July 14, 1959 M. J. DE LEONARDIS 2,894,493

DEVICE FOR HEATING A HEAT TRANSFER MEDIUM

Filed June 7, 1956 3 Sheets-Sheet 1

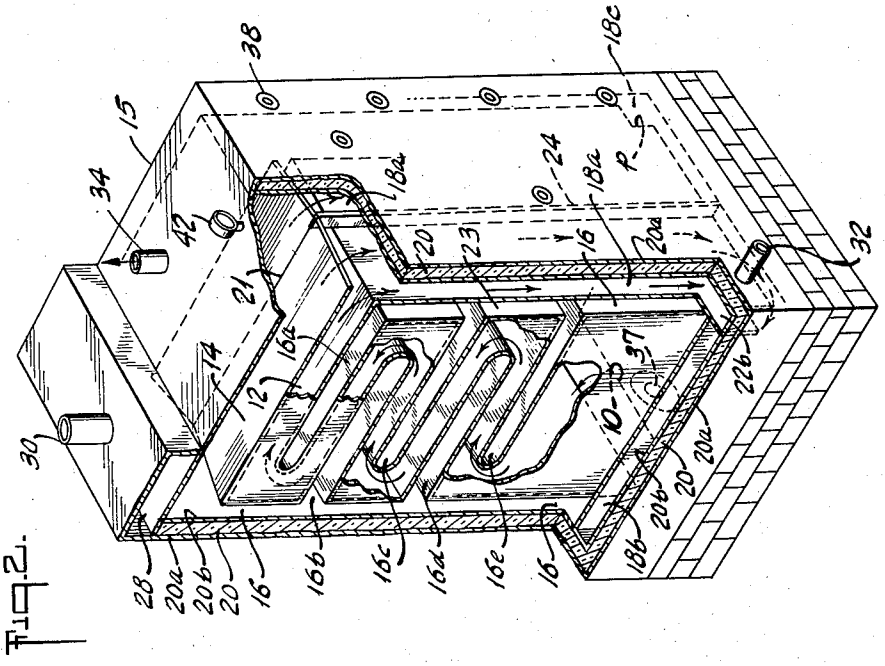

FIG. 2.

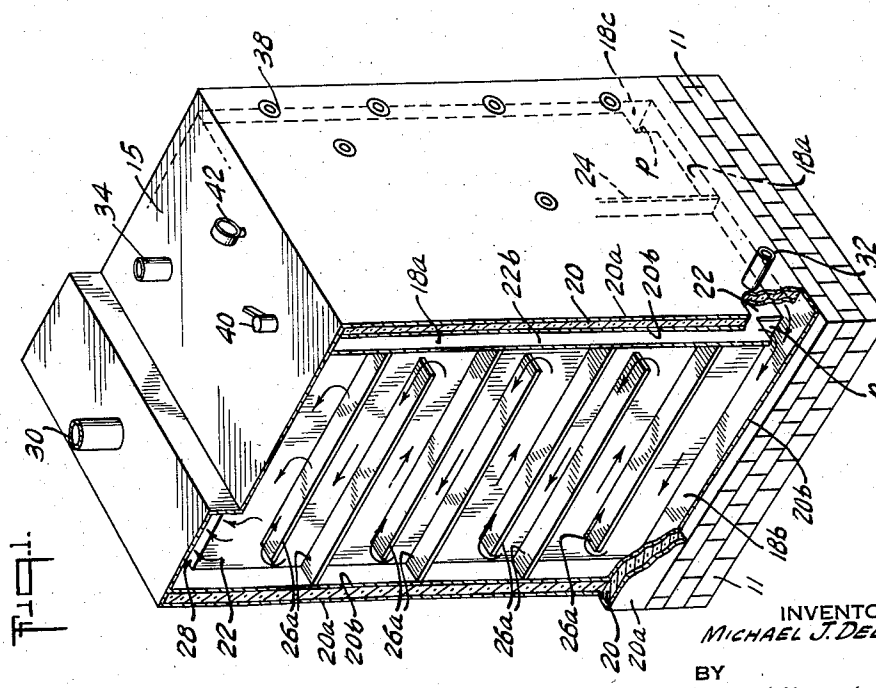

FIG. 1.

INVENTOR
MICHAEL J. DELEONARDIS
BY
Hoag, Kilburn & Carlson.
ATTORNEYS.

