Jan. 9, 1951 M. A. POWERS 2,537,086

HEATING DEVICE

Filed July 12, 1944 2 Sheets-Sheet 1

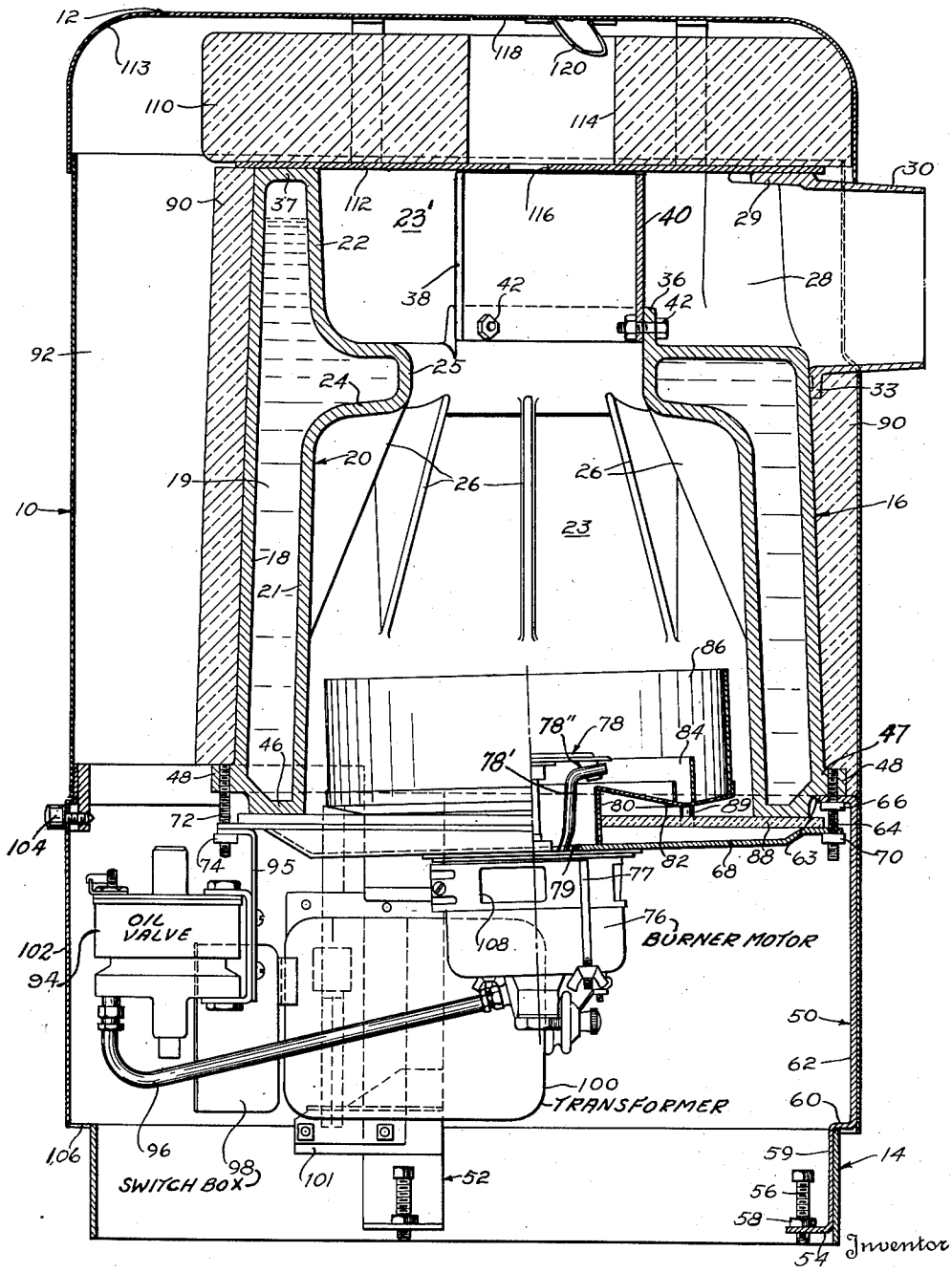


Fig. 1

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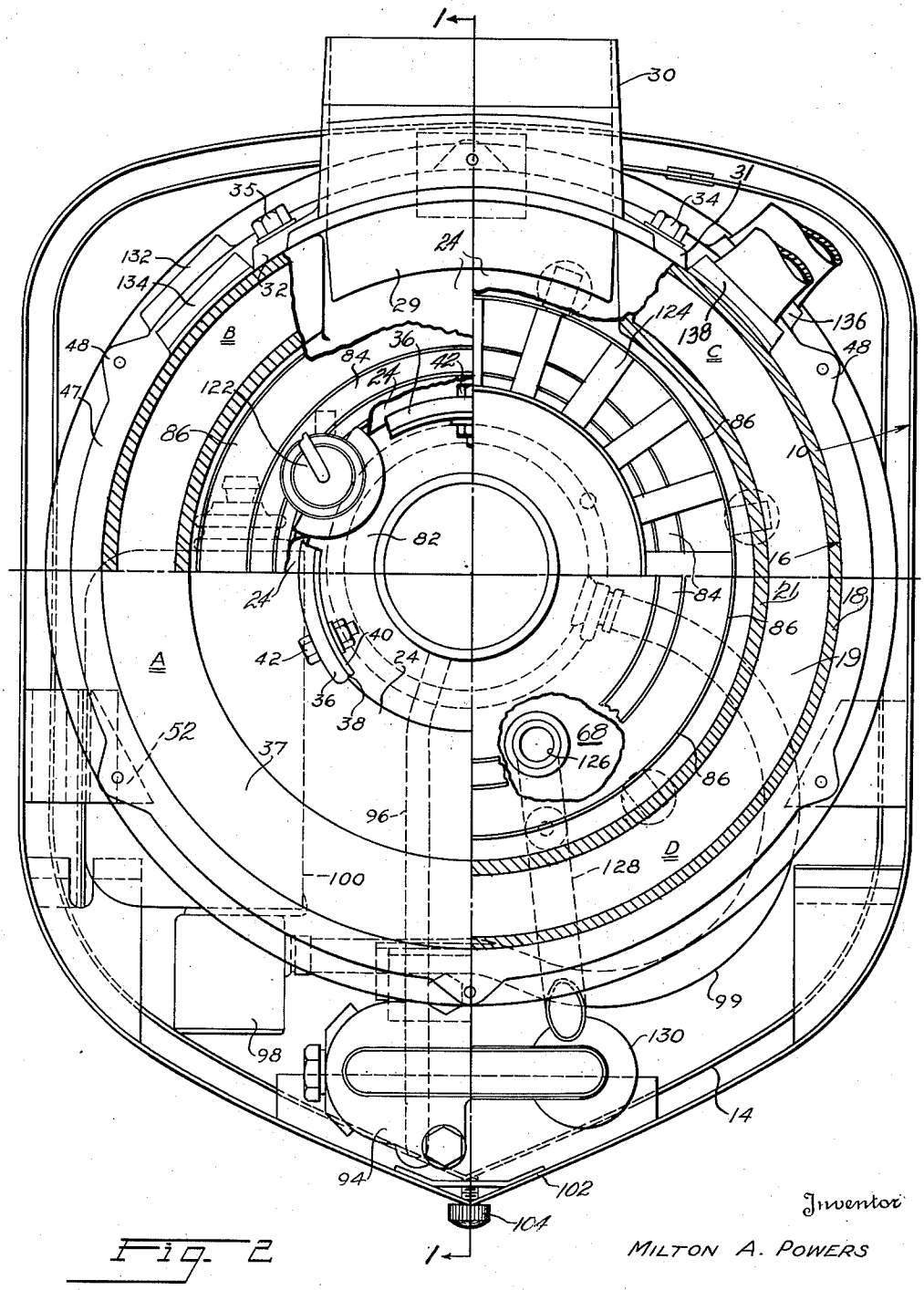


Fig. 2

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UNITED STATES PATENT OFFICE

2,537,086

HEATING DEVICE

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14 Claims. (Cl. 122—156)

1

This invention relates to improvements in water heating devices and particularly to small fuel oil burning units such as are suitable for supplying domestic hot water or for space heating particularly for small houses, apartments and flats.

