

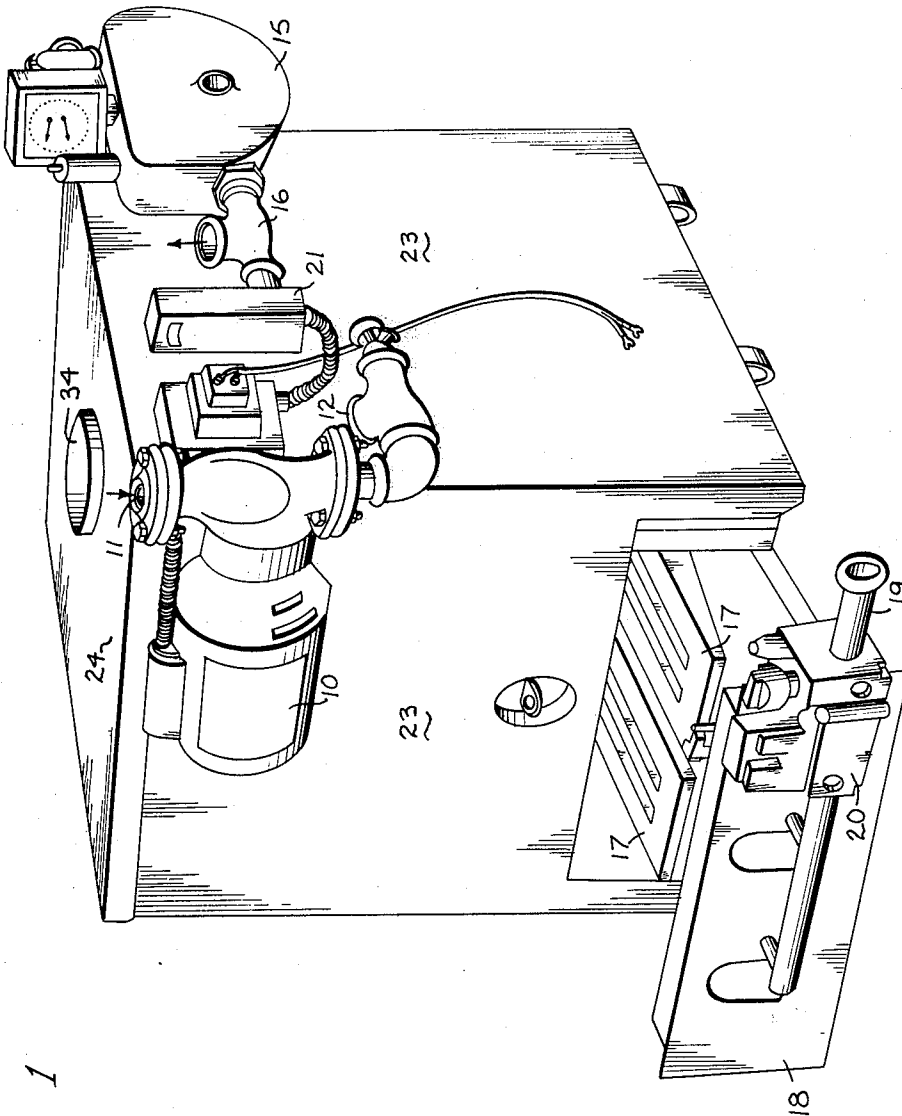
March 29, 1966

W. A. HALE
BOILER SYSTEM

3,242,910

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5 Sheets-Sheet 1



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Fig. 8

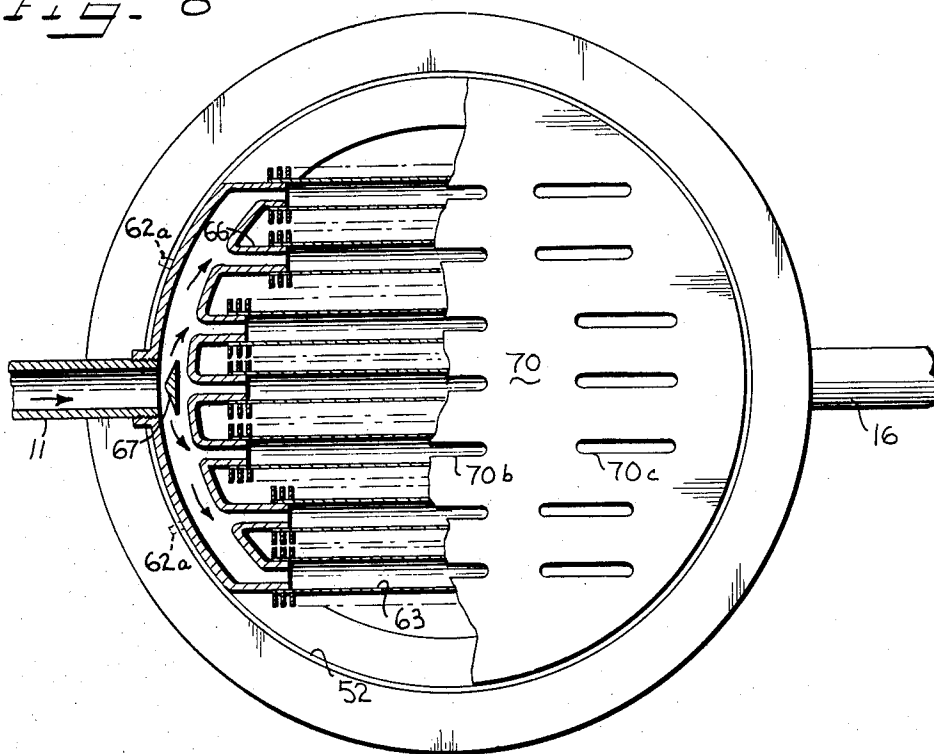
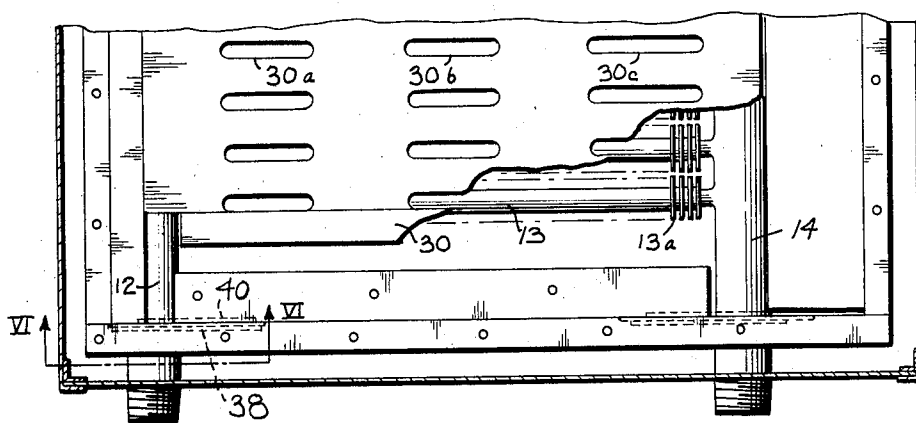