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DEVICE FOR HEATING A HEAT TRANSFER MEDIUM

Filed June 7, 1956 3 Sheets-Sheet 2

Fig. 3.

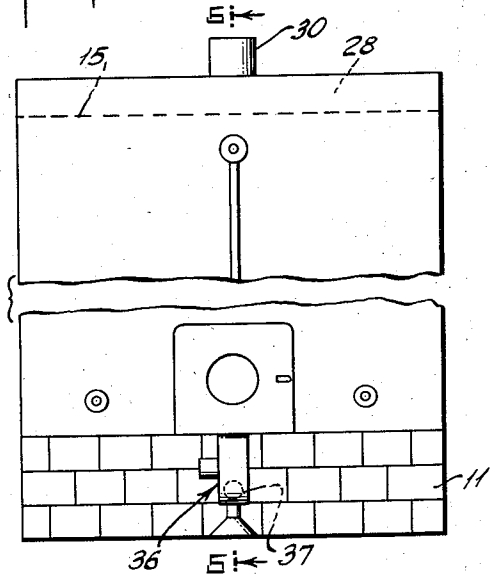


Fig. 4.

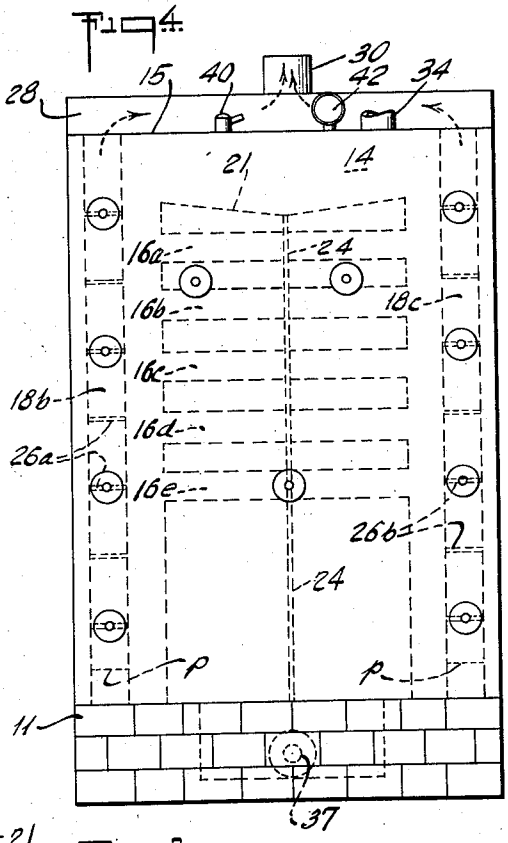


Fig. 5.

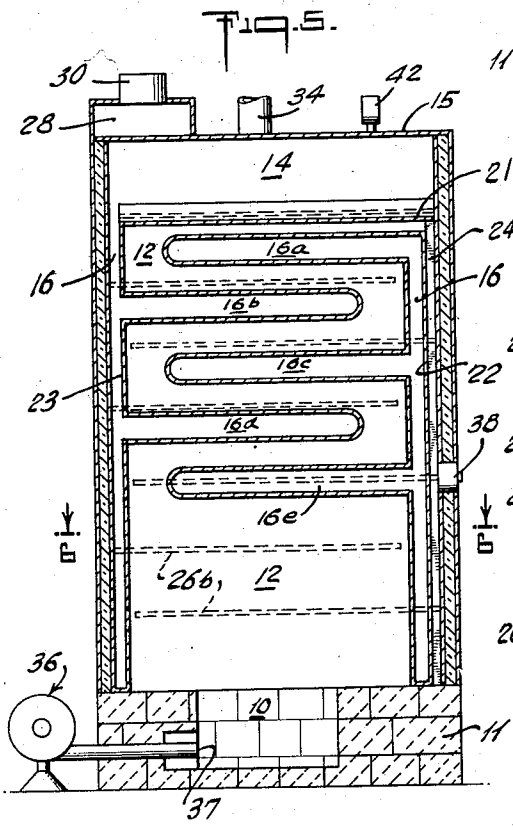
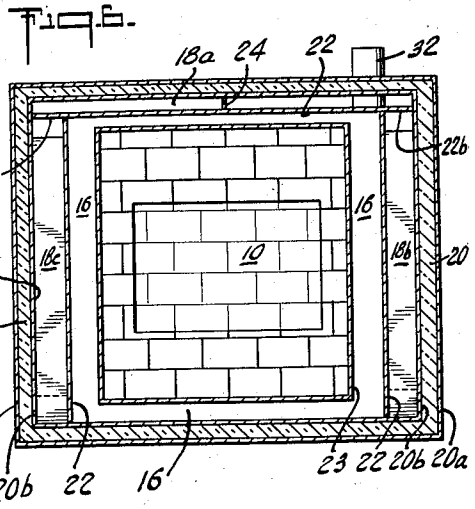


Fig. 6.



