamed gas and air fed burner at the connecting point between each pair of such superimposed sections for the direct heating thereof; and the subdivided superimposed sections of the checkerwork are connected with the remaining part of the checkerwork so that the waste gas products of such combustion for heating the sections, after traversing the sub-divided sections, flow thence on through the remaining part of the checkerwork to the other end of the same and in which the subdivided superimposed checkerwork sections of said one end and their short flamed gas and air fed burners are arranged one above the other in a shaft-like housing; and the remaining checkerwork is arranged in another shaft-like housing, and in which the housings are interconnected with each other at their upper ends, for flow of the products of combustion first upwardly through the directly heated part of the subdivided checkerwork sections in their housing and thence downwardly through the remaining part of the checkerwork in the other housing.

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