May 26, 1936. J. G. AMES 2,041,683

HEATING APPARATUS

Filed March 30, 1934 3 Sheets-Sheet 1

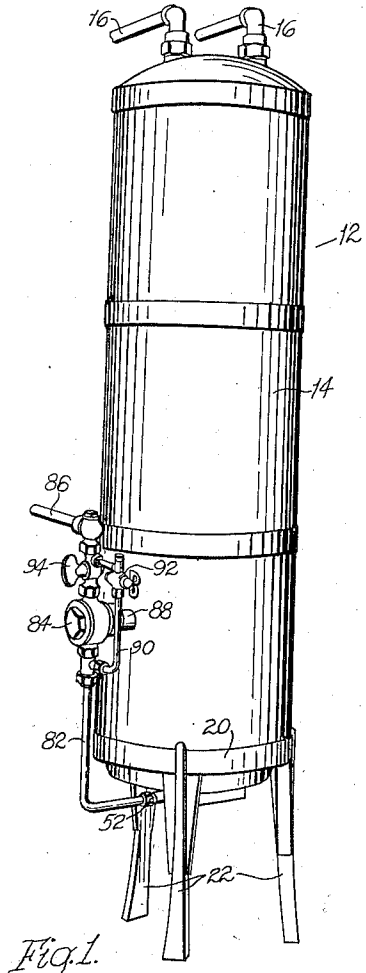


Fig. 1.

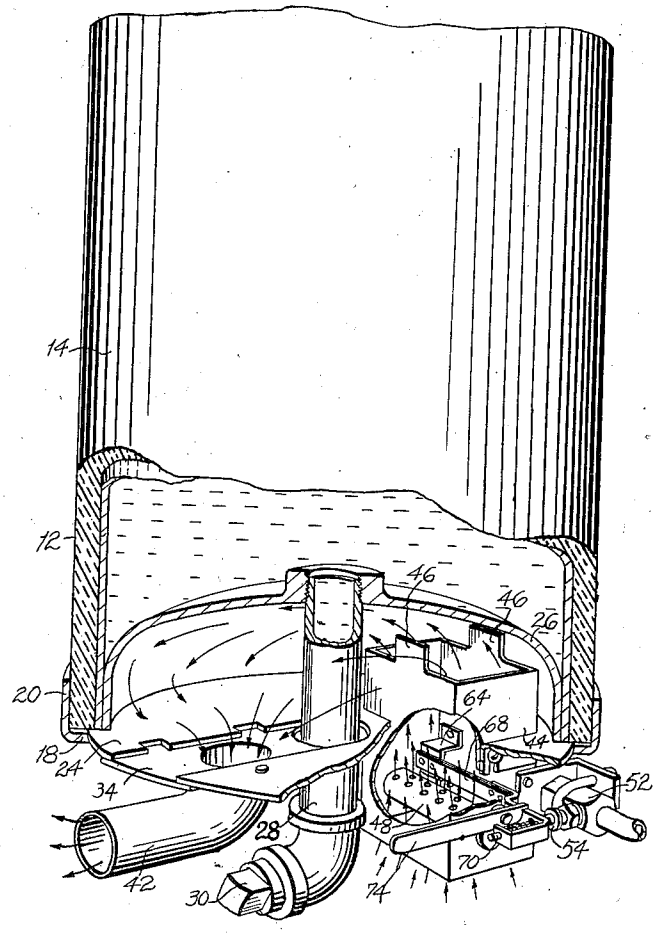


Fig. 2.

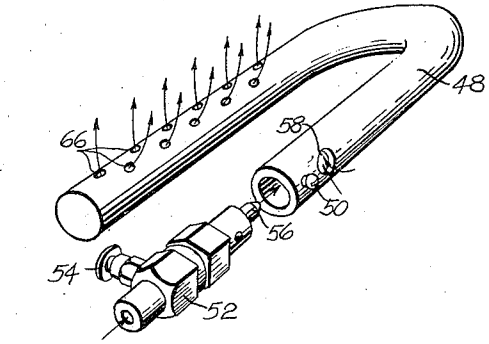


Fig. 3.

