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Wariner

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[54] **WATER HEATER AND METHOD OF CONSTRUCTING THE SAME**

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[52] **U.S. Cl.** **122/136,** 126/360

[51] **Int. Cl.** **F22b 7/00**

[58] **Field of Search** 122/135, 136, 149; 126/360

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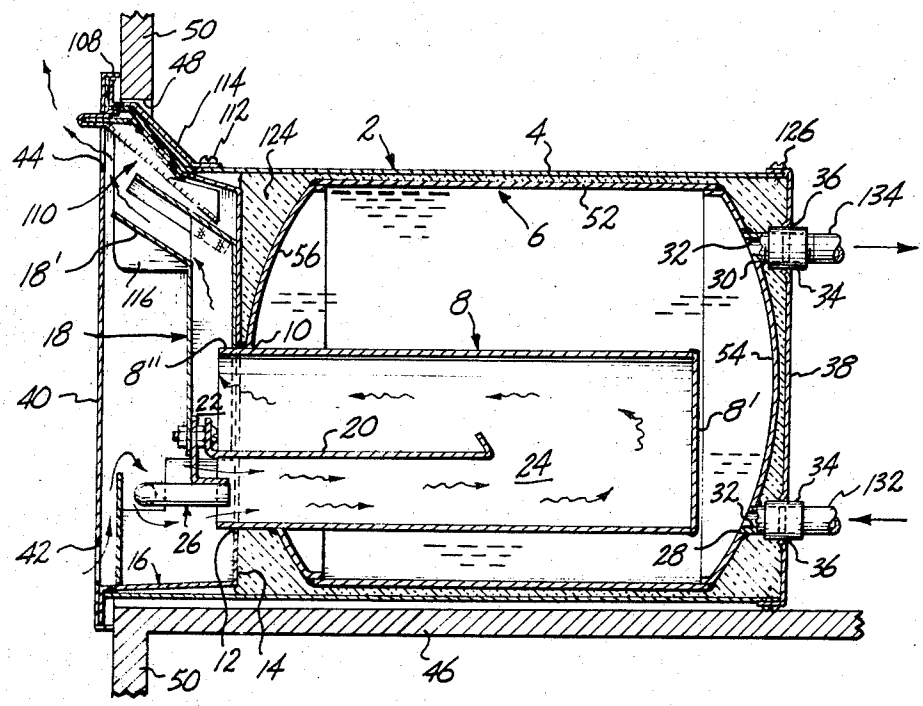
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[57] **ABSTRACT**

A small, inexpensive water heater is disclosed, of the type which uses an atmospheric burner to heat the water, together with a method for making the same from lightweight sheet metal material. According to the method, an elongated heater tube having open and closed ends thereon, is inserted into a liquid container having an opening in the wall thereof. The open end portion of the tube is connected to the wall of the container about the opening so that the opening is closed to the interior of the container while the bore of the tube is placed in communication with the exterior of the container therethrough. The closed end portion of the tube is extended below the operational level of liquid in the container so that the bore of the tube forms an elongated gas flow chamber for heating the liquid therein. Moreover, a baffle is mounted in the bore of the tube so as to separate the upper and lower portions of the chamber for a substantial distance along the length of the tube from the open end thereof. A fuel burner is interconnected with the lower portion of the chamber adjacent the open end portion of the tube so that hot gases can be fed along the bottom of the chamber in the direction of the closed end portion of the tube. A flue is interconnected with the open end portion of the tube adjacent the upper portion of the chamber so that the hot gases are withdrawn along the top of the chamber in the direction of the open end portion of the tube.

