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FUEL BURNING AIR HEATING APPARATUS

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2 Sheets-Sheet 1

FIG. 1.

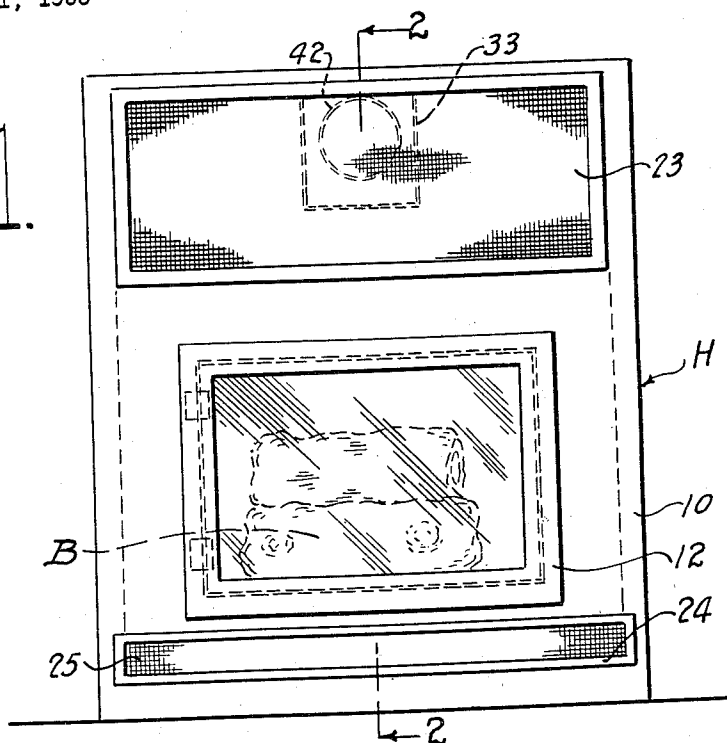


FIG. 2.

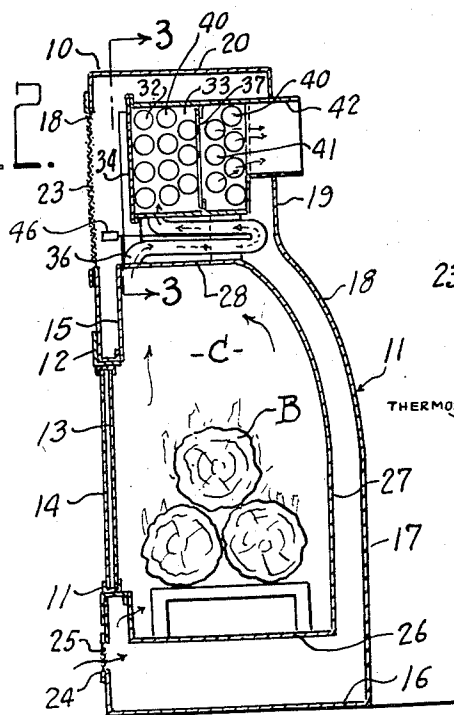
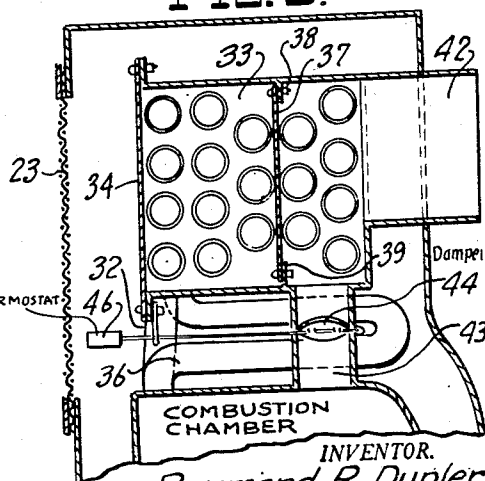


FIG. 3.



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FUEL BURNING AIR HEATING APPARATUS

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7 Claims. (Cl. 126—63)

This invention relates to heating apparatus but more particularly to that type of apparatus employing products of combustion as the source of heat, and an object is to produce a new and improved heater of the above character for heating fluids such for example as air and the like.