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HEATING APPARATUS

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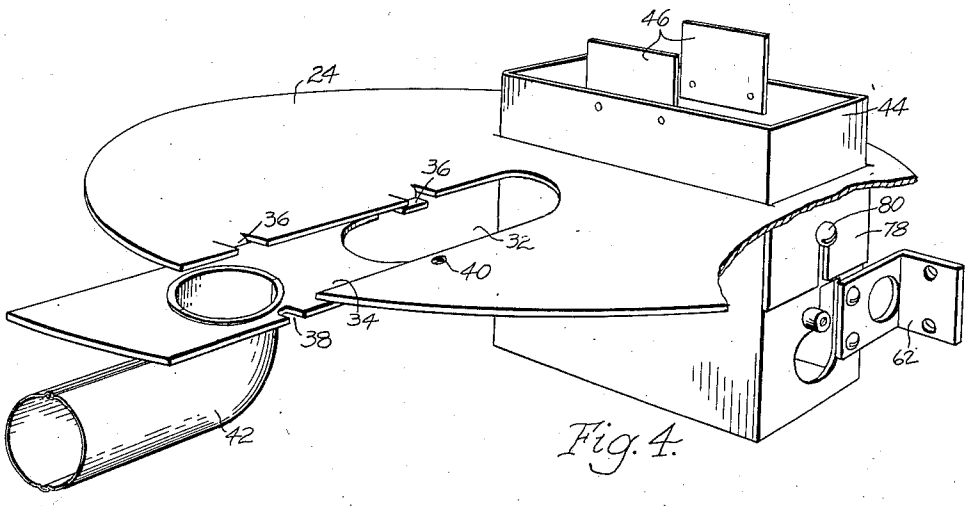


Fig. 4.

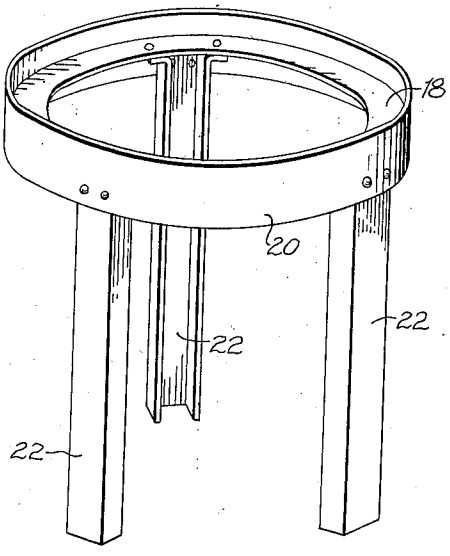


Fig. 5.

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May 26, 1936. J. G. AMES 2,041,683