23 Claims, 3 Drawing Figures



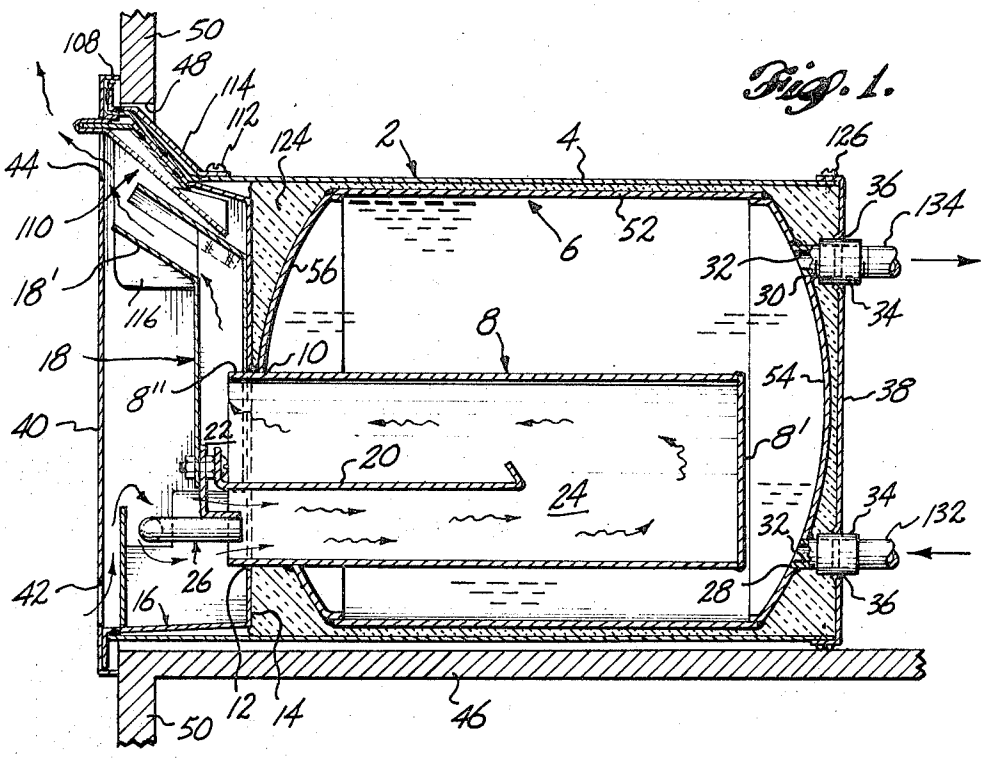


Fig. 1.

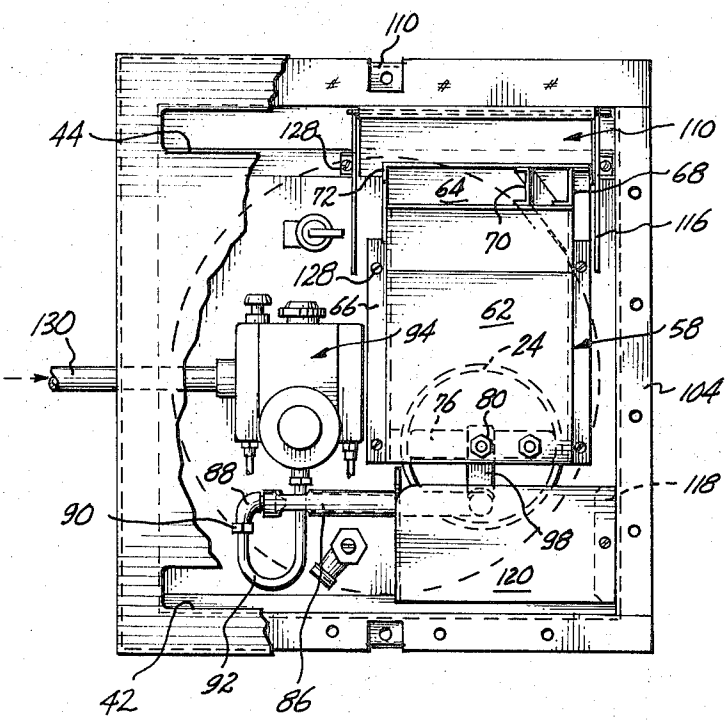


Fig. 2.

