Sept. 6, 1949. D. W. MAIN 2,481,480

AUXILIARY HOT WATER HEATER

Filed May 11, 1946 2 Sheets-Sheet 1

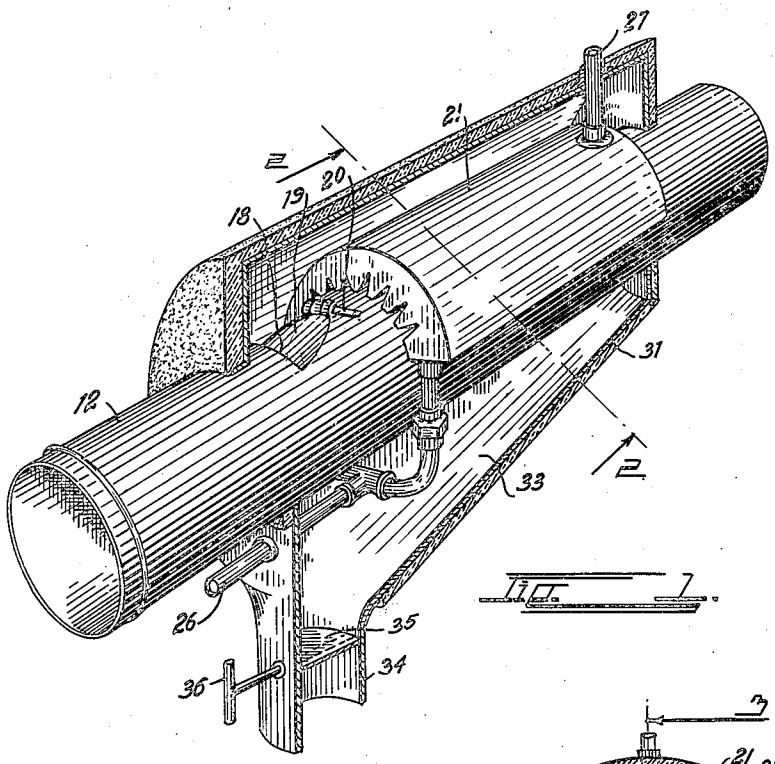


Fig. 1.

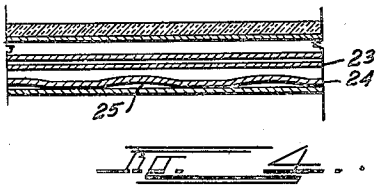


Fig. 4.

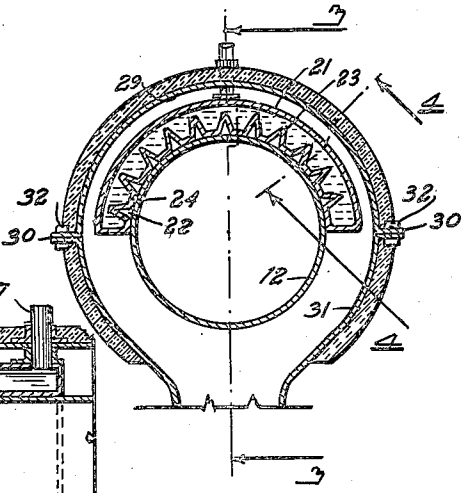


Fig. 2.

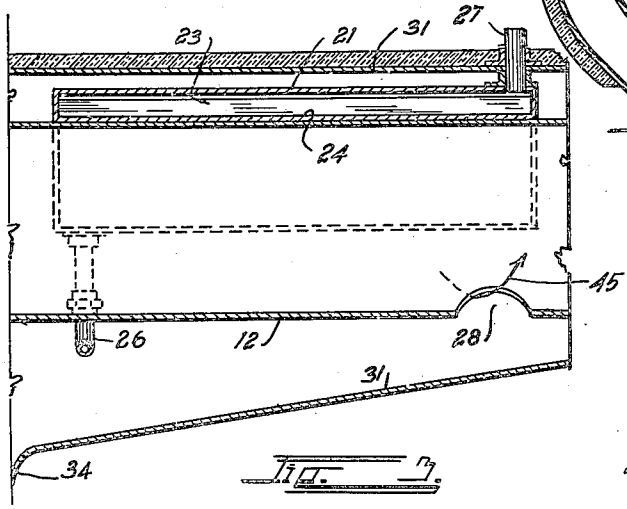


Fig. 3.

INVENTOR.
DAVID W. MAIN.
BY
Martin E. Anderson
ATTORNEY.