Fig. 4



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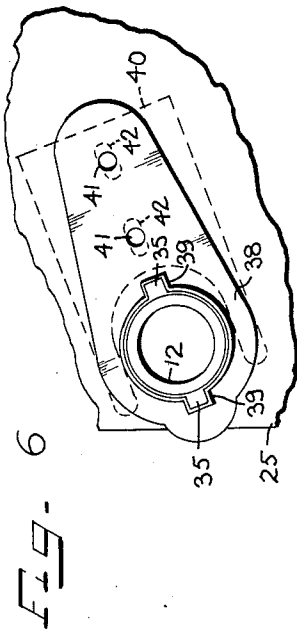
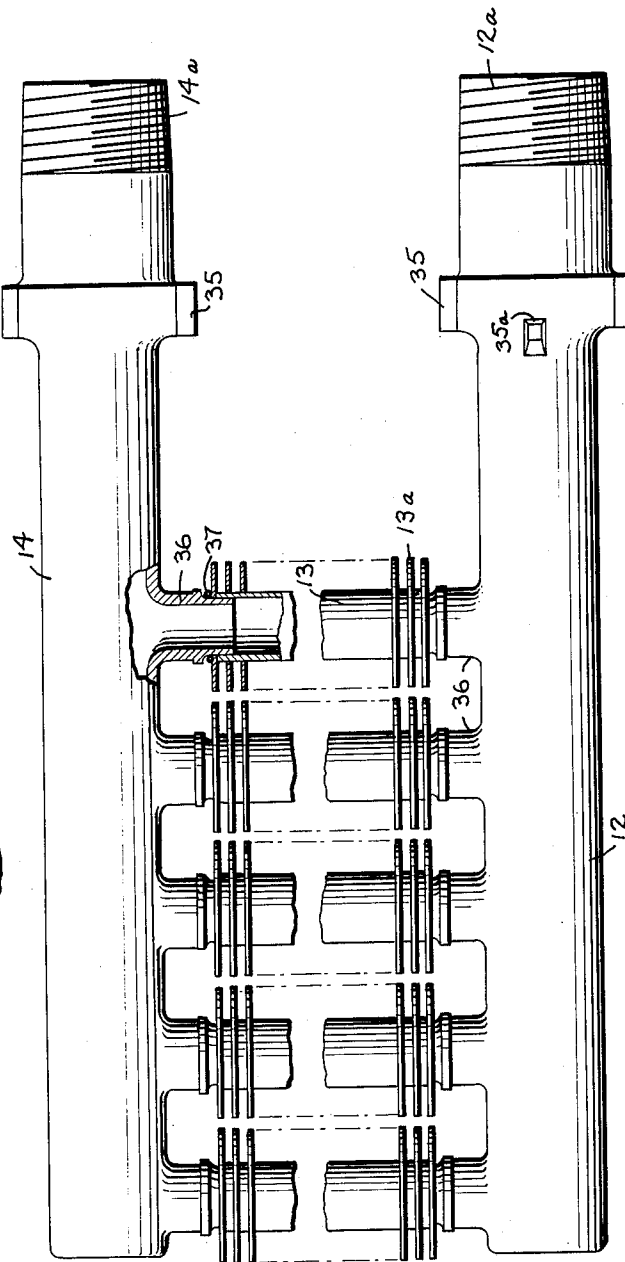
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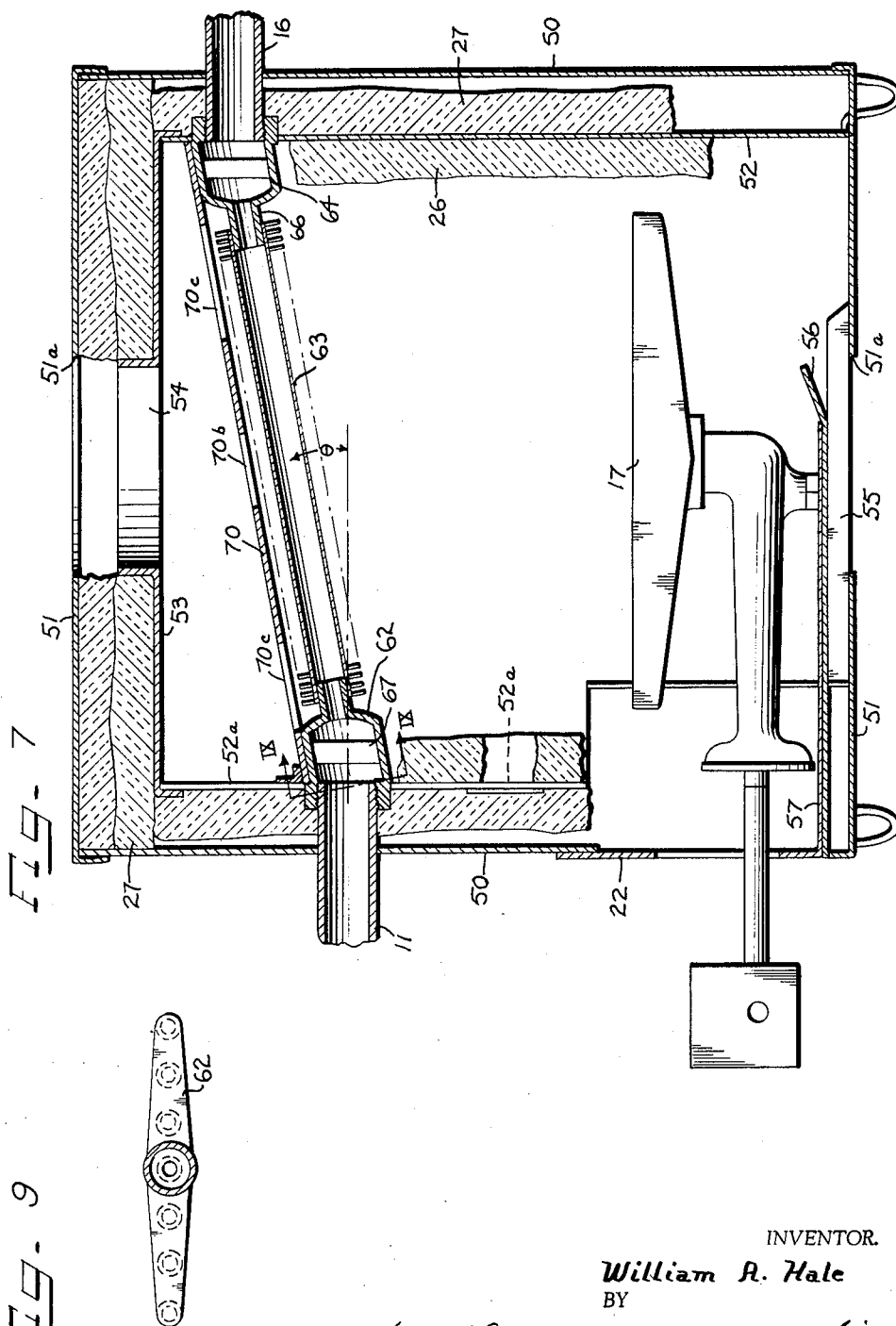
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BOILER SYSTEM

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10 Claims. (Cl. 122-265)

The present invention relates to hot water boiler installations and is, more particularly, concerned with the provision of a substantially improved single stage boiler system for general use in residential housing. As modern building costs have continually increased, the space requirement of the home heating unit has become increasingly more important. The space required to accommodate the boiler system has become more expensive as a result of the rise of building costs and, further, a concerted effort has been made to reduce the cost, as well as the size of the home heating system. At the same time, of course, it has been considered essential to maintain a level of heating capability sufficient to more than adequately satisfy the needs of homeowners throughout the country, including homes in the far north. Not only must a satisfactory boiler system be small in size and low in cost, but also the performance of the system must be reliable, rapidly responsive to control, and quiet.

In accordance with the principles of the present invention, an extremely small gas or oil furnace is provided which is capable of meeting all of the above-mentioned requirements for modern heating. Thus, in accordance with the principles of the present invention, an extremely small furnace is provided having an absolute minimum of parts and at the same time having unusually high efficiency and substantially instantaneous heating action without deleterious noise. In addition, the structure of the present invention has substantially no water pressure drop since the water being heated passes straight through the boiler without any reverse turns in flow direction. Similarly, the particularly high efficiency of heat transfer of the unit eliminates the need for circulating the combustion gases through a plurality of sets of tubes and, instead, the gases pass directly around, in efficient heat transfer manner, the single row of tubes and then directly to the flue without appreciable change in direction of flow. As a result of these characteristics, the boiler of the present invention is particularly efficient and inexpensive.