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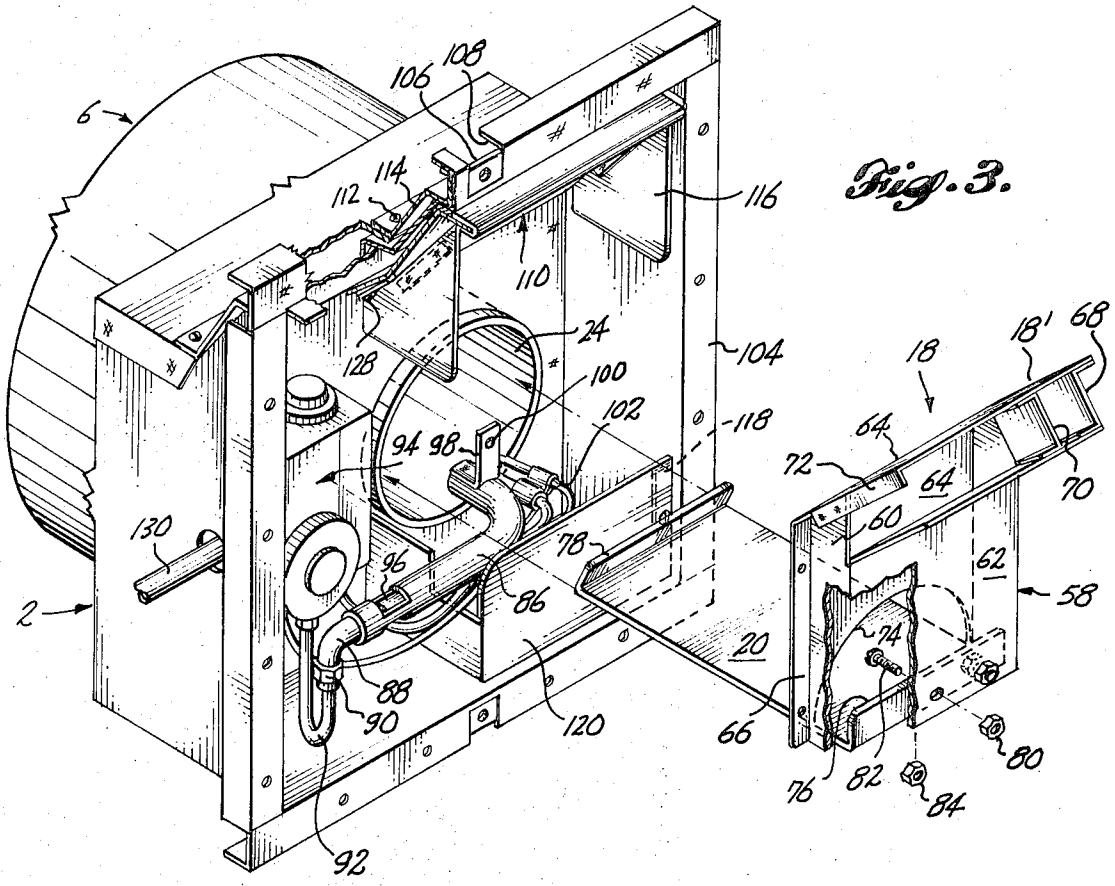


Fig. 3.

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WATER HEATER AND METHOD OF CONSTRUCTING THE SAME

Field of the Invention

This invention relates to liquid heaters and to methods for making the same. In particular, it relates to a water heater of the type which employs an atmospheric burner to heat the water, and to a method for making a heater of this type lightweight sheet metal material. The invention is especially applicable, although not exclusively, to the production of small, inexpensive water heaters of this type which are used in mobile homes, travel trailers, and the like.

BACKGROUND OF THE INVENTION INCLUDING CERTAIN OBJECTS THEREOF

The mobile home and travel trailer industry is a highly competitive industry in which both the cost and the weight of the product are highly determinative of its salability to the consumer. For this reason, inexpensive, lightweight sheet metal material is widely used in the construction of the trailer cabs, as well as in the construction of appurtenances such as water heaters which are included with the trailers, or separately sold for the use therewith.

One object of the present invention is to devise a small-sized water heater of the foregoing type, and a method for making the same, wherein the heater is especially suited for use in mobile homes, travel trailers and the like, and can be made at a cost and weight that are materially reduced from the costs and weights which characterized earlier heaters of this type. Another object is to devise a heater and method of this nature wherein the heater parts or components are constructed from light-weight sheet metal material, and are quickly and easily assembled with one another to form a structural unit which requires only a small number of welds and/or mechanical fasteners to secure it against vibration. A further object is to devise a heater and method of this nature wherein the foregoing parts or components are assembled by a system of slidable or telescopic connections therebetween which quickly interengage and align the parts with one another so that little skill and time are needed to assemble the unit. A still further object is to devise a heater and method of this nature wherein most of these parts are preassembled in a small number of separate subassemblies, which are then post-assembled by a system of telescopic connections therebetween which require little time and skill, and only a few welds and/or mechanical fasteners to secure them against vibration. Other objects include the provision of a heater and method of this nature wherein the foregoing parts and subassemblies are efficiently and compactly arranged with one another, so as to minimize the space and insulation requirements for the unit; and wherein the unit is more efficient in operation than are other units of this type on the market; and moreover, is capable of being readily disassembled should it be necessary to repair or replace one or more of the parts or subassemblies in the unit. Still further objects will become apparent from the description of the invention which follows hereafter.

