April 28, 1942. J. J. GROENEMA ET AL 2,281,431

BOILER

Filed Sept. 21, 1939 2 Sheets-Sheet 1

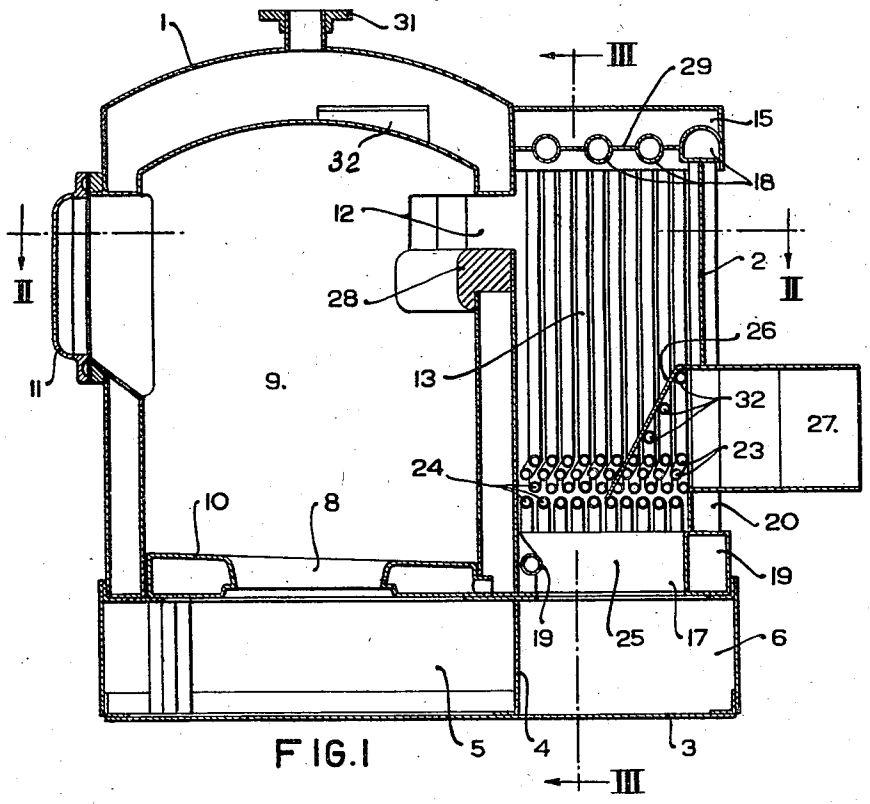

FIG.1

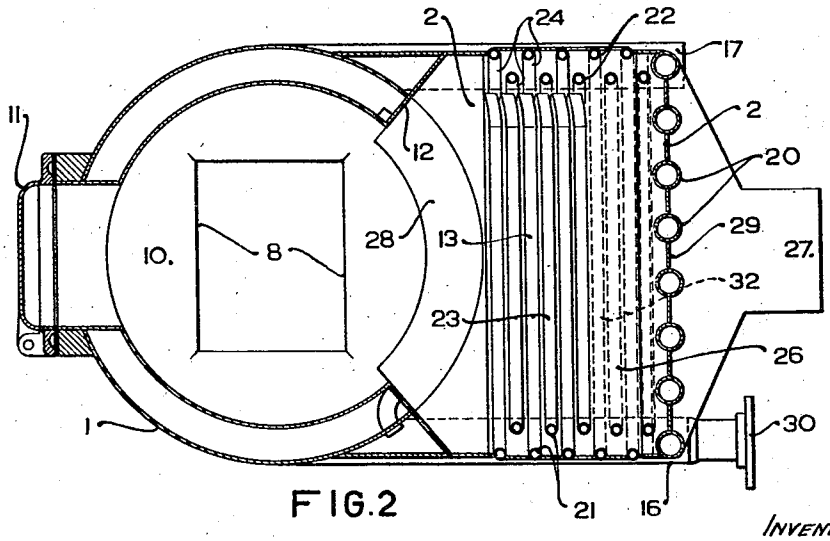

FIG.2

INVENTORS
JAN J. GROENEMA AND
HERMANNUS VAN TONGEREN
BY Stevens and David
ATTORNEYS

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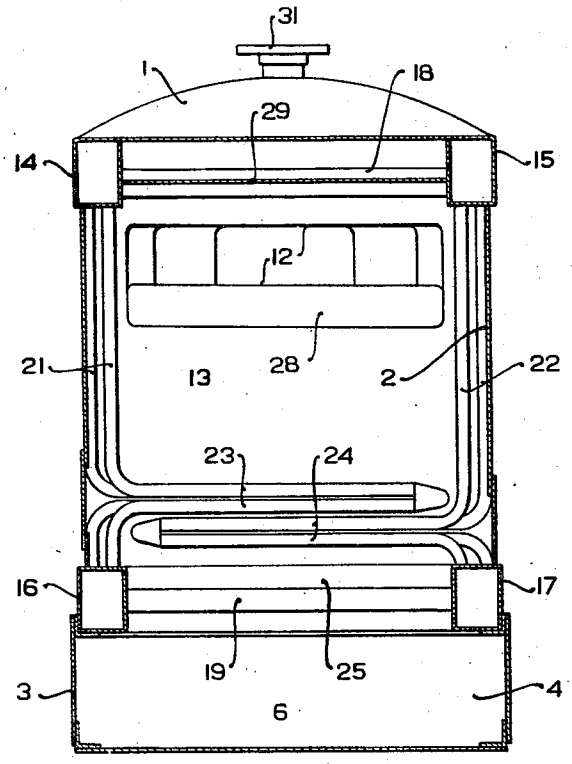

FIG.3

INVENTORS
JAN J. GROENEMA AND
HERMANNUS VAN TONGEREN

BY Stevens & Davis
ATTORNEYS

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UNITED STATES PATENT OFFICE

2,281,431

BOILER

Jan J. Groenema, The Hague, and Hermannus van Tongeren, Heemstede, Netherlands

Application September 21, 1939, Serial No. 295,984
In Germany September 21, 1938

3 Claims. (Cl. 122—187)

Our invention relates to boilers, more especially for central heating systems, comprising a water-jacketed furnace and a heat exchanging apparatus mounted in serial relation with the furnace in such a manner that the hot gases from the combustion chamber of the furnace are compelled, on their way to the chimney, to transmit part of their heat to said apparatus.

In known boilers of this type, the heat exchanging apparatus comprises a tubular system formed by a nest of narrowly spaced water tubes arranged immediately opposite the passage through which the hot gases from the combustion chamber of the furnace flow towards said system. Owing to this arrangement, the hot gases flowing from the furnace into said apparatus are unduly cooled and cannot be burnt completely.

It is well known in the art that economical combustion requires a predetermined ratio between the capacity of the combustion chamber and the amount of coal burnt per unit of time. With a combustion chamber of given capacity, the heating surface is practically fixed, i. e. said surface can only be varied between vary narrow limits, whatever shape be given to said chamber.

Our invention is based upon the discovery that combustion can be appreciably improved by dividing the combustion chamber into two separate chambers, so as to increase the heating surface to furnace capacity ratio.