Sept. 6, 1949. D. W. MAIN 2,481,480

AUXILIARY HOT WATER HEATER

Filed May 11, 1946 2 Sheets-Sheet 2

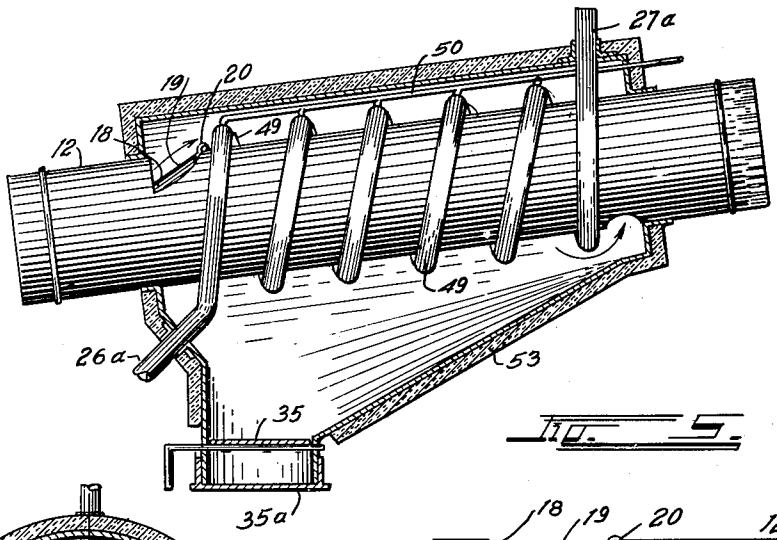


Fig. 5.

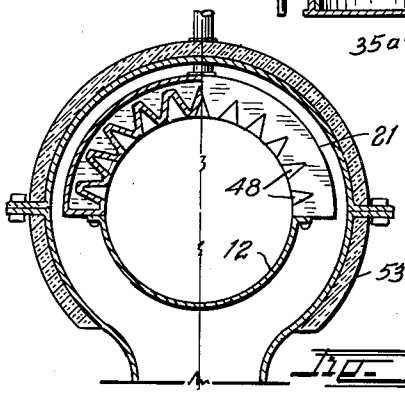


Fig. 8.

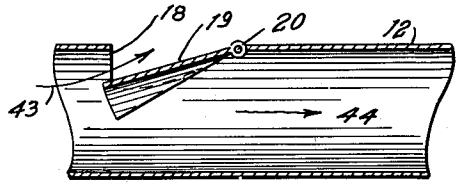


Fig. 6.

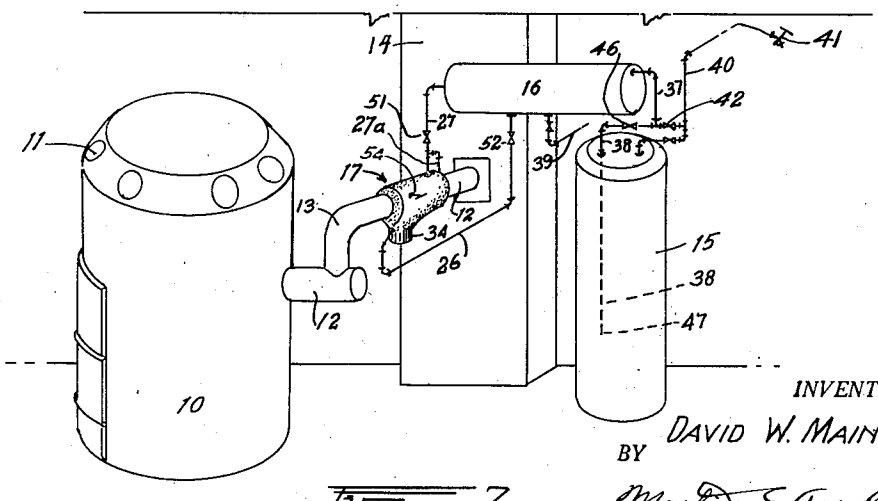


Fig. 7.

INVENTOR.
DAVID W. MAIN.
BY
Martin E. Anderson
ATTORNEY.

Patented Sept. 6, 1949

2,481,480

UNITED STATES PATENT OFFICE

2,481,480

AUXILIARY HOT WATER HEATER

David W. Main, Denver, Colo.

Application May 11, 1946, Serial No. 669,199

6 Claims. (Cl. 257—235)

1

This invention relates to improvements in heat transfer devices and has reference more particularly to an improved device for abstracting heat from flue gases.

It is well known that the heating systems commonly employed in residences and small apartment houses are very inefficient. Tests have shown that the heat loss in such systems is sometimes as high a 60% of the heat actually liberated by the burning coal and that they seldom fall below 30%.