Prior to this invention it was common practice to equip oil burner installations with boilers having a side fire door like those used in coal burner installations.

These early side fire door boilers were not of good efficiency and were not well adapted for use with wall flame burners. The wall flame burner distributes an even zone of uniformly burning combustion products about the interior of the combustion chamber, and the usual side fire door opening was located only a few inches above the burner so that there was an intense heat release directly adjacent the door. This construction resulted in high heat loss, about twenty two per cent, at the fire door, and I have found that even when the door is insulated at considerable expense the heat loss is still unavoidably high.

In its preferred embodiment the invention comprises a unit type boiler having a peripherally continuous heat transfer wall defining a combustion chamber having no side fire door and wherein the evenly distributed hot combustion products from a wall flame burner are enabled to uniformly scour a maximum of heat transfer surface of the boiler, for securing optimum heat transer to the boiler water. My novel boiler is open for inspection, repair and cleaning at the top where the passing combustion products are coolest within the boiler and to my knowledge is the first open-top boiler of this advantageous construction, an insulated removable cover being provided during operation.

With the above in mind, it is a major object of the invention to provide a novel boiler and wall flame burner assembly wherein the wall flame burner evenly distributes the flame and hot combustion products in intimate uniform relation with a peripherally continuous heat transfer wall of the boiler.

A further object of the invention is to provide a novel open-top boiler especially adapted for cooperation with a wall flame burner wherein a maximum of heat transfer area is provided in the boiler side walls and wherein the boiler is provided with a removable insulating cover functioning as a wall of the combustion chamber adjacent the flue.

It is a further object of the invention to provide a novel liquid heating furnace construction wherein a relatively heavy boiler unit and the

2

burner mechanism and controls are supported on the floor directly by rigid structural standards, and the outer furnace casing does not carry any substantial weight, preferably being also supported on the standards.

Other objects and advantages will be more particularly pointed out hereinafter or will become apparent as the description proceeds.

In the accompanying drawings, in which like reference numerals are used to designate similar parts throughout, a suitable embodiment of the invention is illustrated for purposes of disclosure. The drawings are for the purpose of illustration only, and are not to be taken in a limiting or restrictive sense since it will be apparent to those skilled in the art that various changes in the illustrative arrangement may be resorted to without in any way exceeding the scope of the invention.

In the drawings:

Figure 1 is a vertical sectional view on line 1—1 of Figure 2 illustrating a water heating unit constructed according to a preferred embodiment of the invention using an external heat transfer member surrounding the combustion chamber; and

Figure 2 is an enlarged top plan view, partly in section at various horizontal levels of the unit illustrated in Figure 1.

Referring to the drawings, numeral 10 generally indicates a heater enclosing cabinet casing having a removable top 12 and a base or footing generally indicated at 14. As is particularly illustrated in Figure 2, casing 10 is generally rectangular in cross-section with rounded corners except that the front wall projects forwardly to a center line giving it a somewhat prow shaped appearance.

Within cabinet casing 10 is a heat transfer or boiler unit 16 which, in the embodiment of the invention illustrated in Figures 1 and 2, is preferably an integral iron casting. In the claims, reference to the boiler shell or member will be understood to embrace both integral cast boilers such as illustrated or boilers made of cast parts joined together into an equivalent construction.

Casting 16 comprises an outer, generally cylindrical, wall 18 of a thickness sufficient to insure the necessary strength to withstand the maximum hydrostatic pressure to which the boiler is to be subjected, and a substantially concentric inner wall 20 having a lower generally cylindrical portion 21 and an upper, partly cylindrical portion 22. Between upper and lower wall portions 21 and 22, wall 20 is formed with an integral in-

ward annular projection 24. Space 19 between walls 18 and 20 is adapted to contain water to be heated. Space 23 interiorly of wall 20 is the combustion chamber as will appear. Lower wall portion 21 comprises a primary heat transfer surface region and upper wall portion 22 comprises a secondary heat transfer surface region.