In accordance with the principles of the present invention, a square or cylindrical furnace housing is provided containing a single layer or bank of water tubes extending across the internal area of the housing at an angle with the horizontal approximating 5° to 20°. The bank of tubes extends between cross headers and comprises copper tubes having peripheral fins secured thereto transversely of the longitudinal axis of the tube. Immediately above the bank of tubes a baffle is positioned completely across the internal area of the housing and dividing the housing into an upper area leading to the exhaust flue and a lower combustion area. The baffle is positioned immediately adjacent the upper edges of the water tubes and is provided with a number of apertures preferably positioned immediately over the center line of the individual water tubes thereby requiring upwardly moving combustion gases to pass laterally around the finned tubes and over the top surface of the tubes for passing through the baffle into the flue area. In this connection, it is noted that the size of the apertures or, alternatively, the number thereof, is increased at the upper end of the baffle in order to permit the gas to flow through the baffle more rapidly in the upper area. This position permits the upper ends of the tubes to operate at approximately the same temperature level as the lower ends thereof, it being understood that this feature of construction is more desirable with increased angle of inclination which in turn is employed with increasingly larger boiler capacities. By constructing

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the header and tube unit as an integral brazed copper assembly, the boiler unit can be constructed in an assembly fixture in a few minutes' time and results in an extremely rigid and completely service-free structure. Extensive commercial utilization of these furnaces has proven them almost completely service-free in their entirety, extremely inexpensive to construct and maintain, and highly efficient in over-all performance.

It is, accordingly, an object of the present invention to provide a simplified, inexpensive and highly efficient boiler unit having a single layer unitary flow direction water tube complement.

Another object of the present invention is to provide a single layer water tube boiler unit providing a single water pass and a single combustion gas pass.

Still a further object of the present invention is to provide an improved water tube boiler having substantially instantaneous heat transfer characteristics and which is capable of operation at high rates of water circulation without noise and without appreciable water pressure drop.

Another object of the present invention is to provide a single water pass and single combustion gas pass furnace arranged to provide highly efficient operation at a minimum net stack temperature.

A feature of the boiler of the present invention is the provision of mechanical interconnection between the boiler tube headers and the housing in a manner preventing wrench torque applied to the inlet and outlet pipes from stressing the water tube-header connections.

Another feature of the invention is the provision of a single slightly inclined bank of thin water tubes having a coextensive perforated baffle plate immediately thereabove.

Yet a further feature of the invention comprises the provision of a single bank of water tubes positioned immediately below a baffle having perforations therein generally vertically above the individual water tubes providing maximum combustion gas deflection and contact with the water tubes.

Still other and further objects and features of the present invention will at once become apparent to those skilled in the art from a consideration of the attached drawings and specification wherein two embodiments of the invention are shown by way of illustration only, and wherein:

FIGURE 1 is a generally isometric view of a first embodiment of the boiler unit of the present invention;

FIGURE 2 is a cross-sectional view in side elevation of the embodiment of the invention illustrated in FIGURE 1;

FIGURE 3 is a view taken along the line III—III of FIGURE 2 illustrating the water tube and baffle construction of the embodiment of the invention illustrated in FIGURE 1;

FIGURE 4 is a plan view in section, partly broken away, of the embodiment illustrated in FIGURE 2, and taken along the line IV—IV of FIGURE 2;

FIGURE 5 is a plan view, partly broken away to further illustrate detail, of the water tube unit employed in the embodiment of the invention illustrated in FIGURE 1;

FIGURE 6 is a detail view of the header mounting illustrated in FIGURE 4 and taken along lines VI—VI thereof;

FIGURE 7 is a side-elevational view of a second embodiment of the present invention;

FIGURE 8 is a plan view, partly broken away of an embodiment of the invention illustrated in FIGURE 6; and

FIGURE 9 is an end elevational view of the header employed in the embodiment of the invention shown in FIGURES 6 and 7.

As shown on the drawings:

The over-all boiler configuration may be seen from a consideration of FIGURES 1 and 2. As shown in the isometric view of FIGURE 1, the boiler has a generally rectangular housing having a height from the floor to the top surface of the housing of approximately 26 inches and a width of 16 inches across the front. Water to be heated is circulated through the boiler by means of a circulating pump 10 which causes circulation of water from the return line 11 to the boiler by way of inlet header 12, water tubes 13, outlet header 14, air purging control unit 15, and the supply connection 16 leading to the hot water radiators of the home heating system. Gas burner units 17 are carried by a drawer type burner mounting 18, shown in its open position in FIGURE 1. The burner is fed by means of an inlet conduit 19 and is controlled by means of any automatic safety ignition control generally indicated at 20 and including automatic burner shut-off under control of a high limit water sensing thermostat 21 and a high limit flue temperature sensing thermostat, not shown.