INVENTOR
MICHAEL J. DELEONARDIS
BY
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ATTORNEYS

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Filed June 7, 1956 3 Sheets-Sheet 3

Fig. 7.

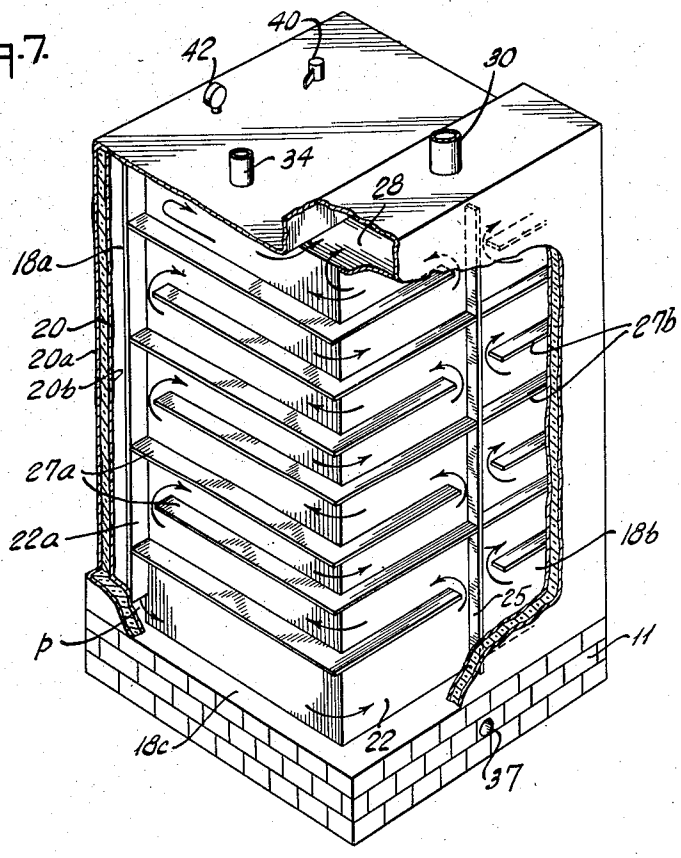
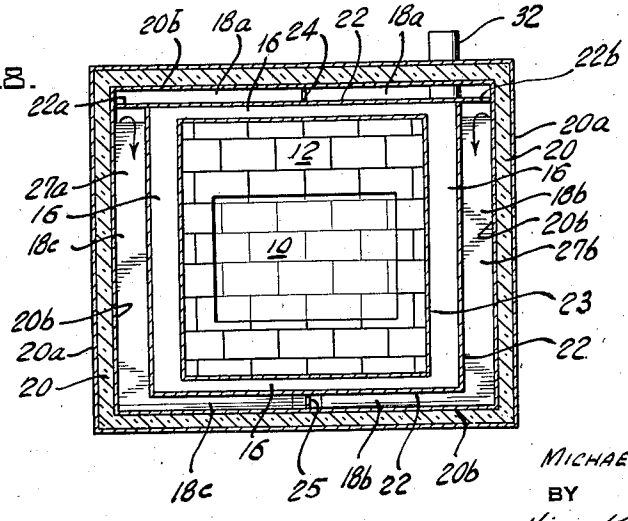


Fig. 8.



INVENTOR
MICHAEL J. DELEONARDIS
BY
Hoag, Fillburn & Carlson.
ATTORNEYS

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DEVICE FOR HEATING A HEAT TRANSFER MEDIUM

Michael J. De Leonardis, Valley Stream, N.Y.

Application June 7, 1956, Serial No. 589,991

2 Claims. (Cl. 122—135)

This invention relates to a gas or oil burning furnace or boiler in which a fluid medium is heated and circulated to a room, office or other space or object which it is desired to heat. While various mediums may be heated and circulated the invention is described herein embodied by a boiler employing water or steam as the heat transferring medium and having connections through which the water or steam may be circulated through any suitable circulation system. This application is a continuation in part of my copending application Serial No. 179,464 filed August 15, 1950, now Patent No. 2,751,892.

