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Inventor(s)	Bullick; Robert L.

Water heater for heating water using various power sources and enhancing energy savings

Abstract

A water heater and a method for heating water using various power sources and enhancing energy savings are disclosed. The water heater includes a first heating element within an inlet pipe. The first heating element draws energy from a first power source to heat water to a first temperature. The water heater further includes a second heating element within an outlet pipe. The second heating element draws power from a second power source to heat water from the first temperature to a second temperature. Optionally, when the second power source is unavailable or insufficient, then the second heating element draws power from a third power source to heat water from the first temperature to the second temperature.

Inventors: **Bullick; Robert L. (Georgetown, TX)**

Applicant: **Bullick; Robert L.** (Georgetown, TX)

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Primary Examiner: Abraham; Ibrahime A

Assistant Examiner: Samuels; Lawrence H

Attorney, Agent or Firm: HULSEY P.C.

Background/Summary

CROSS-REFERENCE TO RELATED APPLICATIONS (1) The present application claims benefit of provisional Application No. 63/538,655, filed Sep. 15, 2023; all of which is incorporated herein in its entirety and referenced thereto.

BACKGROUND OF THE INVENTION

Field of the Invention

(1) The present disclosure relates to a water heating system, and in particular, relates to a water heater for heating water using different power sources while enhancing energy savings.

Description of the Prior Art

(2) It is known that water heaters are commonly used in household or commercial applications. In

typical water heaters, water is introduced into a storage tank via an inlet water pipe at about 50 degrees Fahrenheit (50° F.). The water heater includes an electrical element within the storage tank typically positioned inside the water heater, or beneath the water tank (for gas heaters). The electrical element is used to heat the water within the water tank to a preset temperature. The electrical element is controlled with the help of a thermostat that is capable of monitoring or measuring the temperature within the water tank.

(3) With improvements in the technology, the power required to heat the electrical element is drawn from a variety of sources such as power grid, renewable power source, among others. Several water heaters operating using different power sources have been disclosed in the past. One such water heater is disclosed in a U.S. Pat. No. 11,480,366, entitled “Solar water heating system” (“the '366 Patent”). The '366 Patent discloses systems and methods for a thermosyphonic water heating system for a storage tank. A DC heat pump receives power from a DC power source and heats water via a heat exchanger using a thermosyphonic piping system. A passive back-flushing having a cold-water inlet pipe connected to the hot water return pipe draws cold water into the storage tank through the heat exchanger. A vertical array of temperature sensors distributed throughout the storage tank monitor temperature of stored water at multiple heights and a communication unit communicates monitored data to an external control device.

(4) Another water heater is disclosed in a United States Publication No. 20130266295, entitled “Hybrid Gas-Electric Hot Water Heater” (“the '295 Publication”). The '295 Publication discloses systems and methods (i.e., utilities) broadly directed to the generation of hot water using energy derived from renewable energy sources. In the various aspects, these utilities are directed to the retrofitting of existing water heaters with electrical heating elements that are connectable to a renewable source of electrical energy. While primarily discussed in relation to retrofitting existing water heaters, various aspects are applicable to OEM manufactured systems. Further, various control methods are provided that allow for enhancing the efficiency of hot water generation, net metering, and/or the generation of renewable energy credits.

(5) Yet another water heater is disclosed in a United States Publication No. 20120060827, entitled “Control for a tankless water heater used with a solar water heating system” (“the '827 Publication”). The '827 Publication discloses a tankless water heating auxiliary system for a solar water heating system, includes a solar collector; a tankless water heater auxiliary system; an insulated water storage tank storing the potable water; a heat exchange system for heating stored water; and piping for connecting the collector, the storage tank and the heat exchanger in fluid communication. A first sensor is connected to and located adjacent to the storage tank for sensing the temperature of the stored water at an outlet of the tank. A method for controlling initiation of heating in a tankless water heater auxiliary system, includes monitoring operation of a tankless water heater; measuring water flow using a water flow sensor to determine if water flow rate exceeds a use determined flow rate; implementing a control time delay into the tankless water heater to purge water from the heater and sense the inlet water supply temperature; measuring the water temperature using a heat exchanger outgoing thermistor; comparing the temperature measured by the thermistor to a predetermined temperature; and initiating a combustion sequence if the temperature measured by the outgoing thermistor is less than the predetermined temperature.