The arrangement of the burner and internal boiler parts may readily be seen from a consideration of FIGURES 2, 3 and 4. As there shown, the burner unit 17 is shown in its innermost, operative, condition with the outside door 22 closed flush with the sheet metal casing 23 of the boiler unit. The casing 23 is made of plain 18 gauge sheet steel, providing extreme simplicity. In furtherance of this principle, the bottom and top jacket heads 24 may be constructed similarly, preferably of 18 or heavier gauge sheet steel for rigid securement to firebox sides 25. Insulation is provided in the combustion chamber of any suitable type, such as for example, a one-inch, eight pound density Kaowool self-contained insulation blanket has been found very satisfactory and capable of withstanding temperatures on the order of 2300° F. This insulation indicated at 26 provides suitable protection for the firebox sidewalls 25. Heat transfer to the outside casing 23 is minimized by the additional insulation blanket indicated at 27, which has been found to be very satisfactorily provided by means of conventional fiberglass batt insulation.

As may be observed from a consideration of FIGURE 2, the heat transfer portion of the boiler comprises a single bank of tubes 13 connecting the return or inlet header 12 to the supply or outlet header 14. The tubes comprise copper tubes having integral or otherwise rigidly secured transverse fins 13a throughout their length. As shown in FIGURE 3, in the installation illustrated, eight such tubes 13 are provided. These tubes combine with the headers 12 and 14 in an integral single plane heat transfer unit cooperating with the slotted baffle 30 to provide an unusually efficient boiler system. As may be seen from FIGURES 3 and 4, the slots 30a, 30b, and 30c in the baffle 30 are arranged directly vertically above the respective center line of tubes 13. The edges of the baffle 30d and the ends thereof, 30e closely cooperates with the sidewalls of the combustion chamber so as to require the major flow of combustion gases upwardly around the tubes 13 in contact with the fins 13a, laterally over the top of the tubes 13 and upwardly through the baffle 30 by way of the slot 30a, 30b, and 30c. The combustion gases accordingly pass in heat transfer relation with the tubes 15 and header 12 and 14 from the primary combustion space indicated at 32 to the secondary chamber 33 from which the gases pass upwardly from the furnace by way of flue 34.

From the above it will be observed that the flow of flue gases is particularly efficiently arranged. As a result of the inclination of the tubes 13, discussed below, it has been found desirable to provide somewhat longer slots 30c at the upper end of the tubes 13. This larger gas passage area at the upper end of the tubes provides relief at the uppermost end of the chamber 32 thereby eliminating recirculation of the gases which would lead to incomplete combustion. With the present arrangement it has

been found that substantially complete combustion occurs while at the same time maintaining stack or flue temperatures at a net value approximating 340° F. This stack temperature, which is only slightly above the minimum stack temperature of 320° F. considered safe, is an extremely satisfactory, low, stack temperature indicating high efficiency of heat transfer to the water in the tubes 13. It is noted that the stack temperature is raised significantly, approximately 50° to 75°, by providing holes or slots located at random relative to the center line of the tubes. It is, of course, desired that the maximum efficiency be achieved, consonant with the sufficient stack temperatures to assure combustion. Accordingly, in most installation, it is preferred that the slots or baffles 30a, 30b, and 30c be disposed as illustrated, directly above the center lines of the tubes 13.

As shown in FIGURE 2, and as above mentioned, the tubes 13 are inclined at an angle from the horizontal. This angle, shown as angle θ in FIGURE 2, may range from approximately 5° to approximately 25°, depending upon the intended capacity of the boiler system. As the capacity increases, it becomes increasingly necessary that the tubes be inclined in order to assure flow of the water through the system without generating steam bubbles which cause substantial noise. By providing the inclination, the production of bubbles is substantially eliminated and it has been found that the boiler of the present invention is essentially noiseless. For example, in a boiler application providing 80,000 B.t.u.'s per hour having identical headers and tubes 13 approximately 14 inches in length with an angle $\theta=20^\circ$ provided a noiseless boiler system.

As pointed out above, simplicity is an essential characteristic of the present boiler. This simplicity has reduced the cost of construction to a minimum without in any way sacrificing high performance characteristics. One particularly significant area of cost reduction lies in the configuration of the water tube and header combination. This may be more clearly seen from FIGURES 2 and 5. As there illustrated, the headers 12 and 14 are identical. They are preferably constructed of cast brass with integral radially projecting ears 35 for purposes described below. Abutment stops 35a are provided for positioning the headers relative to the inside casing 23 of the furnace. The tubes 13, constructed of copper and carrying the transverse fins 13a are positioned in the manner illustrated in FIGURE 5 and are brazed to the nipples 36 on the brass headers. This brazing may be, by way of illustration, performed by providing a ring 37 of brazing alloy around the nipple 36 and immediately adjacent the associated end of the tube 13. With the tubes and headers all assembled and held in the desired, fixed, condition, heat is applied to the nipples 36, or to the entire unit, if desired, with the result that the tubes are integrally brazed to the headers in a fixed assembly.

In order to provide for expansion and contraction of the header system, and in order to prevent distortion stresses from being applied to the brazed joints during assembly and disassembly procedures, the headers are secured to the boiler casing by means of anti-torque expansion mountings. The mounting associated with header 12 is illustrated in FIGURE 6 and as there shown, the header 12 projects through the casing wall 23 until the abutment stop 35a prevents further travel. The keys 35 cooperate with a plate 38 having a notch 39 cooperating therewith. The plate 38 is secured to the casing wall 23 to an adjustable cover plate 40 by bolts 41. Slots 42 in the casing wall 23 permit adjustment of the header and plate 38 assembly longitudinally relative to the slot 42 and this is accomplished, on assembly, by assembling the bolts 41 with sufficient inherent snugness to prevent rattling while at the same time permitting slight sliding motion. This may be accomplished in practice

by tightening the bolts 41 against conventional washers and then backing off the bolts approximately one-quarter turn. With the arrangement described, torque applied to the threads 12a and 14a of the respective headers 12 and 14 is transferred directly to the casing wall 23 by the ears 35 and cannot under any circumstances be applied to the joint between the headers and the tubes 13. It has been found in actual operation that this removal of the application of torque from the brazed joints of the heat exchanger has substantially completely eliminated failure at the tube joints so common in earlier types of construction.