Peripheral wall 25 of projection 24 defines a restricted central circular combustion gas escape opening or throat having a diameter approximately one-half the internal diameter of wall 21 of the primary heat transfer chamber below the extension. The internal diameter of wall 22 is preferably the same as that of wall portion 21. The invention however is not limited to these particular proportions and the extent and location of projection 24 may be proportioned as desired to obtain maximum efficiency in various installations.

A plurality of narrow integral radial webs or ribs 26 of generally triangular shape project from wall 20 within combustion chamber 23 and extend across the angle between the under side of projection 24 and lower wall portion 21 of the combustion chamber. Webs 26 are preferably equally spaced around the circumference of combustion chamber 23 and materially assist transfer of heat from the interior of the combustion chamber through inner wall portion 21 to water space 19.

Wall portion 22 of heat transfer unit 16 above projection 24 is provided with a lateral flue opening 28. There is a recess in upper end wall 37 of unit 16 above opening 28 into which is fitted an extension 29 extending inwardly from a tubular flue collar 30 having its outer end projecting through casing 10 for connection with a suitable flue pipe leading to a chimney or stack. Flue collar 30 is preferably formed as a separate casting having integral external side flanges 31 and 32 and a bottom flange 33 and shaped and cemented to make substantially gastight connection with heater unit 16 about opening 28. Collar 30 is secured to wall 18 by suitable means such as bolts 34 and 35 as illustrated in Figure 2. The upper flat surface of extension 29 is flush with the upper flat surface of end wall 37 of heat transfer unit 16 to provide a substantially continuous annular seat for top cover 12.

The upper surface of projection 24 is provided with an upwardly extending integral arcuate flange 36 which surrounds opening 25 except for a sector opening indicated at 38, and particularly illustrated in Figure 2, on the side of unit 16 diametrically opposite flue opening 28. An upstanding partly cylindrical baffle member 40 is secured to the inner surface of flange 36 as by bolts 42, and has a circumferential extent substantially equal to that of flange 36. The flat upper edge of baffle 40 is flush with the upper surfaces of wall 37 and flange 29, and the interrupted sector openings provided by flange 36 and baffle 40 comprise a passage 39 through which hot combustion gases arising through throat 25 escape into the secondary heat transfer space 23'.

Inner wall 20 is spaced from outer wall 18 by a substantially constant amount sufficient to permit the free flow of water through space 19 under the influence of convection, and inner and outer walls 20 and 18 are joined at their upper ends by integral annular wall 37 and at their lower ends by integral annular wall 46.

Around the lower portion of unit 16 adjacent bottom wall 46 is an integral external flange 47 having six outwardly projecting lugs 48 provided with internally screw threaded apertures, for a purpose which will appear.

Heat transfer or boiler unit 16 is supported upon a plurality of legs or standards, two of which are illustrated in Figure 1 and indicated at 50 and 52. There are preferably three such standards, substantially equally spaced around the circumference of unit 16, and each standard comprises, as particularly shown in the sectional view of the standard 50, an inwardly projecting bottom flange 54 apertured and internally screw threaded to receive an adjustable leg or levelling screw 56 locked in adjusted position by a suitable lock nut 58. Above flange 54, each standard has a straight vertical portion 59 extending for the height of footing member 14 and terminated by an outward bend or off-set 60 above which arises another straight vertical portion 62 which is bent inwardly to provide a flange 63 seated against the bottom of casting flange lug 48 and apertured to freely receive a threaded stud 64. Each stud 64 is threaded at its upper end into a lug 48, and nuts 66 on the studs clamp the lugs securely to the standards, which bear the entire weight of casting 16. The standards also bear the entire weight of casing 10 which is welded or otherwise suitably fixed to portions 62 of the standards. Base 14 is also preferably welded to the standards.

The lower end of each stud 64 projects through an aperture in the outer periphery of a sheet metal circular burner hearth plate 68, and a nut 70 is provided on each stud below hearth plate 68 so that hearth plate 68 is mounted upon boiler unit 16. The plate 68 is in the illustrated embodiment additionally supported by extra studs 72 threaded in the other three lugs 48 and provided on their lower ends with corresponding bearing nuts 74.