(6) Although the above discussed disclosures are useful, still, there is a need in the art to provide an improved water heater capable of reducing energy cost for major electrical equipment for both end user and suppliers of energy.

SUMMARY OF THE INVENTION

(7) It is an object of the present invention to provide an improved electric water heater and that avoids the drawback of known water heaters.

(8) It is another object of the present invention to provide an improved water heater capable of reducing energy cost for major electrical equipment for both end user and suppliers of energy.

(9) In order to achieve one or more objects, the present invention provides a water heater and a

method for heating water using various power sources and enhancing energy savings. The water heater includes a first heating element within an inlet pipe. The first heating element draws energy from a first power source to heat water to a first temperature. The first power source indicates a power supplied by utility service providers, say traditional grid. The water heater further includes a second heating element within an outlet pipe. The second heating element draws power from a second power source to heat water from the first temperature to a second temperature. The second power source indicates energy drawn from renewable energy sources such as solar panels, for example. Optionally, when the second power source is unavailable or insufficient, then the second heating element draws power from a third power source to heat water from the first temperature to the second temperature. The third power source indicates energy drawn from renewable energy sources such as batteries or wind turbines, for example.

(10) In one implementation, the water heater provides a different flow path for hot water located outside of the normal water heater. The flow path may have a first heating element (i.e., cal-rod) at the bottom of the outside flow path connected to an alternative power source or standard utility power. Optionally, the water heater includes a trickle charger controlled by a thermostat that maintains a programmed temperature throughout the hot water heater.

(11) Further, the water heater includes a second heating element (e.g., cal-rod) that runs inside of the inlet pipe hot water heater (HWH). The second heating element is designed to run off any available power source, with alternate power preferred to save energy. The selection of power source is supplied by thermostat program. The transfer of temperature is provided by an outside flow path. The second heating element activates as needed to maintain set water temperature when demand is high.

(12) In addition, the water heater includes a third heating element (e.g., cal-rod) placed in the hot water outlet line which becomes the second cal-rod to activate inside of HWH. The water heater includes a controller integrating a thermostat program that takes sensor data from all sensors, available electrical energy and calculates the amount of energy needed to maintain maximum set HWH temperature.

(13) There are two electric Cal-rods that come with most standard electric water heaters and are primarily supplied electrical energy by a utility company. The electric Cal-rods are controlled by the thermostat program, if the three Cal-rods supplied by the alternate energy cal-rods cannot maintain the max temperature set for HWH. In other words, all Cal-rods, a total of five (5) would be activated and have the same effect as a tank-less water heater system. The same process can be used by a gas HWH. Here, once demand for the hot water is met, the HWH would return to normal operations. The outside flow pipe created by the transfer line may be used to create a heat source for additional heat to the house heating system. This approach can be used anytime. The HWH can be used as a type of boiler. The external pipe can be enlarged to hold additional hot water that would be circulated from the HWH outside to the heat pump where heat is transferred to the heat pump coil and then circulated by small pump back to HWH to be reheated making a complete cycle. The heat exchanger is isolated from the heat pumps fan system to enhance the transfer of heat to the heat pump system.

(14) In one advantageous feature of the present invention, the water heater can be used with existing water tanks for heating water while reducing energy cost at household and commercial structures. The water heater presents a multi-stage heating process that increases the water temperature in a short span of time and improves the overall efficiency of the water heater while minimizing the heat loss.

(15) In another advantageous feature of the present invention, the second heating element allows water inside the outlet pipe to be at operating temperature quickly due to water volume inside hot water heater since the outlet valve is small and easy to bring to operating temperature by the second heating element. Setting a low temperature of 40° or 50° F. for heating by the first heating element helps to save energy cost for both users and power utility providers.