It has been found that as a result of the single straight pass header and tube arrangement and the expansion mounting provided therewith, no noise occurs even when cool water is started through the system and expansion occurs rather rapidly. Further, in view of the single pass construction coupled with large capacity headers, substantially no back pressure is provided on the boiler thereby minimizing strain on the circulating system.

In the embodiment of the invention illustrated in FIGURES 7, 8 and 9, further simplification of components has been provided in order to provide substantially universal boiler unit simply adjusted to provide a range of output capacities. As there illustrated, the exterior casing 50 is cylindrical. Upper and lower closure caps 51 are similarly identical sheet steel stampings. Similarly, the inside casing 52 comprises a cylindrical member provided with a vertical seam at 52a and closed by a stamped upper closure cap 53 having a flue extension 54. The bottom cap 51 is provided with a support bracket 55 carrying a drawer support 56 for supporting the burner drawer slide 57. The burner 17 may readily be removed or inserted into the boiler by reciprocation along the support. The aperture 51a which serves as the flue in the upper cap 51 may be employed as an air inlet in the lower cap or may, if it is preferred that air be admitted by way of the burner door tube, be covered by the bracket 55. Insulation shown at 26 and 27 is the same as that mentioned with respect to the first embodiment illustrated in FIGURE 2.

As in the case of the first embodiment, the headers of the embodiment illustrated in FIGURE 7 are identical to each other. Thus, headers 62 and 64 are identical and are arranged so that they merely are inverted with respect to each other.

The nipples 66 are soldered to the tubes 63 in the same manner as described with respect to the assembly illustrated in FIGURE 2. Due to the central feed arrangement, an integral flow spreader 67 is provided thereby preventing an excess of flow through the centermost tubes of the system. As shown, the header and tube combination is mounted at an angle θ approximating 20° as in the embodiment illustrated in FIGURE 2. Similarly, the baffle 70 of the embodiment shown in FIGURE 7 is provided with a plurality of holes or slots 70a, 70b, and 70c which aperture 70c is somewhat larger than apertures 70a and 70b to permit greater circulation flow at the upper end of the system. The baffle 70 is generally elliptical in shape to provide a snug fit with the cylindrical inner casing 52 when inclined in the manner shown in FIGURE 7.

It will be observed that an absolute minimum of parts is employed in the circular construction shown in FIGURES 7, 8 and 9. The capacity of this boiler may readily be modified by increasing or decreasing the number of boiler tubes 63. Thus, an additional pair of tubes 63 may be applied by the extension of the headers 62, 64 or, alternatively, two or four of the outboard tubes 63 illustrated in FIGURE 8 may be removed and the headers correspondingly reduced. This change in tube complement may be accomplished without changing the dimensions of the boiler casing, by providing cooperating baffles 70 with the outboard slots removed, when out-

board tubes are removed or added, should additional outboard tubes to be placed in the system. By providing the seam 52a along the center line of the inlet header 62, modification of the capacity of the boiler may be undertaken in the field by lifting up the caps 51 and 53, removing inlet and outlet conduits 11 and 12, vertically lifting up the inner casing 52 above the outer casing 50 and opening the seam 52a. At this point, the header and tube combination may be removed and a substitute, either larger or smaller in number of tubes, replaced therefore, along with a mating baffle 70. The inner casing 52 is then closed at the seam 52, dropped downwardly into its former position, conduits 11 and 16 threaded into place and caps 51 and 53 repositioned, holding the entire system in place. The headers 62 and 64 are preferably provided with integral cast pins 62a, as illustrated in FIGURE 8, which cooperate with apertures in the inner casing 52. These pins, coupled with the position of the inlet and outlet conduits positively lock the headers, and hence the entire heat transfer assembly, in rigid position relative to the casing and cooperates with the closure cap 53 to retain the seam 52a closed. At the same time the heat transfer unit is replaced or modified, as above outlined, the capacity of the burner 17 may readily be modified by substituting a different drawer unit 22 having a different sized burner and a different size burner control. Accordingly, it will be seen that modifications of this boiler may be accomplished in the field and, in fact, actually, on the spot in a home after installation of a boiler subsequently found to be either too large or too small in output to provide completely efficient home heating.

In the circular embodiment illustrated in FIGURES 7, 8 and 9, unusually efficient thermal circulation is provided by the header and tube combination. As may be seen from FIGURES 8 and 9, the headers provide circulation from the inlet conduit 11 constantly in an upward direction. Even flow in the header units themselves is constantly upwardly in view of the inclination of the headers as well as the tubes. Thus, efficient circulation is ensured and a maximum in heat transfer efficiency is provided.