SUMMARY OF THE INVENTION

These objects and advantages are realized by a small, inexpensive, sheet metal water heater of the foregoing type, and a method for making the same, of my invention, wherein an elongated heater tube having open and closed ends thereon, is inserted into a liquid container having an opening in the wall thereof; and the open end portion of the tube is connected to the wall of the container about the opening so that the opening is closed to the interior of the container while the bore of the tube is placed in communication with the exterior of the container therethrough. The closed end portion of the tube is extended below the operational level of liquid in the container so that the bore of the tube forms an elongated gas flow chamber for heating the liquid therein. Moreover, a baffle is mounted in the bore of the tube so as to separate the upper and lower portions of the chamber for a substantial distance along the length of the tube from the open end thereof. A fuel burner is interconnected with the lower portion of the chamber adjacent the open end portion of the tube so that hot gases can be fed along the bottom of the chamber in the direction of the closed end portion of the tube. A flue is interconnected with the open end portion of the tube adjacent the upper portion of the chamber so that the hot gases are withdrawn along the top of the chamber in the direction of the open end portion of the tube.

The heater tube may be integral with the wall of the container, as for example, where it is extruded from the inner face of the wall to form the opening therein; or it may be separately fabricated and later interconnected with the wall, as for example, where it is welded to the wall about the periphery of the opening therein. Preferably, the tube is a separate item and is slidably inserted in the opening and interconnected to the wall at the edges thereof.

The body of the flue may be aligned with the tube, or it may be arranged at an angle thereto. Preferably, the body of the flue is arranged at an upright angle to the tube, and the baffle is projected into the mouth of the flue so as to direct the hot gases from the chamber upwardly into the flue.

Also, the body of the flue may be supported on the tube and/or separately therefrom. Preferably, the open end portion of the tube is passed through the opening in the wall of the container, and thence projected relatively outwardly therefrom; and the body of the flue is supported in an upright disposition on the projecting portion of the tube.

The body of the flue may also be interengaged with the tube, so as to secure it against vibration thereon. Preferably, the projecting portion of the tube is slidably engaged in the mouth of the flue, between the baffle and the body of the flue.

In addition, the baffle may be interconnected with the body of the flue so as to expedite the mounting thereof. Preferably, the baffle is cantilevered from the body of the flue, and is slidably engageable in the bore of the tube, so that the flue can be readily mounted on the tube by "bayoneting" the baffle into the bore of the tube until the projecting portion of the tube is received in the mouth of the flue.

The mounting process is also expedited if the body of the flue is guided into abutment with a stop, to indicate that the projecting portion of the tube is engaged in the mouth thereof. Preferably, the flue is thereafter attached to the stop.

In the preferred embodiments of the invention, the flue is attached to a mounting frame interposed between the wall of the container and the body of the flue. The frame has an opening therein through which the projecting portion of the heater tube is passed, and thence projected relatively outwardly therefrom, so that the flue can be carried thereon. In addition, the frame has a slotted heat shield formed thereon into which the body of the flue is guided until it abuts with the frame. The projecting portion of the tube is cylindrical in cross section and the body of the flue has a part cylindrical cutout therein which engages the open end portion of the tube as the baffle engages in the bore thereof.

In these embodiments, the projecting or cantilevered portion of the tube is also slidably engageable in the opening of the frame so that the whole system of components can be quickly and easily assembled on the frame by inserting the tube in the opening thereof until the container abuts the adjacent side of the frame, and then bayoneting the baffle into the bore of the tube from the other side of the frame and fastening the flue thereto.

The container is supported in a raised condition on the frame by an additional frame which is interengaged with a pair of lugs on the container. After the container has been mounted on the first-mentioned frame, the other frame is slidably engaged on the lugs to support the container in a condition of suspension therebetween. Preferably, the lugs take the form of nipples projecting from the inlet and outlet ports of the container.

The container is also enclosed in spaced relationship within an insulative jacket having the frames at opposite ends thereof. Usually an insulative filler is packed into the space between the container and the jacket. The jacket consitututes a longitudinal section of an elongated open ended tubular housing having the first-mentioned frame disposed at an intermediate point therein. The opening in the frame for the tube is eccentrically located with respect to the longitudinal axis of the housing so that the fuel burner controls can be mounted on the frame to one side of the flue.