(16) In one alternate implementation, the first heating element is set to heat the water from 100° F. This allows the energy source from the utility company to do the heavy lifting and the second heating element operated using the alternative energy to increase the total tank temperature to a temperature of 125° F. to 140° F. The alternative energy to heat the water tank can be ON to reach set maximum temperature of hot water heater (HWH), once the tank reaches the set temperature, only the alternative energy is needed to maintain temperature at maximum. The natural flow of hotter water to the top of the heater tank is from the cooler bottom of the tank.
(17) In another advantageous feature of the present invention, when there is a power failure, alternate power such as the solar panels get activated and maintain the power for the first heating element.
(18) In yet another advantageous feature of the present invention, the third heating element installed near the bottom of the outside outlet/inlet pipe allows the hot water to flow/migrate upward to aid in maintaining temperature at top of the hot water tank outlets.
(19) In yet another advantageous feature of the present invention, the water heater includes a controller. The controller optimizes the energy usage by controlling the operation of the second heating element based on real-time temperature data. This ensures the energy is consumed only when it is required.
(20) The features and advantages of the invention here will become more apparent in light of the following detailed description of selected embodiments, as illustrated in the accompanying FIGURES. As will be realized, the invention disclosed is capable of modifications in various respects, all without departing from the scope of the invention. Accordingly, the drawings and the description are to be regarded as illustrative in nature.

Description

BRIEF DESCRIPTION OF THE DRAWINGS
(1) FIG. **1** illustrates a diagrammatic representation of a water heater, in accordance with one embodiment of the present invention.
(2) FIG. **2** illustrates a top view of the water heater, in accordance with one embodiment of the present invention.
(3) FIG. **3**, FIG. **4**, FIG. **5**A and FIG. **5**B illustrate partial views of a first heating element, a second heating element and a third heating element (FIG. **5**A and FIG. **5**B), of water heater shown in FIG. **1**;
(4) FIG. **6** illustrates a pop off pressure relief valve, in accordance with one exemplary embodiment of the present invention.
(5) FIG. **7** illustrates a heat pump, in accordance with one embodiment of the present invention.
(6) FIG. **8** illustrates the use of batteries as an alternate source of energy for operating a second heating element in the water heater, in accordance with one embodiment of the present invention.
(7) FIG. **9**A and FIG. **9**B illustrate the water heater as used in the environment of an attic, in accordance with one exemplary embodiment of the present invention.
(8) FIG. **10** illustrates a heat pump having one suction line and one discharge line, in accordance with one exemplary embodiment of the present invention.
(9) FIG. **11** illustrates a schematic view of a housing for receiving a heat pump air conditioning unit or regular air conditioning unit, in accordance with one exemplary embodiment of the present invention.
(10) FIG. **12** illustrates a shade cloth provided at sides of the air conditioning unit, in accordance with one exemplary embodiment of the present invention.
(11) FIG. **13** illustrates a feature of the shade cloth.
(12) FIG. **14** illustrates a bottom portion of the air conditioning unit **118** shown above in FIG. **11**.

(13) FIG. **15** illustrates a schematic diagram representing heating of freon to add usable heat to attic A coil, in accordance with one exemplary embodiment of the present invention.
(14) FIG. **16** illustrates an exemplary setup of a water heater.
(15) FIG. **17** illustrates a method of heating water, in accordance with another embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

(16) The following detailed description set forth below in connection with the appended drawings is intended as a description of exemplary embodiments in which the presently disclosed invention may be practiced. The term "exemplary" used throughout this description means "serving as an example, instance, or illustration," and should not necessarily be construed as preferred or advantageous over other embodiments. The detailed description includes specific details for providing a thorough understanding of the presently disclosed water heater. However, it will be apparent to those skilled in the art that the presently disclosed invention may be practiced without these specific details. In some instances, well-known structures and devices are shown in functional or conceptual diagram form in order to avoid obscuring the concepts of the presently disclosed water heater.

(17) In the present specification, an embodiment showing a singular component should not be considered limiting. Rather, the invention preferably encompasses other embodiments including a plurality of the same component, and vice-versa, unless explicitly stated otherwise herein. Moreover, the applicant does not intend for any term in the specification to be ascribed an uncommon or special meaning unless explicitly set forth as such. Further, the present invention encompasses present and future known equivalents to the known components referred to herein by way of illustration.