At its center, hearth plate 68 carries a burner motor unit 76 which drives a fuel and air projecting head 78 comprising oil flinger tubes 78' and fan blades 78'' similar to United States Letters Patent No. 2,310,333 which extends through an opening 79 in plate 68 so as to be positioned within the lower part of combustion chamber 23. Motor unit 76 is secured to plate 68 by a plurality of suspension bolts 77. The lower part of head 78 is surrounded by a burner collar 80 extending upwardly from hearth plate 68, and extending radially outwardly from the upper end of burner collar 80 is an annular sheet metal hearth 82 which carries a double wall flame ring 84 and, at its periphery, an annular flame shield or baffle 86.

Fuel oil, projected from head 78, strikes the outer wall of double wall flame ring 84 in substantially unatomized condition and is there ignited, preferably by suitable electric ignition means. The oil burns on the inner side of the outer flame ring wall 84 in a current of air which is directed radially outwardly by the usual fan blades on head 78 to strike the inner wall of the double wall flame ring and be deflected upwardly across the fuel combustion zone on the inner surface of the outer flame ring wall. Thus the wall flame burner provides evenly burning combustion products around the periphery of the combustion chamber.

The hot combustion gases pass upwardly from the ignition zone past shield 86 which prevents direct contact of the hot flame with lower areas of water cooled inner wall 20 of heat transfer unit 16 and into contact with inner wall 20 above shield 86. The hot gases then pass along the guide and heat absorbing webs 26 and are re-

stricted by throat 25 which causes a retardation of the flow and a resultant turbulence of the combustion gases below the throat and insures the intimate scouring contact of combustion products with the primary chamber walls and webs 26 and transfer of a large portion of the heat of the combustion products through wall 21 of the lower or primary heating chamber of heat transfer unit 16 to the water in space 19.

The gases then pass through throat 25 into baffle 40 from which they emerge through passage 38 in baffle 40 and flange 36 to flow in opposite directions around the annular secondary heat exchange chamber in intimate scouring contact with inner wall 22 of heat transfer unit 16. The gases in a relatively cool condition then pass out through flue collar 30 to a suitable chimney or stack.

In the embodiment shown, a sheet 88 of suitable insulating material such as an asbestos composition is disposed between hearth plate 68 and the lower surface of bottom wall 46 extending inwardly to burner collar 80. Insulating sheet or gasket 86 prevents the transfer of heat from the combustion chamber above it to the space below hearth plate 68 where undue heat might tend to damage burner motor 76. Gasket 88 also provides a gas-tight seal between support plate 68 and the lower end of the heat transfer unit 16 to prevent the escape of gases from the combustion chamber, since nuts 70 and 74 when tightened clamp gasket 88 between plate 68 and casting wall 46. A pipe 89 conducts overflow oil from hearth 82 downward to inclined hearth plate 68.

Heat transfer unit 16 is surrounded by a lagging or layer of insulating material 90 to prevent radiation of heat from unit 16 to the surrounding room.

The shape of cabinet casing 10 provides considerable air space 92 between the front wall of the casing and the adjacent potrion of insulated heat transfer unit 16.

Within casing 10 below space 92 is mounted a suitable fuel oil control valve, such as the electromagnetic valve generally indicated at 94. Valve 94 is carried by a bracket 95 suspended from boiler unit 16 as illustrated in Figure 1. Valve 94 is connected to burner unit 76 by an oil conduit 96 and is suitably operatively provided with an automatic control device (not shown) so that fuel oil is supplied to the burner only when the burner is operating in response to a demand of the automatic control device. Valve 94 may also act to meter the fuel supplied to the burner to maintain a constant predetermined rate of fuel consumption.

Within the casing space, beneath hearth plate 68, are mounted a switch or relay box 98 and a transformer 100 which supplies high electrical potential for igniting the fuel in the combustion chamber. The supply leads to box 98 are not illustrated and leads from box 98 go out to transformer 100 and through conduit 99 to the burner motor. Transformer 100 is mounted on a support bracket 101 which is welded or suitably secured to portion 62 of an adjacent standard 52. Box 98 is supported by transformer 100.