The burner is suspended from the flue and has a right angular bend therein so that the inlet end of the burner is quickly and easily attached to the fuel controls when the flue is mounted on the tube. In addition, the baffle is cantilevered from the bottom of the flue so as to form a septum between the burner and the mouth of the flue. The baffle is cantilevered by means which effectively thermally insulate it from the flue, however, so as to minimize the heat loss thereto.

The forward or free end of the baffle has an upturned flange thereon to control the reentrant flow of the gases in the closed end portion of the tube.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other features of the invention will be better understood by reference to the accompanying drawings which illustrate one of the preferred embodiments of the invention. In the drawings:

FIG. **1** is a longitudinal cross-sectional view of a water heater unit when the unit is mounted in use;

FIG. **2** is a front elevational view of the unit with portions thereof removed to illustrate the interior of the unit; and

FIG. **3** is a part perspective view of the unit with certain of the interior components exploded therefrom to improve the illustration thereof.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawings, it will be seen that the unit comprises an elongated open-ended tubular sheet metal housing **2**, the right-hand end portion of which in FIG. **1** forms an insulative jacket **4** for a cylindrical water tank **6** enclosed in spaced relationship therewithin. The contents of the tank are atmospherically heated by an elongated cylindrical sheet metal heater tube **8** which is inserted into the tank through an opening **10** in one end wall thereof, and is closed at its inserted end **8'**. The open end portion **8''** of the tube rests in an opening **12** formed in the bottom panel **14** of an open-faced sheet metal box frame **16** which is inserted in and welded to the left-hand end portion of the housing. Mounted in the recess of the frame on the opposite side of the panel **14** from the tank, is a sheet metal box flue **18** which has a sheet metal baffle **20** cantilevered from the mouth **22** thereof into the bore of the tube. The bore of the tube forms an elongated gas flow chamber **24** for the hot gases of combustion from a propane gas burner **26** suspended from the flue. The gases undergo reentrant flow around the baffle, firstly, along the bottom of the chamber in the direction of the closed end portion **8'** of the tube, and thence along the top of the chamber in the direction of the open end portion **8''** of the tube. Thus, all sides of the tube are heated by the gases and the heat in turn escapes into the water which is continually circulated through inlet and outlet ports **28** and **30** in the right-hand end of the tank. The ports have nipples **32** welded therein which in turn have couplings **34** threaded thereon that rest in holes **36** in a flanged cover panel **38** applied as a cap over the right-hand end of the housing. The left-hand end of the housing is also capped by a similar cover panel **40** which is applied over the face of the frame **16.** The apertures in the latter panel includes a pair of elongated horizontal slots, one of which **42** is disposed near the bottom of the panel to admit fresh air about the burner, and the other of which **44** is disposed near the top of the pannel to discharge the exhaust gases from the flue.

Typically, the heater unit is little more than 2 feet in length and is light enough for a man to pick up in his arms. When installed in use, for example, in a mobile home or travel trailer, the unit is generally placed on a narrow shelf or platform **46** which is disposed at one side of the vehicle and opens to that side through a slot **48** in the cab **50** of the vehicle. The slot is sized so that the unit can be inserted and withdrawn through it, and when installed, the unit is disposed so that the recess of the frame is accessible through the slot when the cover panel is removed.

The tank is fabricated from a cylindrical shell **52** to which a pair of dished plates **54** and **56** are welded to give it a closed prolate construction at the ends. The plates are apertured, however, to provide the necessary openings for the tube **8** and the inlet and outlet nipples **32,** and each of these is slidably inserted in its opening and welded to the periphery thereof. In the case of the tube, the opening **10** is formed at an eccentric location with respect to the longitudinal axis of the tank, and the open end portion **8''** of the tube is passed through the

opening, and projected relatively outwardly therefrom. The openings **28** and **30** for the nipples are disposed relatively adjacent the bottom and the top of the tank, respectively.

The flue **18** has an orthogonal cross section and is constructed from several pieces of sheet metal, one **58** of which has the shape of a channel, the sides **60** of which are angularly truncated at the top. The back **62** of the channel has a greater width than the outer diameter of the tube **8**, and is cut away and bent forwardly from the sides **60** at the angle of truncation. A second piece **64** is webbed across the open face of the channel, bent forwardly against the truncated edges of the sides, and secured to the channel **58** by welding. The flanks of the web project outwardly from the sides of the channel to form flanges **66** for the attachment of the flue to the bottom **14** of the frame. In addition, a pair of fillets **68** and **70** are added between the web **64** and the back **62** of the channel to close one side of the canted portion **18'** of the flue, so that the flue gases are deflected into a course inclined more tangentially to the discharge slot **44** in the cover panel **40** of the housing. The opposite side of the canted portion is unclosed, however, with the exception of a short lip **72** which is formed on the adjacent edge of the web.