(18) Although the present invention provides a description of a water heater, it is to be further understood that numerous changes may arise in the details of the embodiments of the water heater. It is contemplated that all such changes and additional embodiments are within the spirit and true scope of this disclosure.

(19) The following detailed description is merely exemplary in nature and is not intended to limit the described embodiments or the application and uses of the described embodiments. As used herein, the word "exemplary" or "illustrative" means "serving as an example, instance, or illustration." Any implementation described herein as "exemplary" or "illustrative" is not necessarily to be construed as preferred or advantageous over other implementations. All of the implementations described below are exemplary implementations provided to enable persons skilled in the art to make or use the embodiments of the disclosure and are not intended to limit the scope of the disclosure.

(20) The present invention discloses a water heater and a method for heating water using various power sources and enhancing energy savings. The water heater includes a first heating element within an inlet pipe. The first heating element draws energy from a first power source to heat water to a first temperature. The water heater further includes a second heating element within an outlet pipe. The second heating element draws power from a second power source to heat water from the first temperature to a second temperature. Optionally, when the second power source is unavailable or insufficient, then the second heating element draws power from a third power source to heat water from the first temperature to the second temperature.

(21) In one implementation, the water heater includes rooftop mounted solar panels supplying power to home HVAC units and to an electricity grid. The utility companies can collect the power generation data. The invention further includes a hybrid water heater with a T-shaped connection tube comprising a heating element powered through solar energy providing alternative source for utility power. The invention further includes a hybrid heat pump with a separate chamber for refrigerant heating through heating element using solar energy to bring temperature back to efficient mode for heat pump. The system includes DC batteries to supply electric power in case of

unavailability of solar power. The refrigerant of the heat pump is reheated by the heating element using solar power or bypassing through an area heated by microwave or heating element operating through solar power.
(22) Various features and embodiments of a water heater are explained in conjunction with the description of FIGURES (FIGS.) **1-18**.
(23) FIG. **1** shows a diagrammatic representation of a water heater **10**, in accordance with one embodiment of the present invention. Further, FIG. **2** shows a top view of water heater **10**, in accordance with one embodiment of the present invention. Water heater **10** includes a housing or enclosure or tank **12** made of a suitable material for holding various electrical and mechanical components required for heating water.
(24) Housing **12** includes an inlet pipe **14**. Inlet pipe **14** receives water W from a water source. In FIG. **1** and FIG. **2**, inlet water flow is denoted with a reference numeral **16** (inlet water flow **16**). Inlet pipe **14** connects to a first heating element **18**. In one example, first heating element **18** indicates a Calrod™ used as a heating element for converting electricity into heat via Joule heating. In accordance with the present invention, inlet pipe **14** has two connections, a first connection and a second connection that are on top of each other and located outside the top of housing **12**. Further, two connections are connected to inlet pipe **14** in a water and pressure tight manner. Here, the first connection is positioned below the first connection. The first connection allows the water to enter inlet pipe **14**. Further, the second (top) connection allows a first armored power wire **20** to go through the water connection and attaches to first heating element **18** inside inlet pipe **14**.
(25) First heating element **18** has an Alternate Current (AC) supplied by a first power source **19**, say via a grid using first power wire **20**. Alternatively, first heating element **18** has a Direct current (DC) supplied, if needed. First heating element **18** utilizes first power source **19** to heat water W up to 40 or 50 degrees Fahrenheit (50° F.) or as may be needed. In some embodiments, first power source **19** includes renewable energy, say solar energy used to heat water W up to 40 or 50 degrees Fahrenheit (50° F.) or as may be needed.
(26) Referring to FIG. **1** and FIG. **3**, constructional features of first heating element **18** are explained. It should be understood that FIG. **3** shows a partial view of water heater **10** containing first heating element **18** within inlet pipe **14**. As can be seen from at least is FIG. **1**, first heating element **18** is attached to the bottom of inlet pipe **14** to prevent fluid from moving first heating element **18** up or down inside inlet pipe **14**. Optionally, first heating element **18** is not attached to inlet pipe **14** since water flows downward under normal operation and keeps first heating element **18** in place. Further, first heating element **18** creates a flow path **22** using slots or holes **24** for heating water at the middle of first heating element **18**. Slots **24** act as open ends for inlet pipe **14** to the whole of water heater **10**.
(27) Further, water heater **10** includes an outlet pipe or hot water discharge pipe **30**, as shown in FIG. **1** and FIG. **4**. Outlet pipe **30** is configured to discharge the heated water. Outlet pipe **30** includes a second heating element **32**. Second heating element **32** indicates a Cal-rod or Calrod™ used as a heating element for converting electricity into heat via Joule heating. FIG. **4** shows a partial view of water heater **10** containing second heating element **32** within outlet pipe **30**. As can be seen, outlet pipe **30** has a cap with a second armored power wire **34** that runs through it and is attached to second heating element **32**. Similar to first heating element **18**, second heating element **32** includes two connections, a first connection and a second connection that are positioned on top of each other and located outside the top of housing **12**. Further, two connections are connected to outlet pipe **30** in a water and pressure tight manner. Here, the first connection is positioned below the first connection. The first connection allows the water to enter outlet pipe **30**. Further, the second (top) connection allows second power wire **34** to go through the water connection and attaches to second heating element **32** inside outlet pipe **30**. Second heating element **32** creates a flow path **36** using slots or holes **38** at the middle of second heating element **32**.
(28) Further, outlet pipe **30** encompasses a bottom cap connection **40**. Bottom cap connection **40**