The lower front portion of cabinet casing 10 is provided with an opening through which control valve 94 and the other mechanism below plate 68 may be inspected and serviced, and this opening is covered by a removable door 102 held in operative position by suitable means such as screw 104.

Footing or base member 14 is smaller in cross sectional area than the bottom of casing 10 by an amount determined by the extent of off-set 60 of the boiler supporting standards. This construction provides an annular opening 106 around the bottom of casing 10 through which air for combustion flows to the space below hearth plate 68 and through air intake openings 108 in the housing of burner motor unit 76 to distributor head 78.

The upper open end of the casing 10 is closed by removable top cover 12 within which is secured a thick block 110 of insulating material covered on its bottom side by a circular metal plate 112. Plate 112 rests upon the flat annular upper end wall surface 37 of heat transfer unit 16 and flange 29 and thus closes the upper end of the unit and provides a closure wall for the upper end of the secondary heat transfer chamber. Plate 112 also contacts the flat upper end of baffle 40 to form a top closure for the baffle member and rests on the upper flat side of flue collar flange 29 as above described. Plate 112 cooperates with baffle 40 in symmetrically dividing flow of the combustion products through the secondary heat exchange chamber and cooperates with baffle 40 and wall 22 in guiding the combustion products to the flue. Insulation block 110 and plate 112 are secured to the concave sheet metal shell 113 of top 12, and are removable therewith so that the upper end of combustion chamber 23 is open when the top 12 is removed.

At or near its center, insulation body 110 is provided with an inspection aperture 114 which surrounds a smaller inspection aperture 116 in the plate 112.

Shell 113 is provided with a movable door 118 overlying aperture 114. When door 118 is raised on a hinge 120, an inspection opening is provided entirely through top 12 through which the flame of the burner in the combustion chamber may be inspected.

In Figure 2, quadrant A represents a top plan view of the heat transfer unit and casing with cover 12 removed. Quadrant B is a somewhat diagrammatic view with projection 24 cut away to show the burner hearth and the electric igniter 122 which is set in the hearth plate adjacent flame ring 84. Quadrant C is a diagrammatic lower section view similar to quadrant B but slightly above and shows in addition shield 86 and a grille member 124 mounted upon flame ring 84 to improve the combustion of the fuel and increase turbulence of the combustion gases as they pass through the combustion chamber. Quadrant D is a section at substantially the same level as quadrant B but shows shield member 86 and a drain opening 126 for removing from the hearth any liquid fuel which may drip from distributor head 78 or flame ring 84 onto the hearth, opening 126 being connected by tube 128 with a trip bucket 130 which operates valve 94 to discontinue burner operation if excess fuel oil flows into the trip bucket. As illustrated in Figure 1, the bottom wall of hearth plate 68 is inclined so that oil thereon flows toward opening 126.

As is also illustrated in Figure 2, heat transfer unit 16 is provided with two pairs of pipe connecting bosses, as indicated at 132, 134, and 136, 138. Bosses 132 and 136 are located near the bottom of unit 16 and bosses 134 and 138 are located near the top of unit 16. A suitable pipe connection extends from one lower boss and one upper boss to a hot water storage tank. The other two bosses may be blanked off, or may be used for other pipe connections as desired.

The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present embodiment is therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description, and all changes, which come within the meaning and range of equivalency of the claims, are therefore intended to be embraced therein.

What is claimed and desired to be secured by United States Letters Patent is:

1. In a liquid heater, a heat transfer unit for use with a wall flame type fuel burner comprising an annular shell having two substantially concentric spaced walls connected at their corresponding ends and enclosing a space adapted to contain liquid to be heated, said shell having an open top and an open bottom, a passage defining restriction within said shell dividing the interior of said unit into a lower primary heating chamber and an upper secondary heating chamber, and a flow directing baffle within said secondary heating chamber providing an effective continuation of said passage discharging laterally into said secondary heat exchange chamber.