HEATING APPARATUS

Filed March 30, 1934 3 Sheets-Sheet 3

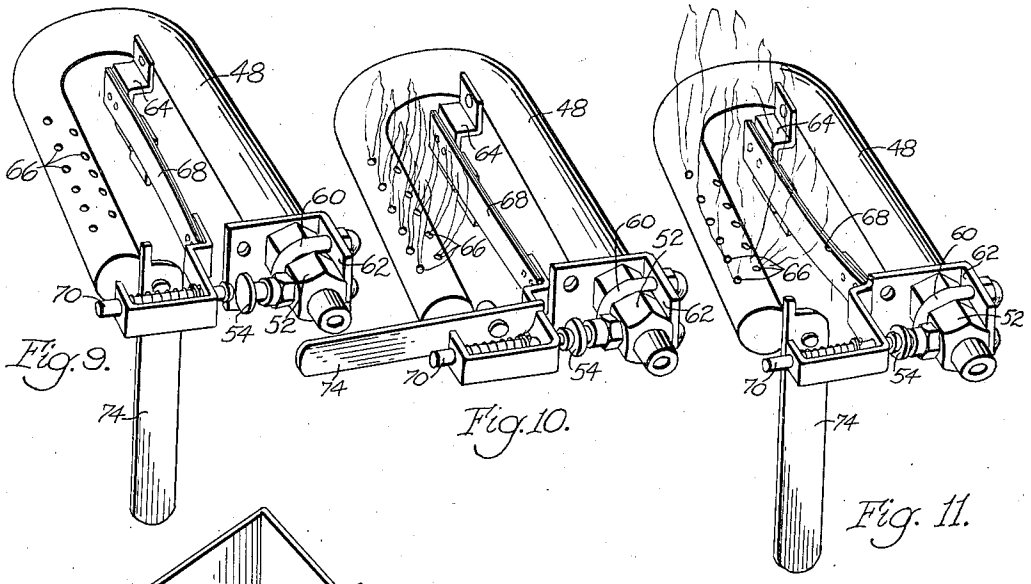


Fig. 9. Fig. 10. Fig. 11.

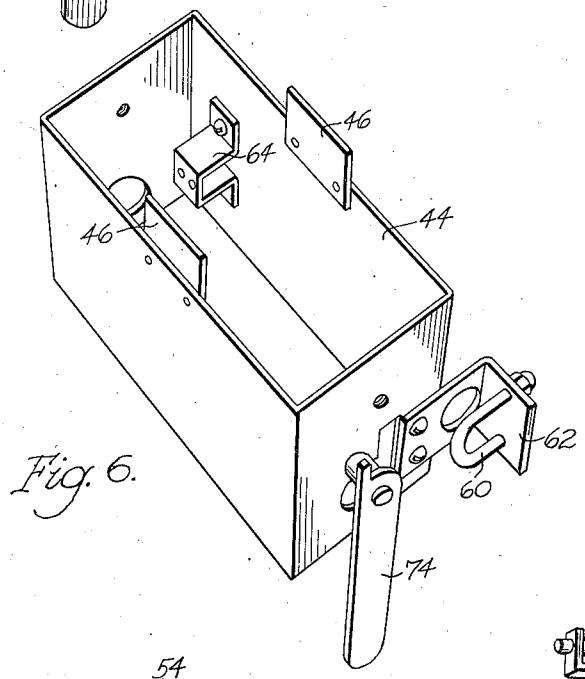


Fig. 6.

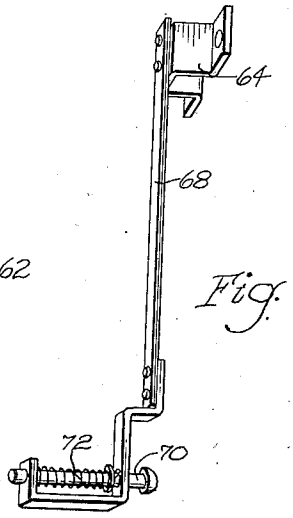


Fig. 7.

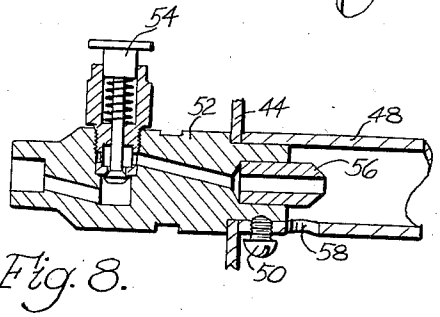


Fig. 8.

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Patented May 26, 1936 2,041,683

UNITED STATES PATENT OFFICE

2,041,683

HEATING APPARATUS

James Gerald Ames, Aurora, Ill.

Application March 30, 1934, Serial No. 718,186

11 Claims. (Cl. 126—350)

This invention relates to water heaters and the like, and is illustrated as embodied in apparatus for heating the water in the storage tank of a domestic water system.