positions underneath second heating element **32** and keeps second heating element **32** in place when water surges up through outlet pipe **30**. Further, bottom cap connection **40** has holes through it to prevent debris from collecting below second heating element **32**.

(29) As specified above, second heating element **32** heats water using a second power source **33** such as solar energy. In one example, second power source **33** includes utility company provided AC, Alternating Current or Direct Current from sources other than utility power. In other words, any source of developed AC, DC or batteries work with the presently disclosed water heater. In some embodiments, batteries **80** are used in addition to solar energy. Batteries **80** can be used to supply electrical energy when solar energy is not available or when the solar energy is insufficient to power second heating element **32**. FIG. **8** shows use of batteries **80** with each of first heating element **18** and second heating element **32** with the help of a converter **82**. As can be seen from FIG. **8**, batteries **80** are used when it is determined that solar energy is not active or insufficient to operate second heating element **32**. In one example, a wind turbine (not shown) is used with batteries **80** to supplement solar panels and during low sun conditions. Optionally, a gas fired water heater or gas fired burner is used to supplement solar panels for operating second heating element **32**. Other natural resources may be used to increase energy savings.

(30) FIG. **9**A shows an exemplary embodiment in which water heater **10** is used at an attic with air **94** from duct wall **90** passing by coils **92** and entering air conditioning duct to ventilator **96** to a living area. The Freon is used similar to an air-conditioner. In one example, hot water is returned to water heater **10** to reuse via water faucet **28**. FIG. **9**B shows another exemplary embodiment in which water heater **10** is used at an attic with air **94** from duct wall **90** passing by coils **92** with hot water and then back to an air conditioning duct to be circulated to add worth to the living area. The Freon is used similar to an air-conditioner. In one example, hot water is returned to water heater **10** via tubes **95** to reuse via water faucet **28**. In one example, the drain line from inside the container for the hot water heater (HWH) is needed in case a water leak is developed. FIG. **9**B is presented to have a different flow path for hot water located outside of a normal water heater. This flow path may have a heating element (cal-rod) at the bottom of the outside flow path connected to an alternative power source or standard utility power. FIG. **10** shows a heat pump **100** having a line **104** sucking air **106** and another line **108** discharging the air **106**. Here, a heat plate **105** separates an area **102** from F Freon. Area **102** is heated by microwave or other heating sources.