It will be apparent to those skilled in the art that variations and modifications may be made in the boiler of the present invention without departing from the scope of the novel concepts set forth above. For example, it will be apparent that a series of small apertures may be employed in place of baffle slots 30a, 30b, 30c, 70a, 70b and 70c. Similarly, the materials may be modified, if desired. While generally rectangular burners 17 have been illustrated, it is to be understood that any conventional burner, either round or rectangular, may be employed in the present boiler unit without departing from the spirit of the present invention. Accordingly, it is my intention that the scope of the present invention be limited solely by that of the hereinafter appended claims.

I claim as my invention:

1. A residential low-pressure water tube boiler unit comprising a housing forming an insulated chamber, a flue gas opening in the top wall of said housing venting the top wall of said chamber to an exhaust stack, fuel burner means in said chamber, a water tube heat exchanger assembly comprising a single layer having a plurality of transversely finned tubes extending between and connecting inlet and outlet headers, said assembly of headers and tubes being positioned in said chamber at an incline from the horizontal providing upwardly directed flow from the inlet to the outlet thereof, a baffle plate positioned over and immediately adjacent said tubes and header and substantially closing off the area therebelow over said burner means, said baffle plate having a plurality of apertures therein for passing combustion gases therethrough to said flue, and means for circulating water through said heat exchanger assembly, said

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headers having the respective inlet and outlets thereof projecting through said housing for connection to a hot water system, and interlocking means on said headers and said housing for preventing rotation of said headers relative to said housing.

2. A residential low-pressure water tube boiler unit comprising a housing forming an insulated chamber, a flue gas opening in the top wall of said housing venting the top wall of said chamber to an exhaust stack, fuel burner means in said chamber, a water tube heat exchanger assembly comprising a single layer having a plurality of transversely finned tubes extending between and connecting inlet and outlet headers, said assembly of headers and tubes being positioned in said chamber at an incline from the horizontal providing upwardly directed flow from the inlet to the outlet thereof, a baffle plate positioned over and immediately adjacent said tubes and header and substantially closing off the area therebelow over said burner means, said baffle plate having a plurality of apertures therein for passing combustion gases therethrough to said flue, and means for circulating water through said heat exchanger assembly, said headers having the respective inlet and outlets thereof projecting through said housing for connection to a hot water system, and having expansion mounting means positioned between said headers and said housing to provide a limited movement of said headers relative to each other and to said housing upon changes in temperature.

3. A residential low-pressure water tube boiler unit comprising a housing forming an insulated chamber, a flue gas opening in the top wall of said housing venting the top wall of said chamber to an exhaust stack, fuel burner means in said chamber, a water tube heat exchanger assembly comprising a single layer having a plurality of transversely finned tubes extending between and connecting inlet and outlet headers, said assembly of headers and tubes being positioned in said chamber at an incline from the horizontal providing upwardly directed flow from the inlet to the outlet thereof, a baffle plate positioned over and immediately adjacent said tubes and header and substantially closing off the area therebelow over said burner means, said baffle plate having a plurality of apertures therein for passing combustion gases therethrough to said flue, and means for circulating water through said heat exchanger assembly, said housing comprising a generally cylindrical housing having its longitudinal axis in a vertical position and said headers each comprising an arcuate element having a water conduit connection thereto and a plurality of nipples thereon for connection thereof with said tubes, and said baffle plate comprising a generally circular plate cooperative with said housing to substantially completely block off upward flow of said combustion gases.

4. A residential low-pressure water tube boiler unit comprising a housing forming an insulated chamber, a flue gas opening in the top wall of said housing venting the top wall of said chamber to an exhaust stack, fuel burner means in said chamber, a water tube heat exchanger assembly comprising a single layer having a plurality of transversely finned tubes extending between and connecting inlet and outlet headers, said assembly of headers and tubes being positioned in said chamber at an incline from the horizontal providing upwardly directed flow from the inlet to the outlet thereof, a baffle plate positioned over and immediately adjacent said tubes and header and substantially closing off the area therebelow over said burner means, said baffle plate having a plurality of apertures therein for passing combustion gases therethrough to said flue, and means for circulating water through said heat exchanger assembly, said housing comprising a generally cylindrical housing having its longitudinal axis in a vertical position and said headers each comprising an arcuate element having a water conduit connection thereto and a plurality of nipples thereon for connection thereof with said tubes, and said baffle plate

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comprising a generally circular plate cooperative with said housing to substantially completely block off upward flow of said combustion gases, said apertures of said baffle plate being positioned directly vertically above the center line of said tubes.

5. A residential low-pressure water tube boiler unit comprising a housing forming an insulated chamber, a flue gas opening in the top wall of said housing venting the top wall of said chamber to an exhaust stack, fuel burner means in said chamber, a water tube heat exchanger assembly comprising a single layer having a plurality of transversely finned tubes extending between and connecting inlet and outlet headers, said assembly of headers and tubes being positioned in said chamber at an incline from the horizontal providing upwardly directed flow from the inlet to the outlet thereof, a baffle plate positioned over and immediately adjacent said tubes and header and substantially closing off the area therebelow over said burner means, said baffle plate having a plurality of apertures therein for passing combustion gases therethrough to said flue, and means for circulating water through said heat exchanger assembly, said housing comprising a generally cylindrical housing having its longitudinal axis in a vertical position and said headers each comprising an arcuate element having a water conduit connection thereto and a plurality of nipples thereon for connection thereof with said tubes, and said baffle plate comprising a generally circular plate cooperative with said housing to substantially completely block off upward flow of said combustion gases, said cylindrical housing having a vertical seam openable at the point of connection of one of the conduits with its respective header whereby said header and tube assembly may be removed from said housing without disassembling said tubes from said header.