Another object is to improve the efficiency of heaters of the above type and to produce a relatively inexpensive unit having the unique features of construction and arrangement hereinafter described.

Other objects and advantages will hereinafter appear and, for purposes of illustration but not of limitation, an embodiment of the invention is shown on the accompanying drawings in which

Figure 1 is a front elevation of a heating apparatus embodying the invention;

Figure 2 is a vertically sectional elevation substantially on the line 2—2 of Figure 1;

Figure 3 is an enlarged fragmentary sectional view substantially on the line 3—3 of Figure 2;

Figure 4 is a view substantially on the line 4—4 of Figure 3; and

Figure 5 is a fragmentary sectional view showing particularly the bypass from the combustion chamber to the collecting header and a damper controlling such by-pass.

The illustrated embodiment of the invention comprises a housing resembling a fireplace designated by the reference letter H, the same being employed for heating the air within a room. The housing is formed with a vertical front wall 10 having a window opening 11 in the lower portion thereof, the same being covered by a door or frame 12, which preferably can be removed or swung outwardly to afford access to the interior. Suitably carried by the door or frame 12 in an inner glass panel 13 and an outer glass panel 14 separated slightly from each other, such panels enabling the occupant of the room to view the burner unit B, which is disposed within a combustion chamber C. The burner unit B may be made to burn gas or oil for example and have an exposed flame, which as above mentioned may be viewed from the outside of the housing.

The combustion chamber C has a front wall 15 having an opening registering with the opening 11 of the housing. The housing H has a bottom wall 16 and a rear wall 17, which extends upward vertically and then gradually curves upwardly and inwardly, as indicated at 18, and then terminates in a vertical upper portion 19 which is in parallel relationship to the front wall 10 of the housing. A top wall 20 connects the top edges of the front and the rear walls of the housing and at the ends of the housing are upright end walls 21 which are secured to the front and rear walls thereby forming an enclosure. The housing is formed from sheet metal of the desired gauge and, as shown, there is an elongate rectangular opening 23 at the upper portion of the front wall 10 which constitutes an hot air outlet. This opening is covered by a screen or foraminous sheet 23. At the bottom portion of the front wall 10 is an elongate opening 24 substantially

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smaller than the opening 23, the same being covered by a screen 25 and this opening serves as an inlet for cold air from the room.

Connected to the front wall 15 of the combustion chamber C is a bottom wall 26 which is spaced upwardly from the bottom wall 16 of the housing H. Secured to the rear end of the bottom wall 26 is a rear wall 27, which is spaced inwardly from the rear wall 17 of the housing and curves upwardly and inwardly similar to the wall 17. At the top of the combustion chamber is a top wall 28 connecting the front and rear walls of the combustion chamber. Manifestly at opposite ends are end walls 28a closing the opposite sides or ends of the combustion chamber.

Formed in the extreme front portion of the top wall 28 of the combustion chamber and extending completely across such wall is a row of equidistantly spaced holes. In this instance there are twelve holes and for assistance in describing the structure, these holes will be referred to in groups, the end groups 29 and 30 of four each being disposed at the outer sides or ends of the row and a group 31 being disposed in the center, the latter also containing four holes. Extending upwardly at substantially right angles from the top wall 28 and connected to the holes in the groups 29 and 30 are L-shaped tubes 32, the inner ends of which connect to the opposite side walls of the front compartment or chamber of a collecting header 33. As shown particularly in Figure 3, the tubes 32 are arranged in somewhat nested form, those toward the center having the shorter vertical and horizontal arms and being connected to the lowermost portion of the side walls of the header. Then the other two are spaced equidistantly from each other and progressively become of greater length having a longer vertical and horizontal arm. Thus the connection to the header forms vertical rows on opposite sides at the front end of the collecting header, particularly as shown in Figure 2. The right angle bend of the tubes 32 is for the purpose of restricting the flow of the products of combustion passing therethrough to enable as much of that heat as possible to be utilized.

It will be noted that the collecting header 33 is in the form of a sheet metal rectangular box, the front end of which is open. A plate 34 closes the front end and this plate is connected by removable fasteners 35 to a flange formed at the front end of the header. This enables access to the interior of the box to be had by removing the closure plate 34, it being understood that the screen 23 must first be removed in order to obtain access to the closure plate 34.