(31) FIG. **11** shows a schematic view of a housing **110** for receiving a heat pump air conditioning unit or regular air conditioning unit **118**. Here, housing **110** is presented to explain a method involving building two walls of two different materials to supply cooler air to the heat pump unit by reducing the sun's hotter rays and enhancing the efficiency of a heat pump or conventional air conditioning system. The first wall is placed four inches from the sides of the heat pump walls and is totally enclosing the heat pump unit. The first wall is made of 80% shade cloth or 45% aluminum covered shade cloth. The shade cloth has 4 inches laying on and attached to the ground to prevent outside air from entering at the bottom of the shade cloth. There is a frame used to hold shade cloth upright. The top of the shade cloth is folded over the frame and is allowed to cover all but a fan opening on all four sides of the AC unit. This shade cloth allows outside air to be pulled thru the shade cloth and be expelled by the fan. If the aluminum covered shade cloth is used it will reflect the sun's rays and heat away before entering the ac unit. This will result in a cooling effect of the outside air temperature. The heat rays are exhausted upward, and the shade cloth removes about 45% of the sun's heat.

(32) The second wall around the heat pump unit consists of radiant barriers that removes and dissipates the heat waves from getting to the shade cloth and improves the cooling effect further. Each of the radiant barriers is placed standing up and are four inches away from each other and overlap each other by four inches, all the way around the heat pump assembly. This arrangement allows free flow of air to the shade cloth minus the heat reflected away. The height of the radiant barriers can be seen as the shadow on the AC unit. It needs to be high enough to keep all sunlight

from hitting on the AC unit at any time of the day on any side.

(33) Still referring to FIG. **11**, housing **110** encompasses a container **112**. In one implementation, all sides of container **112** are provided with silvishade cloth reflective material. The silvishade reflects sunlight, creating shade on the air conditioning unit, such that the air will be cooler on the inside than outside. In winter conditions, it is possible to add between the air conditioning unit and the shade cloth a heat blanket to aid the heat pump operations, similar to electric blanket. Container **112** presents a wall **114**, say house brick wall on one side, concrete slab at the bottom and receives cooler sir **116** from the opposite side of wall **114**. The area denoted by X inside container **112** indicates an area on the outer air conditioning unit cover where outside air is condensed and blown out through top by a fan (forced air). FIG. **12** shows an air conditioning unit **120** (similar to air conditioning unit **118**), in accordance with one embodiment of the present invention. air conditioning unit **120** includes a housing unit **122** having posts **124** at all corners for affixing to the wall. In one example, three sides **126**, **128** of air conditioning unit **120**, say about 80% of the air conditioning unit **120** is provided with shade material (silvishade cloth reflective material) at an angle of 45 degrees. Air conditioning unit **120** includes a fan housing **130** having blades **132**. FIG. **12** is shown to illustrate that shade cloth **126**, **128** is provided at the bottom and sides of air conditioning unit **120** such that air temperature being circulated through the condenser coil is at least 10 degrees below the ambient temperature and would make the condenser more efficient and reduce the energy cost. FIG. **13** shows a feature of shade cloth **126** on all sides. Here, shade cloth **126** does not cover fan housing **130**. FIG. **14** shows a bottom portion of air conditioning unit **118** shown above in FIG. **11**. Here, area **135** indicates an area of flow created when fan **130** is ON. Two valves **138** are provided to check coils **137** housed in a container **136**. Coils **137** are insulated and used as a form of heating freon for winter operations and supply heat to hot water heater which maintains a constant temperature to heat exchanger. This would be used to improve efficient use of heat pump when operating below its optimum for heating reuse.

(34) FIG. **18** shows water heater **160**, in accordance with one exemplary setup. The exemplary setup presents a PVC pipe system used to run a line from the external HWH line to the air conditioning duct work where, past the coil. A heat exchanger is placed inside of existing duct work with a return line to the hot water heater. This feature would only be active in cold weather and controlled by a controller (not shown) integrating an artificial intelligence (AI) program. The process ceases when the thermostat setting was reached. The AI program determines the proper time to start or stop hot water flow. Here, water is used as fluid to provide a safety system and a drain line would catch water leaking from water lines and heat exchanger. The A/C filter positioned ahead of the heat exchanger is used to capture and clean air to heat exchanger or a separate exchange filter is used. The additional adoption would be with AC Freon and no water. The same approach would be taken with the Freon as the water. Two Freon lines would be run (one intake, one outtake) one insulated and one not. The process would be the same as water, except the Freon method is used to enhance the ability to heat and cool during weather extremes. The Freon exchanger is attached to the AC unit by way of testing ports normally provided to service the AC unit. The ability to test the heat exchanger and main AC requires an additional set of testing ports at the end of the heat exchanger for service. The heat exchanger function is controlled inside by the thermostat/controller using AI program. The heat exchanger is finned on the outside to improve efficiency for both heating and cooling. The heat exchanger is shut off when not needed for efficiency. Water heater **160** includes a primary duct **162**, and an electric bar **164**. Primary duct **162** receives air, which passes through electric bar **164**. The air flow is directed to AC through a RM duct **166**. In some implementations, the airflow **168** is directed to HWH pipe **170** having a heating member **172** connecting a powerline **174**. Water heater **160** includes a heat exchanger **176** with fins **178**. Heat exchanger **176** connects to outlet **180** having a drip pan **182** for the air-conditioning unit. Outlet **180** connects to an outside pipe **184**. Further, outlet **180** connects to a hot water tank pipe **186**. Cold water is supplied to water heater **160** via an inlet line **188**. Here, exchanger **176** has a