Thus, in accordance with our invention, the heat exchanging apparatus comprises a spacious combustion chamber, which has water cooled walls and accommodates the tubular system referred to in such a manner that said system is mounted in the vicinity of the chamber outlet and occupies only the smaller part of the chamber, leaving the greater part of the chamber void. This construction ensures appreciably increased efficiency of the combustion gases.

In order that the combustion gases may flow through the heat exchanging apparatus at substantially uniform speed, a baffle or partition may be provided in said combustion chamber in such a manner as to gradually reduce its cross-sectional area in a direction from inlet to outlet, in which case the tubular system is preferably disposed on either side of said baffle.

In order that our invention may be more fully understood and carried into practice, we shall now proceed to describe it in further detail with reference to the annexed drawings, on which:

Fig. 1 is a longitudinal sectional elevation of a boiler constructed in accordance with our invention,

Fig. 2 is a plan sectional elevation along the line II—II in Fig. 1, and

Fig. 3 is a transverse vertical sectional elevation along the line III—III in Fig. 1.

As illustrated, the boiler comprises a vertical, cylindrical, water jacketed furnace or fire box 1 and, in serial relation therewith, a heat exchanging apparatus 2 adapted to be heated by the combustion gases from the furnace. Said parts are mounted on a hollow base 3, which is divided by a vertical partition 4 into two compartments 5, 6. Compartment 5 is located vertically below the fire box and may accommodate a feed screw (not shown), by means of which coal can be fed into the fire box through an opening 8, through which said compartment communicates with the combustion chamber 9 inside the fire box. Said opening 8 is enclosed by a water cooled ring 10.