One important object of the invention is to provide a simple and inexpensive but efficient heater which can readily be attached to the ordinary tank of such a system, and especially one which cooperates directly with an adjacent portion of the tank for forming a combustion chamber for the burner, so that the burning fuel acts directly on the tank wall.

In one desirable arrangement, the heater includes a plate peripherally engaging the edge of the tank bottom, the plate and the tank bottom jointly forming the desired combustion chamber. Usually the bottom of the tank is so formed that the plate may be a simple flat steel plate.

Where the tank has the usual central drain pipe at its bottom, the plate may have on opening extending from one edge to its center, and which fits over and engages one side of the drain pipe. The heater may have a slide or other means closing this opening and engaging the other side of the drain pipe, and as a matter of convenience I prefer to mount an exhaust conduit on this slide.

In the illustrated arrangement, the above-described plate peripherally engages and supports the edge of the tank bottom, and rests on a flange on a support having suitable legs or other means for supporting the entire assembly.

The arrangement of the exhaust or vent as described above on the opposite side from or at least some distance from the burner and at about the same level, has two substantial advantages. First, it insures that the burning and heated gases will sweep across the bottom of the tank, efficiently transferring their heat thereto. Second, it insures that when the burner is off, or on "low", that there will be no circulation of cold air through the heater due to any stack or chimney action.

I prefer to supply fuel for the burner under the control of two valves, one of which is turned on and off under the control of a thermostat responsive to the temperature of the water in the tank and which has a by-pass for feeding a reduced amount of fuel when the valve is closed, and the other of which is controlled by a safety device at the burner.

One feature of the invention relates to this safety device, which is shown in the form of a thermostatic strip above and heated by the burner and which at its end engages and opens (when heated) the said second valve, which may conveniently be a spring-closed plunger valve.

I prefer to provide a latch engaging this strip to hold the valve open when the burner is being started. When the burner has started and has heated the thermostat, it pulls away from the latch which immediately moves automatically (by gravity, in the arrangement shown) to an idle position where it does not interfere thereafter either with the valve or the thermostat.

A very important feature of the invention relates to the structure and arrangement of the burner of the heater, it being extremely simple and inexpensive to manufacture as well as compact and easy to adjust when attaching the heater to different tanks.

In the arrangement shown, the burner includes an air box for the secondary air held by the above-described plate, and which is shown frictionally seated in an opening in the plate so that it is easily adjusted perpendicularly of the plate, i. e. toward and from the tank bottom. This box may be provided with a projection engageable with the tank bottom, to determine positively its preferred position.

I prefer to mount the burner proper on this air box, so that it is automatically adjusted in position with the box. In the form illustrated, the fuel conduit has an extension within and extending through the side of the box, and shown as a loop, having means for drawing in primary air to be mixed therein with the fuel, and formed with combustible-mixture discharge openings just below the above-described thermostat of the safety device. Thus the heat of the burner deflects the thermostat to hold the fuel valve open, and when the burner goes out the thermostat almost immediately closes the valve.

The above-described features are especially advantageous when combined to provide what may be called a "conversion" water heater,—i. e. a heater readily attached to a water storage tank which is already installed, without changing or even disconnecting the tank. The movement of the tank necessary for inserting the novel conversion heater below it is so small that it does not necessitate disconnecting the water connections. Various features of the invention, however, are useful even if the heater and tank are built into a single unit.

The above and other objects and features of the invention, including various novel combinations of parts and desirable particular constructions, will be apparent from the following descrip-

tion of the illustrative embodiment shown in the accompanying drawings, in which:

Figure 1 is a side elevation of a tank and heater assembled on a base or support;

Figure 2 is a similar elevation, on a larger scale and partly broken away in vertical section, of the lower part of the tank and with the heater in place;

Figure 3 is a perspective of the looped conduit which forms the burner proper, and the safety valve device, in line with each other but separated far enough to show the structure;

Figure 4 is a perspective of the plate of the heater, with the secondary-air box and the slide carrying the exhaust conduit mounted thereon;

Figure 5 is a perspective of one form of base or support for the heater and tank;

Figure 6 is a perspective view of the secondary-air box;

Figure 7 is a perspective view of one form of safety device which may be used at the burner;

Figure 8 is a section through the valve which is controlled by the burner safety device; and

Figures 9, 10, and 11 are perspective views of the burner showing how the thermostat is latched out when the burner is being started.