In the ordinary furnace employing coal, and to some extent when gas or oil is employed, the gases of combustion enter the smoke pipe at temperatures much higher than that required for draft purposes and all heat is excess of this is wasted.

It is the object of this invention to produce an apparatus and a combination of elements by means of which a large amount of the heat that would otherwise pass to and up the chimney will be conserved and utilized.

It is obvious that any device connected with the flue gas conduits for the purpose of abstracting heat from the flue gases lower the temperature and my invention contemplates the use of means for adjusting the abstraction to an amount that will not interfere with the draft.

A further object is to produce a heat exchange unit of such construction that it can be readily installed in any heating plant.

Another object is to produce a heat exchange unit or vent pipe that can be easily cleaned.

A still further object is to produce a heat exchange unit so that hot gases will contact large surface areas to facilitate heat transfer.

The above and such other objects as may appear as the description proceeds are attained by means of a construction and relationship of parts that will now be described in detail, and for this purpose reference will be had to the accompanying drawings in which the invention has been illustrated, and in which:

Figure 1 is a view partly in elevation and partly in section showing my improved heater transfer unit in assembled relation;

Figure 2 is a transverse section taken on line 2—2, Figure 1;

Figure 3 is a longitudinal diametrical section taken on line 3—3, Figure 2;

Figure 4 is a section taken on line 4—4, Figure 2;

Figure 5 is a view similar to that shown in Figure 1 and shows a slightly modified construction;

2

Figure 6 is a fragmentary detail showing one feature of the construction of the combustion gas flue;

Figure 7 is an assembly view showing my invention embodied in a water heating system; and

Figure 8 is a section similar to that shown in Figure 2, but shows a slightly modified form thereof.

Referring now to Figure 7, reference numeral 10 designates an ordinary furnace of the hot air type having openings 11 for hot air flues. Reference numeral 12 designates the furnace smoke pipe which has been shown as provided with an elbow 13 and which extends into chimney 14. Positioned adjacent the furnace is a hot water tank 15 of any suitable type, preferably an automatic gas operated hot water tank. Reference numeral 16 designates an auxiliary water tank and reference numeral 17 designates the heat transfer unit to which this invention relates and which will now be described in detail.

Referring now to Figures 1 and 3: The gases of combustion flow on their way to the chimney through the smoke pipe or conduit 12. This pipe may be of the usual furnace pipe construction and ordinarily has a diameter of eight inches; although the size and length is immaterial so far as this invention is concerned.

One section of pipe 12, the one shown in Figure 1, is provided at its top with an opening 18, which is shown more clearly in Figure 6 to which reference may be had. A damper 19 is positioned on the inside of the pipe and is mounted for pivotal movement about hinged pin 20. Means is provided for moving the damper and for holding it in adjusted position somewhat as shown in Figure 6. The adjusting means has been shown in a general way in Figure 7 of the drawing and may be so constructed that the frictional resistance of the hinge will hold the damper in adjusted position; however, any other suitable means in addition thereto may be used, if desired. Supported on the upper surface of pipe 12 is a water chamber comprising an elongated hollow body 21 that rests saddle-like against the upper surface of the pipe. In the embodiment shown, member 21 is semi-cylindrical and the inner surface is folded so as to produce longitudinal ribs 22 that extend upwardly to point 23, near the inner surface of the outer wall. The inner vertices of the folded inner wall, which have been designated by reference numeral 24, are somewhat undulated as shown in Figure 4, so as to provide gaps 25 through which soot may escape and which facilitates cleaning, in a manner which

will hereinafter be pointed out. Water is introduced to the lower end of member 21 through pipe 26 and leaves through pipe 27 which is connected in the outer wall thereof. Since the smoke pipe is preferably upwardly and rearwardly inclined, water, when introduced through pipe 26, will have to flow upwardly to the exhaust pipe 27 when its temperature is raised, because the specific gravity of heated water is less than that of a lower temperature. Pipe 12 is provided with an opening 28 in its lower surface directly underneath the upper end of member 21 as shown in Figure 3.

A housing comprising an upper semi-cylindrical shell 29 is provided with outwardly extending flanges 30 that are bolted to similar flanges on the lower section 31 forming a closed housing. The two parts are held in assembled relation by means of bolts 32, as shown in Figure 2. Parts 29 and 31 may be covered with heat insulating material as shown. Section 31 has a downwardly rearwardly and rearwardly inclined inner surface 33 that terminates in a downwardly extending tubular part 34. A damper 35 serves to close the opening in part 34 and is provided with a handle 36 that is accessible on the outside for opening and closing the same.