Extending from the group of holes 31 at the center and forming the central group of openings are curved return bend tubes 36. It should be noted that each of the tubes 36 are curved throughout at all bends and do not have the right angle bends as formed in the tubes 32. For example, the extreme end tubes 36 or those tubes closest to the L-shaped tubes 32 curve upwardly from the openings 31 and thus extend horizontally substantially parallel with the top wall 28 of the combustion chamber and outwardly beyond the side walls 28a of the combustion chamber to a point close to the end walls 21 of the housing H. Thence these tubes extend rearwardly to a point about in line with the inner end of the collecting header 33 and thence incline forwardly and upwardly to the bottom wall of the header 33 adjacent the front end thereof. The two intermediate tubes 36 likewise curve upwardly from their openings 31 and thence laterally and rearwardly to the rear wall portion 19 of the housing and thence curve forwardly and inwardly terminating in upwardly curved ends connected to the front portion of the bottom wall of the header 33. Thus the ends of the curved tubes 36 are arranged in a row

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at the front portion of the bottom wall of the header, particularly as indicated on Figure 4.

The interior of the collecting header 33 is divided into two chambers, a front and rear chamber, by a vertical baffle plate 37, which is removably connected to a flange 39 by fasteners 38. Thus by removing the front closure plate 34 access can be had to the baffle plate 37 which can also be removed to enable the tubes to be cleaned, as will more fully appear hereinafter.

The front and rear chambers of the collecting header are connected by relatively long hair-pin shape tubes 40, there being four relatively long hair-pin tubes 40. The front ends of the tubes 40 connect to the side walls of the header and then extend outwardly in a horizontal direction and terminate in curved portions adjacent the side walls 21 of the housing. Then the tubes extend inwardly in a horizontal fashion and parallel to the other arm of the U and connect to the same side wall of the header but at a point close to the rear wall of the header, as shown on Figure 4. Thus there are four hair-pin like tubes 40 in each side of the header and they connect to openings arranged in a row parallel to the connecting openings between the L-shaped tubes 32 and the side wall of the header, all as indicated in Figure 2. Disposed intermediately of the relatively long hair-pin tubes 40 are relatively short hair-pin tubes 41, there being three of such tubes on each side of the header. These do not extend out quite so far as the relatively long tubes but terminate adjacent the side walls 28a of the combustion chamber, as indicated in Figures 3 and 4, and the opposite ends connect to openings arranged in the header on the inner side of the baffle plate 37 adjacent thereto, these also being arranged in a row and being disposed forwardly of the rear connecting openings of the relatively long tubes 40, as shown in Figure 2.

Integral with the collecting header and disposed at its rear wall thereof is a relatively short smokepipe 42, which extends through an opening in the rear wall portion 19 of the housing H, this providing a conduit to which suitable connection can be made to the smoke chimney, as will be readily understood.

It is desired that when the burner B is first turned on and before heat has been generated to any extent, that the products of combustion pass directly to the rear compartment of the collecting header 33. For this purpose a bypass pipe 43 extends vertically from the top wall 28 of the combustion chamber C to the bottom wall of the header at a point in rear of the baffle plate 37. Disposed within the bypass pipe 43 is a pivotly mounted damper 44 rotated by a horizontally disposed shaft, which extends forwardly towards the front of the housing H. A suitable thermostat 46 is provided in the region of the screen 23, a so-called spiral thermostat being found to be satisfactory for this purpose, the same operating to turn the shaft 45 when a predetermined degree of temperature has been reached thereby to close the damper 44 and cause the product of combustion to pass through the tubes above described. The damper will then stay closed so long as the proper heat is generated but when the burner B is shut off or automatically goes off, then the thermostat 46 operates automatically to open the damper 44 and hold it in opened position until heat of predetermined degree has again been generated. Thermostats of this character are well known in the art and detail description and illustration thereof are not considered necessary.