The illustrated embodiment of the invention includes a novel heater adapted to be arranged at the bottom of a water storage tank 12, ordinarily covered by heat insulation 14, and which has any desired inlet and outlet water connections 16. In the particular arrangement illustrated, the tank is supported by an annular horizontal flange 18 integral with a ring 20 encircling the base of the tank, and which is mounted on legs or other supports 22 as shown in Figures 1 and 5.

My novel conversion heater, in the form selected for illustration, includes as one of its principal structural parts a novel base or plate 24 peripherally resting on the flange 18, and upon the margin of which in turn rests the edge of the bottom of the storage tank. Thus, in cases where the storage tank is already installed, it may without disconnecting the pipes 16 be lifted far enough to slip the heater plate 24 in place under it.

The bottom 26 of the tank, which in nearly all cases is either concave as shown in Figure 2, or at least is spaced sufficiently above its peripheral edge to define a substantial combustion space above the plane of that edge, and the heater plate 24 define between them the combustion chamber of the heater, so that the burning fuel wipes across the tank in direct engagement with the bottom 26 to the exhaust or vent 42 on the opposite side of the chamber, and in most cases directly opposite. This arrangement and construction of the combustion chamber I believe to be broadly new, and it contributes greatly to the design of a heater which is both effective and inexpensive, since the major part of the combustion chamber is formed by the tank itself. It also prevents circulation of cold secondary air through the heater by a stack or chimney action, if the burner is not on, or is too low to heat the air sufficiently. Moreover it gives a balanced combustion chamber, thereby adding to the effectiveness.

Where, as is usually the case, the storage tank has at its bottom a central drain pipe 28 (with the usual removable plug 30 or its equivalent), I form the plate 24 with an opening 32 extending from its edge to the center and arranged to embrace and fit against one side of the drain pipe 28. This opening is closed by a plate or the like 34 fitting against the other side of the drain pipe 28, and which is shown supported by lugs 36 integrally formed by slitting the plate 24 inwardly from the opening 32.

As will be apparent from Figure 4, slide 34 may be formed with a notch 38 for a screw or bolt or the like extending through an opening 40 in plate 24, to hold the slide 34 in place when the heater is assembled as in Figure 2.

I prefer to mount an exhaust conduit or vent 42 for the burner on the plate 34 or its equivalent. According to an important feature of the invention, this exhaust or vent is at the opposite side of the heater from the burner, or at least arranged a considerable distance from the burner, to give the sweeping movement of the hot gases in wiping engagement with the tank bottom, as indicated by arrows in Figure 2. I prefer also to arrange the exhaust at approximately the level of the burner, or even below that level, to eliminate any stack or chimney action due to the heat of the water in the tank acting on the air in the heater and tending to circulate cold air when the burner is off, or, when the burner is on "low" as in the cycle herein described, tending to circulate more air than is required for "low" combustion.

Secondary air for the burner may be supplied through an open-ended air box 44, shown slidably fitting frictionally within an opening in the plate 24 so that it may readily be adjusted toward and from the bottom 26 of the tank, perpendicularly of the plate 24. The box 44, in the form shown, has a projection or projections 46 engageable with the tank bottom, for positively determining the best position of adjustment. These projections may be integral, as shown in Figure 2 or riveted or otherwise secured to the air-box as shown in Figure 4.