Referring now again to Figure 7, it will be seen that pipe 27 extends upwardly to water tank 16 and is in communication with the interior thereof. From the other end of tank 16, a pipe 37 extends downwardly and connects with the cold water pipe 38 above the automatic heater 15. The cold water pipe that connects with the city water supply has been designated by reference numeral 39 and the hot water pipe from tank 15 has been designated by reference numeral 40. This extends to a sink or other fixture and the flow of liquid therefrom is controlled by means of a valve 41. A pipe and valve 42 connect the lower end of pipe 37 with the hot water pipe 40. Normally valve 42 is closed, but may be opened under certain circumstances which will be referred to hereinafter.

Let us now assume that the parts are connected as shown in Figure 7 and that a brisk coal fire is burning in the furnace. Gases of combustion will flow through the smoke pipe and into the chimney. Since damper 19 is partially open, as shown in Figures 5 and 6, a portion of the gases of combustion will pass upwardly through opening 18 in the direction of arrow 43, while the other portion will flow in the direction of arrow 44. Some of the gases that pass through opening 18 will flow through the passages between the inner wall of member 21 and the outer surface of the smoke pipe and other portions will flow around the outside of member 21 and will then pass downwardly about the outer surface and finally again enter the smoke pipe through opening 28, in the direction of arrow 45 in Figure 3. A portion of the heated gases will flow through the smoke pipe and will keep the wall thereof very hot. Some of this heat will be transferred by conduction to the inner wall of member 21 and this will be absorbed by the water in member 21. The outer surface of the hollow body 21 will also be kept hot by the action of the heated gases that leave pipe 12 through opening 18 and enter it again through opening 28. The heat from the gases of combustion will thus be absorbed by the water and since this is connected with tank 16 in a manner similar to that in which a furnace coil is connected with an ordinary hot water heater, a local circulation will be set up and if continued long enough all of the water in tank 16 will become hot, either by actually passing through the interior of member 21, or by absorbing heat from the water that has thus been heated.

Let us now assume that the automatic hot water tank 15 is inactive and that valve 46 is closed and valve 42 open. If valve 41 is now opened, hot water will be drawn directly from tank 16.

If a large amount of water is used and the automatic heater 15 is also in operation, valve 42 is closed and valve 46 is open and therefore whenever valve 41 is opened, water will be drawn from the top of tank 15 and will be replaced by warm water from tank 16 and this, in turn, will be replaced by cold water entering through pipe 39. The water from tank 16 will be delivered to the interior of tank 15 through the downwardly extending cold water pipe 38 that terminates at 47.

It will be seen from the above that the auxiliary heater, that forms the subject of this invention, with its tank 16 forms an independent hot water heating unit that serves as a preheater for water in tank 15. Less heat is therefore required to heat the water in tank 15 to the temperature desired.

Referring now to Figure 8 where a slight modification has been shown, it will be seen that the upper half of pipe 12 has been removed, leaving a hole or opening that is closed by the elongated member 21. Since there is no wall between the inner longitudinal ribbed wall of member 21 and the inside of pipe 12, the heated gases are free to come into direct contact with the surfaces of the longitudinal grooves 48. This gives a direct contact between the hot gases inside of the pipe and the inner surface of the water containing element 21. With the exception of the removal of the upper wall of pipe 12, the arrangement shown in Figure 8 is identical with that shown in Figures 1 to 3, inclusive.

In places where a somewhat simpler and less expensive installation is desired, member 21 may be replaced by a copper tube 49 which is wrapped helically around the furnace smoke pipe as shown in Figure 5. The water enters at 26*a* and leaves at 27*a*. The heated gases that pass through opening 18 come into direct contact with the outer surface of pipe 49 and transfers heat to the pipe and to the water contained therein. At the same time heat is conducted from the gas on the interior of pipe 12 to pipe 29 and to the water therein. In order to assure that no considerable amount of air will be trapped in pipes 49, every turn of the pipe is connected at its highest point to a drain pipe 50 that connects with pipe 27 at some suitable point between the heater and tank 16, as shown in Figure 7.

If, for any reason, the auxiliary heater that forms the subject of this invention becomes inoperative, it may be disconnected by closing valves 51 and 52. With these valves closed, the auxiliary heater may be entirely removed, if desired. Tank 15 will remain in the position shown. The enclosing housing may, of course, be covered with insulating material 53, if desired.