The baffle **20** is cantilevered from the back **62** of the channel through a semi-circular cutout **74** removed from the bottom edge of the web **64.** The cutout corresponds in diameter to the outside diameter of the heater tube, whereas the baffle has a width corresponding to the inside diameter of the tube. Upturned flanges **76** and **78** are formed at the ends of the baffle, and the rear flange **76** is bolted to the back of the channel by means of two pairs of nuts **80** and bolts **82.** Also, an additional pair of nuts **84** is interposed on the bolts between the flange **76** and the channel so that the baffle and the flue are effectively spaced from one another on all sides.

The upturned flange **78** on the forward or free end of the baffle is bent slightly toward the flue.

The propane gas burner **26** is formed by a metal tube **86** and a nozzle **88** threaded into the rear end thereof. The tube and nozzle are each bent through a right angle turn, and the unthreaded end of the nozzle is equipped with a nut **90** for making a slip fitting with a U-shaped gas feed tube **92** emanating from the fuel control system **94** for the burner. In addition, the burner tube **86** has a pair of mutually opposing circumferential slots **96** therein, upstream from the nozzle, which act as an air intake for the gas when it is discharged into the burner in use.

The burner is suspended in a horizontal disposition from the back of the flue by means of a right angled tab **98** welded to the discharge end of the tube **86.** The tab has a hole **100** therein for receiving one of the bolts **82** used in connecting the baffle and the flue, and when the baffle and flue are interconnected with one another, the tab is inserted between them and simultaneously bolted into place under the baffle. The baffle thus acts as a septum between the burner and the mouth **22** of the flue.

The fuel control system **94** for the burner forms no specific part of the invention and need not be discussed in detail other than to say that it is mounted on the frame by means of a threaded nipple (not shown) projecting from the bottom thereof, and includes a pair of pilot controls **102** which are extended into the mouth of the heater tube for ignition of the burner.

The box frame **16** is slightly canted at the sides to facilitate welding it to the housing, and is flanged at the rim **104** to abut the end of the housing when it is installed. Clips **106** behind notches **108** in the rim provide for mounting the cover panel **40** thereon. In addition, the upper side of the frame has a built-up construction thereon comprising several layers of sheet metal which are loosely sandwiched with one another to form a heat shield **110** that projects out the discharge slot **44** of the panel. The upper side of the housing **2** is cut back to accommodate the shield, and sheet metal screws **112** rather than welds, are used to interconnect the cover flap **114** of the shield with the housing. The shield absorbs and dissipates the heat from the flue to safeguard the cab **50** of the trailer from scorching or other damage, and also has side skirts **116** thereon which guide the flue into position as it is mounted on the tabs. The skirts control the discharge of the gases from the flue, and assure that they fan out over the whole width of the slot **44** in the panel.

The box frame also has a small right angle tab **118** welded to the lower right-hand corner thereof (FIG. 3), to which a right angle sheet metal burner shield **120** is secured between the burner and the cover panel.

The foregoing components are quickly and easily assembled with one another. In advance of the operation, the heater tube and container are preassembled with one another, as are the flue, the baffle and the burner. The burner controls **94** are mounted in the box frame, and as the first step in the assembly operation, the frame is inserted in the left-hand end of the housing and welded to it from within the housing. The flap **114** may also be attached at this time. Next, the housing **2** is turned up on end and rested on the frame, the tank and tube assembly is inserted in the housing, and the projecting portion **8''** of the tube is slidably engaged in the opening **12** of the frame. An insulative filler **124** is also packed about the tank at this time. Then, the couplings **34** are applied to the nipples, and the rear cover panel **38** is engaged on the couplings and secured to the upturned end of the housing by means of screws **126.** Thereafter, the housing is placed in a horizontal position on a table or stand, and the open face of the frame is turned to view. The pilot controls **102** are inserted in the bottom of the tube, and the burner, flue, and baffle assembly is gripped in one hand and mounted on the tube by guiding the canted portion **18'** of the flue between the skirts **116** of the shield while the baffle **20** is bayoneted into the bore of the tube. The projecting portion **8''** of the tube engages in the mouth **22** of the flue, between the baffle and the body of the web **64,** and when the web abuts both the bottom of the frame and the right-hand skirt, the assembly is in position to be secured to the frame by means of screws **128** in the flanges **66** of the web. The burner **26** is also in position to be attached to the U-shaped fuel supply tube **92** by means of the slip fitting. Thereafter, the burner shield **120** is slipped under the pilot controls and attached to the tab **118,** and the front cover panel **40** is applied over the rim **104** of the frame and secured to the two clips **106.**

When the unit is put into use, the front cover panel **40** is easily removed to hook up the fuel supply **130** to the controls. In addition, the water supply and discharge lines **132** and **134** are threaded to the couplings **34,**

and normally it is not necessary to remove the rear cover panel 38 in this connection.