The burner proper is illustrated as a looped extension 48 of the fuel conduit, the end of the conduit, shown as a casing 52 described below, passing through the side of the box 44 (see Figure 8) and fitting into the extension 48 and being detachably secured thereto by means such as a setscrew 50. This portion of the fuel conduit in the specific arrangement shown includes a valve casing 52 carrying a spring-closed plunger valve 54 operated as described below, and terminating in a nozzle 56 discharging the stream of fuel gas into the extension 48 opposite a primary-air opening 58.

The valve casing 52 is shown attached to the air-box by means such as a U-bolt 60 securing it to a bracket 62 riveted or otherwise secured to the end of the air box. The extension 48 may if desired be supported, in addition to its support on the end of the valve casing 52, by suitable brackets or the like (not shown) inside the air box. It extends around the interior of the box horizontally, with burner openings 66 on its upper side adjacent the closed end.

Above, but slightly at one side of, the openings 66, and closely adjacent but not exactly in the path of the burning fuel-air mixture, is arranged safety control means such as a bimetallic strip thermostat 68 secured at its end to a bracket 64 or other fixed support. The free end of the thermostat 68 carries a yieldingly-mounted plunger 70, urged to the right in the drawings by a spring 72 which is stronger than the spring of the plunger valve 54.

When the burner is on, and thermostat 68 is heated by the burning mixture of air and gas

streaming upwardly from the openings **66**, as in Figure 11, the thermostat warps to the right and plunger **70** holds the plunger valve **54** in open position. If the burner goes out, the thermostat **68** straightens out again, and the valve **54** automatically closes, shutting off the fuel (Figure 9).

In starting the burner, a trigger **74** pivoted on the end of the air box is turned to the position of Figure 10, where it locks with the thermostat **68** to hold the valve **54** temporarily open. As soon as the thermostat heats up, it pulls away from the trigger, and the latter automatically falls into idle position as shown in Figure 11.

The plate **24** may if desired have a down-turned lug or bracket **78** (Figure 4) slotted adjustably to receive a setscrew **80** threaded into an opening in the end of the air-box **44**, to hold it in adjusted position.

Fuel is supplied to the valve **52** by a conduit **82** from a main control valve **84** which connects with the gas supply line **86**. The valve **84** is a thermostatic valve of any desired standard type, the thermostatic portion **88** of which is responsive to the temperature of the water in the tank, so that when the water is cold the valve is open while when the water is above a predetermined temperature the valve automatically closes. The particular thermostat shown is in a casing extending into the water, but there are other well-known types which may be used if desired.

A bypass **90** (which may have a manually-adjustable valve **92**) connects conduits **86** and **82** around the main thermostatic valve **84**, to furnish a diminished supply of fuel even when valve **84** is closed. The apparatus therefore operates on a high-and-low cycle, although valve **84** operates on an open-and-closed cycle. Valve **84** may have a manually-adjusted valve **94** in series therewith, if desired. By adjusting the valves **92** and **94**, the amount of fuel in the low and high parts of the cycle may be determined.

In operation, the burner is lighted, with valves **92** and **94** adjusted approximately, and with valve **54** held open by the latch **74** as in Figure 10, by holding a match adjacent to the apertured portion of the extension **48**. Valves **92** and **94** are then adjusted. Thereafter the apparatus operates automatically unless the burner goes out, in which case the valve **54** closes.

While one illustrative embodiment has been described in detail, it is not my intention to limit the scope of the invention to that particular embodiment, or otherwise than by the terms of the appended claims. The above-described burner is claimed in my copending application No. 54,633 filed December 16, 1935.

I claim:

1. A conversion burner structure, for use in combination with a water tank, comprising a plate adapted to cooperate with a part of the tank to form a combustion chamber, an open-ended air box extending through the plate, and a burner in said box, said box with the burner being adjustable in a direction perpendicular to the plate.

2. A conversion burner structure, for use in combination with a water tank, comprising a plate adapted to cooperate with a part of the tank to form a combustion chamber, an open-ended air box extending through the plate, and a burner in said box, said box with the burner being adjustable in a direction perpendicular to the plate and said box having at its upper end a projection engageable with the bottom of the tank to determine the adjusted position of the air box and burner.