An object of the invention is to provide an efficient means for heating a heat transfer medium.

Another object of the invention is to provide a simple, practical and efficient device having a maximum B.t.u. output for the amount of fuel consumed.

Another object of the invention is to provide a device of the above described kind which is of small size in proportion to its heat output.

Another object of the invention is to provide a device of the above described kind which can be operated without any chimney external to the furnace casing.

Other objects of the invention will be in part obvious or in part pointed out hereinafter.

The invention accordingly consists in the features of construction, combination of elements, arrangements of parts, and in the several steps and relation and order of each of said steps to one or more of the others thereof, all as will be pointed out in the following description, and the scope of the application of which will be indicated in the following claims.

The invention will best be understood if the following description is read in connection with the drawings, in which,

Figure 1 is a perspective view of a device embodying my invention, partly cut away to show the flow of heated gases over the back and sides of the heat transfer fluid compartment;

Figure 2 is a perspective view similar to Figure 1 but further cut away to show the interior of the boiler and especially the heat transfer fluid compartment and the path of the heated gases i.e. products of combustion around the projections of the fluid compartment which are above the fire box;

Figure 3 is a front elevation partly broken away of the device shown in Figure 1;

Figure 4 is a rear elevation of the device shown in Figure 1;

Figure 5 is an elevation taken on the line 5—5 of Figure 3;

Figure 6 is a plan view of a horizontal section taken on the line 6—6 of Figure 5;

Figure 7 is a perspective view similar to Figure 1 but showing the baffles which direct gas back and forth over the sides of the water compartment extended part way over the front of the water compartment, and

Figure 8 is a plan view of a horizontal section through the structure shown in Figure 7.

As will be seen more clearly from Figure 6, the device comprises a fire-box **10**, a first combustion chamber **12** leading upwardly from the fire-box; and a boiler space **14** above said first combustion compartment and comprising part of the compartment **16** for water or other fluid transfer medium that extends entirely around the said first, or combustion chamber; and a second or flue-gas chamber **18** extending around the rear and sides of compartment **16** and communicating at the top with chamber **12**, and an insulation chamber **20** extending around the rear and sides of **18** and over the front. Space **14** is above space **12** and separated from it by the horizontal partition **21**.

Insulation chamber **20** is defined by walls **20***a* and **20***b* extending from base **11** to top wall **15** of the boiler. Compartment **18** is separated from compartment **16** by vertical wall **22**, and compartment **16** is separated from chamber **12** by vertical wall **23**.

The products of combustion pass from the fire-box upwardly in space **12** through an elongated path around the vertically spaced horizontally disposed and inwardly projecting portion **16***e*—**16***a* of compartment **16**. Portions **16***a*, **16***c* and **16***e* project from rear to front within space **12** of the first chamber and portions **16***b* and **16***d* extend from front to rear within space **12** and substantially overlap said extensions **16***a*, **16***c* and **16***e* although spaced vertically therefrom thus defining an elongated path for the products of combustion from fire-box **10** around the projecting portions **16***a*—**16***e* of the heat transfer fluid chamber **16**, over the top of the rear wall of said chamber **16** to the top of chamber **18** which extends along the rear portion of chamber **16**, between chamber **16** and the insulation compartment **20**, and communicates at its lower end with compartments within which the heated gases are passed back and forth over the respective sides of chamber **16** as will be described. Said horizontal projecting portions **16***a*—**16***e* of compartment **16** extend across the first chamber **12** and along their lateral margins respectively as well as along their rear margins are open to the main vertically extending compartment **16**. Thus each portion **16***a*—**16***e* opens into three of the four vertically extending portions of compartment **16**.