6. A residential low-pressure water tube boiler unit comprising a housing forming an insulated chamber, a flue gas opening in the top wall of said housing venting the top wall of said chamber to an exhaust stack, fuel burner means in said chamber, a water tube heat exchanger assembly comprising a single layer having a plurality of transversely finned tubes extending between and connecting inlet and outlet headers, said assembly of headers and tubes being positioned in said chamber at an incline from the horizontal providing upwardly directed flow from the inlet to the outlet thereof, a baffle plate positioned over and immediately adjacent said tubes and header and substantially closing off the area therebelow over said burner means, said baffle plate having a plurality of apertures therein for passing combustion gases therethrough to said flue, and means for circulating water through said heat exchanger assembly, said housing comprising a generally cylindrical housing having its longitudinal axis in a vertical position and said headers each comprising an arcuate element having a water conduit connection thereto and a plurality of nipples thereon for connection thereof with said tubes, and said baffle plate comprising a generally circular plate cooperative with said housing to substantially completely block off upward flow of said combustion gases, said cylindrical housing having a vertical seam openable at the point of connection of one of the conduits with its respective header whereby said header and tube assembly may be removed from said housing without disassembling said tubes from said header, said headers each having projection fins thereon projecting through cooperating holes in said housing for maintaining said heat exchanger assembly in fixed relation in said housing when said housing is in seam-closed condition.

7. A residential low-pressure water tube boiler unit comprising a housing forming an insulated chamber, a flue gas opening in the top wall of said housing venting the top wall of said chamber to an exhaust stack, fuel burner means in said chamber, a water tube heat exchanger assembly comprising a single layer having a plu-

ality of transversely finned tubes extending between and connecting inlet and outlet headers, said assembly of headers and tubes being positioned in said chamber at an incline from the horizontal providing upwardly directed flow from the inlet to the outlet thereof, a baffle plate positioned over and immediately adjacent said tubes and header and substantially closing off the area therebelow over said burner means, said baffle plate having a plurality of apertures thereon for passing combustion gases therethrough to said flue, and means for circulating water through said heat exchanger assembly, said housing being generally cylindrical about a vertical axis and said headers each comprising an arcuately configured element having its respective inlet conduit connections at the symmetrical center thereof, said headers being positioned diametrically opposite each other with the outlet header positioned above the inlet header.

8. A residential low-pressure water tube boiler unit comprising a housing forming an insulated chamber, a flue gas opening in the top wall of said housing venting the top wall of said chamber to an exhaust stack, fuel burner means in said chamber, a water tube heat exchanger assembly comprising a single layer having a plurality of transversely finned tubes extending between and connecting inlet and outlet headers, said assembly of headers and tubes being positioned in said chamber at an incline from the horizontal providing upwardly directed flow from the inlet to the outlet thereof, a baffle plate positioned over and immediately adjacent said tubes and header and substantially closing off the area therebelow over said burner means, said baffle plate having a plurality of apertures therein for passing combustion gases therethrough to said flue, and means for circulating water through said heat exchanger assembly, said headers having the respective inlet and outlets thereof lying substantially parallel to each other and projecting through said housing for connection to a hot water system, and having expansion mounting means positioned between said headers and said housing to provide a limited movement of said headers relative to each other and to said housing upon changes in temperature but preventing rotation of either of said headers relative to said housing.

9. A residential water tube boiler unit comprising a housing forming an insulated chamber, a flue gas opening in the top wall of said housing venting the top of said chamber to an exhaust stack, fuel burner means in said chamber, a water tube heat exchanger assembly com-

prising a single layer having a plurality of transversely finned tubes extending between and connecting inlet and outlet headers, said tubes being positioned at an incline from the horizontal providing upwardly directed flow from the inlet to the outlet header, a baffle plate positioned over and immediately adjacent said tubes and having a plurality of apertures therein for passing combustion gases therethrough to said flue, and means for circulating water to be heated through said tubes, said apertures increasing in size as they become closer to the upper, outlet, header, and said flue gas opening.

10. A residential low-pressure water tube boiler unit comprising a housing forming an insulated chamber, a flue gas opening in the top wall of said housing venting the top of said chamber to an exhaust stack, fuel burner means in said chamber, a water tube heat exchanger assembly comprising a single layer having a plurality of transversely finned tubes extending between and connecting inlet and outlet headers, said tubes being positioned at an incline from the horizontal providing upwardly directed flow from the inlet to the outlet header, a baffle plate positioned over and immediately adjacent said tubes and substantially closing off said combustion chamber and having a plurality of apertures therethrough for passing combustion gases therethrough to said flue, and means for circulating water through said tubes, said apertures in said baffle plate being positioned immediately vertically above the center line of the respective tubes of said heat exchanger whereby combustion gases must pass over and around said tubes in at deflected path to reach said apertures, said apertures increasing in size as they become closer to the upper, outlet, header and said flue gas opening.

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