The gases that leave a furnace are always quite hot, their temperature depending on various considerations, for example the heat abstracting properties of the furnace itself, the directness of the path from the combustion chamber and the velocity of the gases of combustion. After the gas leaves the furnace proper, any

heat that is contained in them is dissipated. The only useful portion thereof being that which is required to produce the necessary draft by hydrostatic action, due to differences in temperature and density. Since the gases are always much hotter than necessary to produce the required draft, all of the heat above that may be abstracted without in any way interfering with the operation of the heating plant and any heat thus abstracted costs nothing because it is not made use of, it is simply dissipated.

In the embodiment shown in Figure 5, in addition to damper **35**, a removable cap **35***a* has been shown. This cap serves to more closely seal the outlet to prevent the entrance of air at this point.

Referring to Figure 7, attention is called to the handle **54** that is accessible from the outside and by means of which damper **19** may be adjusted whenever required to obtain the best division of the heated gases.

From time to time the auxiliary heater must be cleaned and this is accomplished by tapping the outside dislodging any soot that may adhere. The soot falls into the top surface of member **31** and flows downwardly lodging on damper **35** and may be removed by opening the damper.

By placing the heat absorbing member **21** on the outside of pipe **12**, the draft is not interfered with and by means of damper **19**, the maximum quantity of heated gases may be bypassed and brought into contact with the outer surface of member **21**.

Referring now to Figure 3 which shows opening **28** in the under side of pipe **12**. Attention is called to the fact that this opening may be elongated or enlarged to any extent and it will then allow fly ash to fall through and onto the upper surface **33** of the lower part. The fly ash may then be readily removed through pipe **34** by opening damper **35**.

Referring again to Figure 4 and to the gap **25**, attention is called to this feature of the construction. With gaps like **25** the soot and fly ash that would otherwise collect in the spaces or channels above the outer surface of conduit **12**, can escape and drop into the compartment below the conduit. By striking the wall of the outer housing or conduit **12**, the ash may be loosened to facilitate its passage through openings **25**.

Having described the invention, what is claimed as new is:

1. In combination with a pipe having a section for the escape of hot gases of combustion, means for abstracting heat from the gases, comprising, a housing enclosing a portion of the section of the pipe, the latter having an opening in the top, communicating the interior thereof with the interior of the housing at the gas inlet end, and an opening in the bottom near the other end of the housing, whereby hot gases may enter the housing through the first mentioned opening and leave through the other opening, an elongated substantially semi-cylindrical hollow heat absorbing body resting on the upper surface of the pipe in the housing, and means for circulating water through said body.

2. In combination with a pipe having a slightly inclined section for the escape of hot gases of combustion, means for abstracting heat from the gases, comprising a housing enclosing a portion of said section of the pipe, the latter having an opening in the top communicating the interior thereof with the interior of the housing at the gas inlet end, and an opening in the bottom near the other end of the housing, whereby hot gases may enter the housing through the first mentioned opening and leave through the other opening, a hollow heat absorbing body in the housing, means for circulating water through said body, a damper in the first mentioned opening, and means accessible from the outside for controlling and adjusting the position of the damper to change the proportion of the gases passing through the housing.

3. In combination with a pipe having a slightly inclined section for the escape of hot gases of combustion, means for abstracting heat from the gases, comprising a housing enclosing a portion of said section of the pipe, the latter having an opening in the top communicating the interior thereof with the interior of the housing at the gas inlet end, and an opening in the bottom near the other end of the housing, whereby hot gases may enter the housing through the first mentioned opening and leave through the other opening, a hollow heat absorbing body having one side concave, positioned in close contact with the outer surface of the pipe, and means for circulating water through said body.

4. A device in accordance with claim 1 in which the bottom wall of the housing has an opening through which soot may be removed and means for closing the opening.

5. A device in accordance with claim 1 in which a damper is provided in the pipe adjacent the first opening for varying the proportionate amount of hot gases that pass through the housing.

6. In combination with a pipe for the escape of hot gases of combustion, means for abstracting heat from the gases, comprising a housing enclosing a section of the pipe, a hollow heat absorbing body positioned in the housing, the side of the body facing the pipe being curved to conform to the shape of the latter, the concave inner surface being longitudinally fluted, the vertices being longitudinally undulated to provide openings for the escape of soot and fly ash.

DAVID W. MAIN.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
687,735	Elmendorf	Dec. 3, 1901
1,206,081	Becker et al.	Nov. 28, 1916
1,896,671	Heaps	Feb. 7, 1933
2,020,686	Kaiser	Nov. 12, 1935
2,035,341	Radloff	Mar. 24, 1936