Compartment **16** communicates with space **14**, on both side edges of horizontal partition **21** as well as in front of partition **21**. The products of combustion, heated to a high temperature in the fire-box, pass from the fire upwardly over the inner face of compartment **16**, and around the extensions of said compartment **16***e*, **16***d*, **16***c*, **16***b* and **16***a* which are disposed in staggered overlapping relation, to the upper rear end of the portion of space **12** which is above the horizontally extending portion **16***a* and below the partition **21** and communicates with compartment **18** which constitutes a continuation of the gas passage provided within space **12**. Compartment **18** comprises portions **18***a*, **18***b* and **18***c*. Portion **18***a* extends over the rear of fluid compartment **16**. Portions **18***b* and **18***c* overlie the respective sides of compartment **16**. Said portion **18***a* is divided vertically by the partition **24** and the spaces thus provided on the opposite sides of partition **24** communicate respectively with the chambers **18***b* and **18***c* at their lower ends through cut outs *p* at the lower corners of wall **22** which is extended laterally to the wall **20***b* by the lateral extensions **22***a* and **22***b*. The ports *p* are formed by cutting away these lateral extensions **22***a* and **22***b* at the bottom. The gas chamber portions **18***b* and **18***c* have horizontal baffles **26***a* and **26***b* respectively arranged therein in staggered relation and extending substantially across the full width of the sides respectively so that the products of combustion, after flowing downwardly through divided portion **18***a*, travel upwardly through

an extended path in chamber portions 18*b* and 18*c* respectively over the outer surface of opposite side portions of chamber 16, to opposite sides of exhaust chamber 28, from which they may be discharged through the small, pipe-like exhaust conduit 30, the diameter of which may be on the order of two to four inches depending upon the size of the heating unit.

Compartment 16 is thus heated on a plurality of surfaces by direct contact with the highly heated products of combustion and a fluid medium therein absorbs heat rapidly and circulates from the inlet and return conduit 32, through chamber 14, from which it passes, in vapor or liquid phase according to the heating system employed, to and through the outlet conduit 34, to the radiators, coils, or other known heat radiating or transferring means employed (not shown) and back to conduit 32.

The structure described above when operated with blower-burner means adjusted as is described herein, provides extremely efficient heating apparatus in which so much of the heat of the heated gases or products of combustion has been successfully transferred to the heat transfer medium in compartment 16 that gases having a temperature in the fire-box on the order of 2400° F. have a temperature on the order of 190° F. in exhaust conduit 30, upon leaving exhaust chamber 28.

In Figures 7 and 8 the structure described above is modified to the extent that the chamber for the heated products of combustion is extended over the front of the chamber 16, and is divided by the vertical partition 25. The baffles 27*a* and 27*b* respectively are extended from each side of the boiler around to the front so that the two heated gas streams which are giving up their heat to the fluid transfer means each travel back and forth across a side and part of the front of wall 22 in a continuous path. Thus portion 18*b* of compartment 18 includes one half of the space between walls 20*b* and 22 in front of the front portion of water compartment 16, and portion 18*c* of compartment 18 includes the other half of the space between said walls 20*b* and 22 in front of the front portion of water compartment 16, the line of division being vertical partition 25 the flue gas chamber as shown in Figure 8, comprises two halves. Each half comprises a part of portion 18*a* and a side-and-front portion 18*b* or 18*c*. Each side-and-front portion comprises a side portion and part of the front portion.

The heated gas products of combustion thus flow from the fire box through compartment 12 into the top of portion 18*a* of compartment 18. Within portion 18*a* the heated gas is divided by partition 24 into two streams which pass down over the rear portion of the heat transfer medium chamber 16 and through ports *p* into portions 18*b* and 18*c* respectively of the flue gas chamber 18. As best seen in Figure 8 the heat transfer chamber 16 and the flue gas chambers 18*a*, 18*b* and 18*c* have the wall 22 in common. Within each of said portions 18*b* and 18*c* the gases pass back and forth substantially horizontally over one side and half the front of the water compartment 16, rising gradually from beneath the lowest baffle 26 to the exhaust conduit 36. The two streams of gases reach the exhaust conduit from opposite directions by way of exhaust chamber 28. The portions 18*b* and 18*c* of the flue gas chamber each has a wall in common with a side portion of the heat transfer chamber 16 and a front portion of the heat transfer chamber 16.

In my device the products of combustion flow through an extended path from the fire-box to the exhaust conduit 30 which is of relatively small cross sectional area, and due to the many changes in direction of flow of the products of combustion the rate of flow is slow and gentle. This has two important results. First it produces prolonged contact of the products of combustion with the surface of the compartment 18, without interference due to down draft, and second, it causes the mixture of fuel and air introduced to the fire box through

the blower-burner 36 and the port 37 in the front wall of the furnace, to remain in the fire-box long enough to be substantially completely consumed. The slow non-turbulent flow of the products of combustion in my device permits full utilization of the thermal energy of the gases and results in a very efficient transfer of energy to the fluid transfer medium.