2. In a water heater, an annular hollow shell open at top and bottom and having a lateral flue opening and an upper end wall externally formed as a continuous cover seat interrupted by a flue opening recess, a tubular flue collar secured to said shell about said opening, and means on said flue collar fitting into said recess providing a substantially flush continuation of said cover seat across said recess, whereby a substantially continuous cover seat is provided on the upper end of said shell.

3. In a liquid heater, a boiler unit enclosing a combustion chamber, a casing surrounding said boiler unit constructed and arranged to provide therewithin a first space below said boiler unit and a second communicating space substantially continuous therewith forwardly of the boiler unit, means providing a removable front cover on said casing affording access to said spaces, and means mounting a fuel burner unit and associated controls in said spaces, said controls including a fuel control valve located in said communicating space adjacent said cover.

4. In a liquid heater, a boiler unit, a casing surrounding said unit and heat insulated therefrom, rigid standards extending downwardly from said boiler unit for supporting the latter directly on and spaced from a floor or the like, a fuel burner mounted within said casing at the bottom of said boiler unit, said casing terminating short of said floor, and means providing a base covering about the lower ends of said standards, said covering being spaced from said casing to provide therebetween peripheral passage means permitting entrance of combustion air to said burner.

5. In a liquid heater, an open-top boiler unit having a fluid contacting inner wall surrounding a combustion chamber, means in said boiler unit separating said combustion chamber into a lower primary heat exchange chamber and an upper secondary heat exchange chamber and defining a restricted throat through which hot combustion gases may flow from said primary chamber to said secondary chamber, means providing a flue opening in said secondary chamber, and a laterally apertured baffle mounted on said throat defining means and disposed in said secondary chamber, said baffle providing a substantial continuation of said throat for delivering said hot combustion gases to said secondary chamber out of registry with said flue opening.

6. In the liquid heater defined in claim 5, said baffle comprising a tubular member mounted on said throat defining means and having an open side laterally opposite said flue opening.

7. A boiler unit open at both upper and lower ends comprising a substantially annular heat conductive shell for surrounding a combustion chamber and having inner and outer walls separated by a space adapted to contain liquid to be heated, said space being substantially closed except for inlet and outlet connections, means providing a substantially radial inward extension of said inner wall providing a restricted throat region separating said combustion chamber into lower primary and upper secondary heat exchange chambers, and a plurality of generally vertical heat absorption fins on said inner wall below said extension.

8. A liquid heater comprising a boiler unit surrounding an internal combustion chamber separated into lower primary and upper secondary heat exchange chambers interconnected by a flow restricting passage, said primary chamber being adapted to contain a fuel combustion assembly and said secondary chamber having a flue outlet, turbulence creating means in said primary chamber insuring intimate contact of the hot combustion products with the walls of said primary chamber, and flow deflecting means in said secondary chamber forming a passage which insures intimate passage of said combustion products along the walls of said secondary chamber before escaping into said flue outlet, said flow deflecting means comprising a baffle constituting a portion of said latter passage and directing emergent combustion products toward the walls of said secondary combustion chamber substantially opposite said flue outlet and defining a substantially annular passage for said emergent combustion products within said secondary chamber.

9. In a liquid heater, a heat transfer unit for use with a wall flame type fuel burner comprising an annular shell having two substantially concentric spaced walls connected at their corresponding ends and enclosing a space adapted to contain liquid to be heated, said shell having an open top and an open bottom, a passage defining restriction within said shell dividing the interior of said unit into a lower primary heating chamber and an upper secondary heating chamber, a flue outlet passage in the well of said secondary heating chamber, and a flow directing baffle within said secondary heating chamber positioned in partially surrounding relation to said passage so as to provide a substantial continuation of said passage and having a side opening out of registry with said flue outlet passage discharging laterally into said secondary heat exchange chamber out of registry with said flue outlet passage.