I claim:

1. A water heater of the type wherein an atmospheric burner is used to heat the water, comprising a liquid container having an opening in the wall thereof, an elongated immersion heater tube having open and closed ends thereon, inserted generally horizontally into the container and having the open end portion thereof connected to the wall of the container about the opening therein so that the opening is closed to the interior of the container while the bore of the tube is placed in communication with the exterior of the container therethrough, and forms an elongated gas flow chamber for heating the liquid in the container, a flat baffle inserted generally horizontally into the bore of the tube for a substantial distance along the length of the tube inwardly from the open end thereof, but terminating short of the closed end of the tube, so as to separate the lower and upper portions of the chamber for reentrant flow of the gases therethrough, a fuel burner nozzle arranged in communication with the lower portion of the chamber adjacent the open end portion of the tube so that the hot gases therefrom are fed along the bottom of the chamber in the direction of the closed end portion of the tube, and a flue interconnected with the open end portion of the tube adjacent the upper portion of the chamber so that the hot gases therein are withdrawn along the top of the chamber in the direction of the open end portion of the tube, the open end portion of the tube passing through the opening in the wall of the container, and thence projecting relatively outwardly therefrom, and the body of the flue being supported in an upright disposition on the projecting portion of the tube.

2. The water heater according to claim 1 wherein the heater tube is slidably inserted in the opening in the container wall and interconnected to the wall at the edge thereof.

3. The water heater according to claim 1 wherein the body of the flue is arranged at a right angle to the tube, and the baffle is projected into the mouth of the flue so as to direct the hot gases from the chamber upwardly into the flue.

4. The water heater according to claim 1 wherein the projecting portion of the tube is slidably engaged in the mouth of the flue, between the baffle and the body of the flue.

5. The water heater according to claim 4 wherein the baffle is cantilevered from the body of the flue, and slidably engaged in the bore of the tube.

6. The water heater according to claim 4 wherein the flue is also attached to a stop in abutment therewith.

7. The water heater according to claim 6 wherein the flue is attached to a mounting frame interposed between the wall of the container and the body of the flue.

8. The water heater according to claim 7 wherein the frame has an opening therein, and the projecting portion of the heater tube passes through the opening in the frame, and thence projects relatively outwardly therefrom, with the flue carried thereon.

9. The water heater according to claim 8 wherein the frame has a slotted heat shield formed thereon into which the body of the flue is inserted in abutment with the frame.

10. The water heater according to claim 8 wherein the projecting portion of the tube is cylindrical in cross section, and the body of the flue has a part cylindrical cutout therein which engages the open end portion of the tube.

11. The water heater according to claim 8 wherein the projecting portion of the tube is slidably engaged in the opening of the frame.

12. The water heater according to claim 7 wherein the container is supported in a raised condition on the frame by an additional frame interengaged with a pair of lugs on the container.

13. The water heater according to claim 12 wherein the lugs are slidably engaged in holes in the additional frame, and the container is supported in a condition of suspension between the frames.

14. The water heater according to claim 13 wherein the lugs take the form of nipples projecting from the inlet and outlet ports of the container.

15. The water heater according to claim 12 wherein the container is enclosed in spaced relationship within an insulative jacket having the frames at opposite ends thereof.

16. The water heater according to claim 5 wherein the jacket constitutes a longitudinal section of an elongated, open ended tubular housing having the first mentioned frame disposed at an intermediate point therein.

17. The water heater according to claim 16 wherein the opening in the frame for the tube, is eccentrically located with respect to the longitudinal axis of the housing.