The fire box 1 is provided with a front door 11 and, opposite said door, with an opening 12, through which the combustion gases from the chamber 9 flow into a second combustion chamber 13 forming part of the heat exchanging apparatus 2.

The apparatus 2 comprises four parallel, horizontal headers 14, 15, 16 and 17 of rectangular cross-section. Headers 14 and 15 communicate with the top portion of the water jacket of the fire box 1 through substantially diametrically opposed, tangential openings 32 thereof, whereas the headers 16 and 17, which are located vertically below the headers 14 and 15, respectively, communicate with the lower portion of the water jacket in a similar manner not shown as do the top headers 14, 15. As shown, headers 14 and 15 communicate through horizontal, transverse water tubes 18 interconnected by webs 29 so as to form an impervious top wall, and headers 16 and 17 communicate through horizontal, transverse water tubes 19. The rearmost tubes of the series of tubes 18 and 19 communicate through vertical water tubes 20 interconnected by webs 29a so as to form the impervious rear wall of the heat exchanging apparatus 2.

The headers 14 and 16 communicate through two series of vertical water tubes 21 disposed in staggered relation to one another, and the headers 15 and 17 communicate in a similar manner by vertical water tubes 22. The tubes 21, 22 thus form linings of the side walls of the apparatus 2. They are provided, at a small distance above the headers 16 and 17, respectively, with horizontal bends 23 and 24, respectively,

which extend through substantially the full width of the heat exchanging apparatus so as to virtually form a kind of bottom. Provided below said bottom tubes **23, 24** is a small box **25**, which, together with the compartment **6** and an inclined baffle **26**, serves to reverse the direction of flow of the hot gases on their way from the opening **12** to the flue **27**, through which the heat exchanging apparatus is connected with the stack (not shown).

The sill of opening **12** is formed by a fire bridge **28**, which preferably is provided with passages (not shown), through which preheated secondary air is supplied so as to ensure complete combustion of the gases in the chamber **13**.

The cold water feed pipe is designated by **30**, the hot water discharge nozzle by **31**.

Water tubes **32** are provided for cooling the baffle **26**.

It may still be remarked that the substantially horizontal position of the tubes **23, 24** is of essential importance with a view to the transmission thereto of heat from the hot gases, the general direction of flow of which is at substantially right angles thereto, and also with a view to obtaining a spacious, void combustion chamber in serial relation with the primary combustion chamber **9**.

What we claim is:

1. In a boiler for a central heating system, a water-jacketed furnace, walls forming a chamber adjacent said furnace, walls extending from near the top of said furnace and said chamber establishing a passageway therebetween, a continuous tubular heat exchange system lining most of the wall area of said chamber, said heat exchange system including a lower bank of tubes adjacent the lowermost wall of said chamber, said system occupying only a minor portion of the space of said chamber, means defining a flue opening in a wall of said chamber, the upper extremity of the opening lying above all of the tubes constituting said lower bank, and a baffle extending inwardly and downwardly from the uppermost point of said means defining a flue opening to a point below at least some of the tubes constituting said lower bank and below said flue opening, whereby burning gases issuing from the furnace through the passageway will be caused to contact the upper runs of the heat exchange system in the chamber and then before issuing through said flue opening to contact the lower bank of tubes.

2. In a boiler for a central heating system, a water-jacketed furnace, walls forming a chamber adjacent said furnace, walls near the top of said furnace and said chamber establishing a passageway therebetween, a continuous tubular heat exchange system lining those walls of said chamber which lie in planes parallel the axis of the passageway, said heat exchange system including a lower bank of tubes adjacent the lowermost wall of said chamber, said system occupying only a minor portion of the space of said chamber, a wall of said chamber lying at right angles to the axis of said passageway having a flue opening therein extending thereacross, the upper extremity of said opening lying above all of the tubes constituting said lower bank, and a baffle coextensive in width with said opening extending inwardly and downwardly from the uppermost defining edge thereof to a point below at least some of the tubes constituting said lower bank and below the lower defining edge of said flue opening, whereby burning gases issuing from the furnace through the passageway first will be caused to contact the upper runs of the heat exchange system in the chamber and then before issuing through said flue opening to contact the lower bank of tubes.

3. In a boiler as claimed in claim 1, means establishing communication between said tubular heat exchange system and the water jacket of said furnace.

JAN J. GROENEMA.
HERMANNUS VAN TONGEREN.