10. In a liquid heater, an open top boiler unit having a fluid contacting inner wall surrounding a combustion chamber, means in said boiler unit separating said combustion chamber into a lower primary heat exchange chamber and an upper secondary heat exchange chamber and defining a restricted throat through which hot combustion gases may flow from said primary chamber to said secondary chamber, means providing a lateral flue opening in said secondary chamber, and a laterally apertured baffle posi-

tioned in said secondary chamber in effective continuation of said throat defining means, said baffle being in partially surrounding relation to said throat and having its lateral aperture out of registry with said flue opening for directing said hot combustion gases that arise through said throat into said secondary chamber out of registry with said flue opening.

11. In the liquid heater defined in claim 10, a cover assembly on said boiler unit, and said baffle comprising a tubular member extending substantially between said throat defining means and said cover assembly and having an open side laterally opposite said flue opening.

12. In a liquid heater, a boiler member for containing liquid to be heated and having an inner wall substantially continuously peripherally and symmetrically surrounding a combustion chamber and having an open top, peripheral means on said inner wall providing a substantially central internal restricted passage intermediate the top and bottom of said boiler member separating said combustion chamber into lower primary and upper secondary combustion chamber portions, an outer wall on said boiler member substantially coextensive with said inner wall and spaced therefrom so that said walls may maintain an annular column of liquid to be heated therebetween, a removable cover assembly extending over said boiler top in gas tight sealing engagement therewith and serving as a top wall for said secondary combustion chamber portion, a baffle member within said secondary combustion chamber comprising a substantial continuation of said passage, said baffle member having a side opening through which products of combustion are directed into said secondary combustion chamber portion, a wall flame fluid fuel burner disposed within said primary combustion chamber portion for supplying hot combustion products evenly around the periphery of said combustion chamber inner wall to evenly release heat to be evenly absorbed by said column of liquid between said walls, said burner and the inner wall of said combustion chamber being accessible through said open top and said passage for cleaning and repair upon removal of said cover assembly, and means providing a lateral flue passage through said boiler member walls at the upper end of said secondary combustion chamber portion out of registry with said baffle side opening.

13. In a liquid heater, a boiler unit surrounding an internal combustion chamber, means separating said chamber into lower primary and upper secondary heat exchange chambers interconnected by a flow restricting throat, said primary chamber being adapted to contain a fuel burner assembly and providing a continuous peripheral heat exchange wall in the path of the hot products of combustion from said burner assembly, a flue outlet in said secondary chamber, and tubular flow directing means in said secondary chamber in the path of said products of combustion admitted by said throat positioned in effective continuation of said throat, a lateral opening in said tubular means disposed oppositely to said flue outlet for substantially symmetrically dividing said products of combustion and providing for intimate passage of said products of combustion along the walls of said secondary chamber before escaping into said flue outlet.

14. In a liquid heater, an annular boiler shell surrounding a lower primary heat exchange chamber, an upper secondary heat exchange chamber and a restricted passage therebetween for conducting hot products of combustion from said primary to said secondary chambers, a lateral flue outlet in said secondary chamber, a top cover assembly on said shell closing the top of said secondary chamber, and a tubular baffle extending between said cover assembly and said shell within said secondary chamber, said baffle being laterally apertured out of registry with said flue outlet for laterally discharging said products of combustion into said secondary chamber out of registry with said flue outlet.

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REFERENCES CITED

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

UNITED STATES PATENTS

Number	Name	Date
490,880	Mosely et al.	Jan. 31, 1893
596,486	Don	Jan. 4, 1898
766,889	McCartney	Aug. 9, 1904
1,029,300	Jones	June 11, 1912
1,046,178	Grant	Dec. 3, 1912
1,602,869	Vaughn	Oct. 12, 1926
1,609,661	Quinn et al.	Dec. 7, 1926
1,889,270	Thomas et al.	Nov. 29, 1932
1,954,803	Doble	Apr. 17, 1934
1,964,306	Wenger	June 26, 1934
1,991,557	Johnson	Feb. 19, 1935
2,064,080	Powers	Dec. 15, 1936
2,130,471	Powers	Sept. 20, 1938
2,306,891	Powers et al.	Oct. 24, 1944

FOREIGN PATENTS

Number	Country	Date
512,994	Great Britain	Oct. 2, 1939