In my device unconsumed fuel passes through a flue gas passage which is very long compared with the relatively short distance between the fuel inlet and the exhaust port or chimney of the ordinary burner installation, and the very high temperature throughout said long path completes the combustion of any fuel not consumed in the fire-box. The passing of the gases or heated products of combustion first upwardly around the projecting portions 16*e*, 16*d*, 16*c*, 16*b* and 16*a* of compartment 16, and then successively down over the rear of the compartment 16 and upwardly over the opposite sides of said compartment provides a very long passage in which flame is supported provided a large portion of air is introduced into the boiler through the oil burner causing a very actively burning flame within the fire box and a stream of flame and products of a combustion travelling gently and slowly through said long restricted path heated to such a high degree that fuel not consumed in the fire box is consumed while travelling through said path, thus effecting a considerable saving over the ordinary type of furnace.

Because no chimney extending directly from the fire box upwardly to a point outside the furnace casing is employed there is no draft such as is caused by such a chimney. The mixture of fuel and air is thus held back by atmospheric pressure including the weight of the gas column directly above it and moves along its extended path very slowly in contrast to the rapid flow through and above the fire box of prior art boilers caused by the suction at the top of the chimney which acts to pull the products of combustion. Such suction both works against complete combustion, and materially shortens the time the heated products of combustion remain in contact with the effective heating surfaces inside the standard and prior art boilers.

Plugs 38 have been indicated extending through the insulating outer wall of the furnace. A number of these are provided so that, when removed, ready access may be had to the interior of the compartments through which the products of combustion pass first after leaving the fire box 10 and the space 12 above the fire box to facilitate cleaning of this space. A safety pressure valve or plug 40 of an ordinary kind is indicated on top of the furnace as well as the pressure indicator 42 of any well known type. Actual use has shown that very little cleaning is required because of the substantially complete combustion which is accomplished.

It will thus be seen that there has been provided by this invention an apparatus in which the various objects hereinabove set forth together with many thoroughly practical advantages are successfully achieved. As various possible embodiments might be made of the mechanical features of the above invention and as the art herein described might be varied in various parts, all without departing from the scope of the invention, it is to be understood that all matters hereinbefore set forth or shown in the accompanying drawings is to be interpreted as illustrative and not in a limiting sense.

What I claim is:

1. A boiler or water heater of the class described comprising a plurality of nesting chambers, including a first innermost chamber comprising a combustion chamber, an intermediate chamber for heat transfer medium, and a third chamber surrounding the intermediate chamber and forming a flue gas chamber comprising, a rear portion and two side-and-front portions, the rear portion being parallel with and having a wall in common with the rear portion of the intermediate chamber and hav-

ing means dividing said rear portion vertically into two separate parts, the said side-and-front portions each having a portion parallel with and having a wall in common with a side of the intermediate chamber and a portion parallel with and having a wall in common with one half of the front of the intermediate chamber, a passage for the flue gas extending from said first chamber to the said rear portion of the flue gas chamber, means providing communication between the said parts of said rear portion of the flue gas chamber and said two side-and-front portions respectively, and vent means communicating with said two side-and-front portions respectively to exhaust flue gas after it has passed from the combustion chamber down the rear portion of the flue gas chamber and up the two side-and-front portions respectively of the flue gas chamber.

2. A boiler or water heater of the class described comprising, a plurality of nesting chambers, including a first innermost chamber comprising a combustion chamber, an intermediate chamber for heat transfer medium, and a third chamber surrounding the intermediate chamber and forming a flue gas chamber, means vertically dividing the flue gas chamber into two halves each of which comprises, a part of the rear portion of the flue gas chamber, which is parallel with and has a wall in common with a portion of the rear of the intermediate chamber, a side portion which is parallel with and has a wall in common with a side of the intermediate chamber and a front portion which is parallel with and has a wall in common with part of the front of the intermediate chamber, a passage for the flue gas extending from the combustion chamber to both of said halves of the flue gas chamber, means separating the upper portions of the said parts of the rear portion of the flue gas chamber respectively from the side portions of the said halves of the flue gas chamber, and means in each of the side and the front portions of each of the halves of the flue gas chamber for directing the products of combustion from the bottom thereof back and forth therein to the top, and vent means communicating with said side and said front portions at the top.

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