3. A conversion burner structure, for use in combination with a water tank, comprising a plate adapted to cooperate with a part of the tank to form a combustion chamber, an open-ended air box extending through the plate, and a burner in said box, said box with the burner being adjustable in a direction perpendicular to the plate and said box having means engageable with the tank to determine the adjusted position of the air box and burner.

4. Water heating apparatus comprising in combination with a tank having a drain tube arranged centrally of its bottom, a plate constructed and arranged to form with the bottom of the tank a combustion chamber and having an opening extending from one edge to its center and which fits over and engages one side of said drain tube, means closing said opening and fitting against the other side of the drain tube and which is provided with exhaust means, and a burner opening into said combustion chamber.

5. Water heating apparatus comprising in combination with a tank having a drain tube arranged centrally of its bottom, a plate constructed and arranged to form with the bottom of the tank a combustion chamber and having an opening extending from one edge to its center and which fits over and engages one side of said drain tube, means closing said opening and fitting against the other side of the drain tube and which is provided with exhaust means, and a burner opening into said combustion chamber, said burner and said exhaust means being generally across the combustion chamber from each other.

6. Water heating apparatus comprising in combination with a tank having a drain tube arranged centrally of its bottom, a plate constructed and arranged to form with the bottom of the tank a combustion chamber and having an opening extending from one edge to its center and which fits over and engages one side of said drain tube, means closing said opening and fitting against the other side of the drain tube and which is provided with exhaust means, and a burner opening into said combustion chamber, said burner and said exhaust means being approximately at the same level, so that there is no stack action due to the heat of the water in the tank which tends to draw air through said chamber independently of the operation of the burner.

7. A conversion burner structure, for use in combination with a water tank, comprising a plate adapted to cooperate with a part of the tank to form a combustion chamber, an open-ended air-box extending through said plate at one side of said chamber, a burner in said box and an exhaust opening through said plate at the opposite side of said chamber, said box being adjustable in a direction perpendicular to the plate.

8. A conversion burner structure for use in combination with a water tank having a concave bottom, comprising a plate adapted to fit over said bottom to form therewith a combustion chamber, an open-ended air-box extending through said plate, a burner in said air-box, and an exhaust opening through said plate, said air-box and said exhaust opening being at opposite sides of said chamber, said air-box being adjustable in a direction perpendicular to the plate, and having at its upper end a projection engageable with the bottom of the tank to determine the adjusted position thereof.

9. Water heating apparatus comprising in combination with a tank having a drain tube arranged centrally of its bottom, a plate constructed and arranged to form with the bottom of the tank a combustion chamber and having an opening extending from one edge to its center and which fits over and engages one side of said drain tube, means closing said opening and fitting against the other side of the drain tube and which is provided with exhaust means, an open-ended air-box extending through said plate, and a burner in said box, said box with the burner being adjustable in a direction perpendicular to the plate.

10. The combination, with an upright storage tank having a downwardly concave bottom the periphery of which is joined to the lower edge of the wall of the tank, of a plate supported in engagement with said lower edge to form a combustion chamber, and means for burning a fuel in and at one side of the chamber so formed and for exhausting the products of combustion downwardly through said plate at the opposite side of said chamber, whereby said gases sweep in an arcuate path across the full width of said bottom.

11. The combination, with an upright storage tank having a downwardly concave bottom the periphery of which is joined to the lower edge of the wall of the tank, and a support upon which said lower edge rests, of a plate supported in engagement with said lower edge and having its margin held between said support and said lower edge to form with said bottom a combustion chamber, and means for burning a fuel in and at one side of the chamber so formed and for exhausting the products of combustion downwardly through said plate at the opposite side of said chamber, whereby said gases sweep in an arcuate path across the full width of said bottom.

JAMES GERALD AMES.