From the above it will be understood that I have produced a highly efficient and economical heater from which the maximum heat is extracted from the products of combustion issuing from the combustion chamber C. The arrangement of the curved return bend tubes 36 is important because they are connected to the combustion chamber where the heat is the greatest. The gases are permitted to pass through these tubes with as little restriction of movement as possible, this being

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achieved by employing curved bends instead of angular bends which would otherwise slow up the passage of the gases therethrough. Since the tubes 36 extend a relatively long distance before reaching the front chamber of the collecting header 33, a large amount of heat is extracted. On the other hand the gases which pass into the L-shaped tubes 32 are not so intensively hot so that the speed of their passage is intentionally restricted by the right angle construction of these tubes. The gases which enter the front chamber of the collecting header have a large portion of the heat extracted but most of the heat which remains is dissipated in passing through the hairpin tubes 40 and 41 to the rear chamber of the collecting header where they pass from the apparatus through the smokepipe 42. Thus the gases which enter the smokepipe 42 are relatively cool, as cool as can reasonably be permitted.

As shown the cold air enters the heating apparatus through the inlet 24 at the base of the housing H and then passes upwardly through the space between the rear wall of the combustion chamber and the rear wall of the housing and in this passage the air is preheated since the rear wall of the combustion chamber is heated. Then the air passes over and about the network of tubes above described so that as discharged into the room through the screened outlet 22, the air will be substantially heated.

The feature by which the tubes can be readily cleaned is of importance. To accomplish this the screen 23 is first removed to enable access to be had to the closure plate 34 which can then be easily unfastened. Thereafter the baffle 37 can be removed to gain access to the inner ends of the hairpin tubes 40 and 41. The combustion chamber door or frame 12 can be removed or opened for access to the opposite ends of the tubes 32 and 36.

As above pointed out, the gases from the combustion chamber C pass directly to the outside through the bypass pipe 43 until such time as sufficient heat is generated by the burner C whereupon the damper 44 is automatically closed by the thermostat 46 and remains closed so long as a predetermined heat is being generated in the combustion chamber. However, when the burner B is turned off or fails to generate the proper heat, then the damper 44 is automatically opened and held in open position until the proper heat is again generated.

Numerous changes and details of construction, arrangement and choice of materials may be effected without departing from the spirit of the invention especially as defined in the appended claims.

What I claim is:

1. Heating apparatus comprising a shell forming a combustion chamber adapted to receive a heater therein, a housing enclosing said shell and spaced therefrom at the sides and rear to provide a passage for air to be heated, said shell and housing being provided with means forming a common framed opening at the front, means forming an inlet for air to the lower portion of the passage, a collecting header in spaced relation to the top of the combustion chamber shell and housing walls to receive products of combustion from said combustion chamber, a baffle separating the interior of the header into front and rear compartments, a series of tubes leading from the combustion chamber to the front compartment and arranged in the path of movement of air from said inlet means, tubes connecting said front and rear compartments and extending from the collecting header in the path of movement of air from said inlet means, means forming an outlet for heated air in front of the header and tubes, and means providing a conduit from the rear compartment to the outside of the housing forming an outlet for the products of combustion.

2. The organization as claimed in claim 1 in which the series of tubes from the combustion chamber to the collecting header comprises U tubes extending from the central top of the combustion chamber, and L-shaped tubes

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communicating with the combustion chamber on laterally opposite sides of the central top of the combustion chamber.

3. The organization as claimed in claim 2 in which the tube means connecting the front and rear header compartments are hairpin shaped.

4. The organization as claimed in claim 3 in which the hairpin shaped tubes comprise a vertical row of relatively long tubes and a vertical row of tubes substantially shorter than said long tubes.

5. The organization as claimed in claim 1 in which the collecting header comprises a box open at the front, a removable plate closing said front, and a mounting for the baffle enabling removal thereof to effect cleaning of the tubes.

6. The organization as claimed in claim 1 comprising a by-pass pipe extending directly from the combustion chamber to the rear compartment, a damper in said pipe,

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and thermostatic means responsive to rise in temperature of the air heated by the heater to close the damper for actuating said damper.

7. The organization as claimed in claim 1 comprising a glass panel covering the framed opening in the housing and shell affording a view of the burner within the combustion chamber and access to the tubes leading therefrom for enabling cleaning thereof.

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