18. In a water heater of the type wherein an atmospheric burner is used to heat the water, a liquid container having an opening in the wall thereof, an elongated cylindrical immersion heater tube having open and closed ends thereon, inserted generally horizontally into the container and having the open end portion thereof connected to the wall of the container about the opening therein so that the opening is closed to the interior of the container while the bore of the tube is placed in communication with the exterior of the container therethrough, and forms an elongated gas flow chamber for heating the liquid in the container, and a flat baffle inserted in the bore of the tube for a substantial distance along the length of the tube inwardly from the open tube thereof, but terminating short of the closed end of the tube, so as to separate the lower and upper portions of the chamber for reentrant flow of the gases therethrough, said baffle being disposed substantially in the horizontal diametral plane of the tube and having a width slightly less than the diameter of the bore, so that it is longitudinally slidably supported therein, and the forwardly inserted end of the baffle having an upturned flange thereon to control the reentrant flow of the gases in the closed end portion of the tube.

19. The water heater according to claim 18 wherein the open end portion of the tube passes through the opening in the wall of the container, and thence projects relatively outwardly therefrom.

20. The water heater according to claim 19 wherein the rearward end of the baffle projects relatively outwardly beyond the open end of the tube.

21. A water heater of the type wherein an atmospheric burner is used to heat the water, comprising a liquid container having an opening in the wall thereof,

an elongated immersion heater tube having open and closed ends thereon, inserted generally horizontally into the container and having the open end portion thereof connected to the wall of the container about the opening therein so that the opening is closed to the interior of the container while the bore of the tube is placed in communication with the exterior of the container therethrough, and forms an elongated gas flow chamber for heating the liquid in the container, a flat baffle inserted generally horizontally into the bore of the tube for a substantial distance along the length of the tube inwardly from the open end thereof, but terminating short of the closed end of the tube, so as to separate the lower and upper portions of the chamber for reentrant flow of the gases therethrough, a fuel burner arranged in communication with the lower portion of the chamber adjacent the open end portion of the tube so that the hot gases therefrom are fed along the bottom of the chamber in the direction of the closed end portion of the tube, and a flue interconnected with the open end portion of the tube adjacent the upper portion of the chamber so that the hot gases therein are withdrawn along the top of the chamber in the direction of the open end portion of the tube, the fuel burner being suspended from the flue and having a right angular bend therein so as to extend toward one side of the flue.

22. A water heater of the type wherein an atmospheric burner is used to heat the water, comprising a liquid container having an opening in the wall thereof, an elongated immersion heater tube having open and closed ends thereon, inserted generally horizontally into the container and having the open end portion thereof connected to the wall of the container about the opening therein so that the opening is closed to the interior of the container while the bore of the tube is placed in communication with the exterior of the container therethrough, and forms an elongated gas flow chamber for heating the liquid in the container, a flat baffle inserted generally horizontally into the bore of the tube for a substantial distance along the length of the tube inwardly from the open end thereof, but terminating short of the closed end of the tube, so as to separate the lower and upper portions of the chamber for reentrant flow of the gases therethrough, a fuel burner arranged in communication with the lower portion of the chamber adjacent the open end portion of the tube so that the hot gases therefrom are fed along the bottom of the chamber in the direction of the closed end portion of the tube, and a flue interconnnected with the open end portion of the tube adjacent the upper portion of the chamber so that the hot gases therein are withdrawn along the top of the chamber in the direction of the open end portion of the tube, the baffle being cantilevered from the bottom of the flue by means which effectively thermally insulate it from the flue, so as to form a septum between the burner and the mouth of the flue.

23. A water heater of the type wherein an atmospheric burner is used to heat the water, comprising a liquid container having an opening in the wall thereof, an elongated immersion heater tube having open and closed ends thereon, inserted generally horizontally into the container and having the open end portion thereof connected to the wall of the container about the opening therein so that the opening is closed to the interior of the container while the bore of the tube is placed in communication with the exterior of the container therethrough, and forms an elongated gas flow chamber for heating the liquid in the container, a flat baffle inserted generally horizontally into the bore of the tube for a substantial distance along the length of the tube inwardly from the open end thereof, but terminating short of the closed end of the tube, so as to separate the lower and upper portions of the chamber for reentrant flow of the gases therethrough, a fuel burner arranged in communication with the lower portion of the chamber adjacent the open end portion of the tube so that the hot gases therefrom are fed along the bottom of the chamber in the direction of the closed end portion of the tube, and a flue interconnected with the open end portion of the tube adjacent the upper portion of the chamber so that the hot gases therein are withedrawn along the top of the chamber in the direction of the open end portion of the tube, the forward end of the baffle having an upturned flange thereon to control the reentrant flow of the gases in the closed end portion of the tube.

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