hotter flow to upper heat exchange with a lower cool water return to hot water.

(35) In accordance with the present invention, first power source **19** is used to heat the water up to 40° F. If the water heater is set for 125° F., then the difference between 40° F. and 125° F., i.e., 85° F. is achieved using second power source **33** i.e., using solar energy. Optionally, when the second power source **33**, say solar energy is not available at night time, then an alternate source say, batteries **80** are used to achieve the temperature of 125° F., from the water temperature of 40° F. This way, water heater **10** helps to reach the required temperature of 125° F. much faster.

(36) Further, water heater **10** includes a pop off pressure relief valve **45**. Pop off pressure relief valve **45** connects to a third heating element **50** via a third pipe or outlet line **52**. Third pipe **52** is insulated from top to bottom of water heater **10** to reduce heat loss. The length of third pipe **52** can be adjusted to increase the amount of hot water availability in water heater **10**.

(37) FIG. **5**A shows a partial view of pop off pressure relief valve **45** positioned adjacent to water heater **10**, in accordance with one embodiment of the present invention. FIG. **5**B shows a partial view of pop off pressure relief valve **45** positioned adjacent to water heater **10**, in accordance with another embodiment of the present invention. In one example, pop off pressure relief valve **40** has a third armored power wire **54** connecting pop off pressure relief valve **40** and third heating element **50**. Pop off pressure relief valve **40** helps to relieve high pressure inside housing **12** for safety. Further, third heating element **50** is connected to a drain valve **56**. The flow path with third heating element **50** outside of the hot water tank **12** from drain valve **56** to pop off pressure relief valve **40** is installed with or without third heating element **50** installed. This is done to allow natural flow of hot water to top of hot water heater **10**. Here, installation of third heating element **50** at the lower end of the outside third pipe **52** presents an advantage should other heating features fail. It should be noted that third heating element **50** is placed high enough in third pipe **52** to allow for draining of any sediment that might accumulate through drain valve **56**. In some instances, third heating element **50** may take extra room below where it is set to catch sediment for removal via drain valve **56**. In one example, water heater **10** includes a faucet **28** to discharge water from water heater **10**.

(38) FIG. **6** shows an alternate embodiment of pop off pressure relief valve **45**. Here, a T-shaped connection tube is in pop off pressure relief valve **45** in order to use drain valve **56** temporarily. In accordance with one embodiment of the invention, FIG. **7** shows an above view of heat pump **72**, a discharge line **76**, and a return line **74** both with check valves to allow connections for auxiliary functions outside the AC unit to be installed. Here, heat pump **72** connects to a first valve **74** and a second valve **74**. Each of first valve **74** and second valve **74** includes check valves. A separate unit that is pressure tight such as A/C service unit is used to operate and match with the operating pressure of the A/C using a service unit. In one example, heat pump **72** with a separate chamber for refrigerant heating through heating element using solar energy to bring temperature back to efficient mode for heat pump **72**. In one example, a control box (not shown) is used to regulate the source of power i.e., A/C solar or batteries. This is to help in the case of loss of A/C from the grid.

(39) Here, the temperature of first heating element **18** is set to 40 or 50 degrees Fahrenheit (50° F.) or as may be needed. Setting a low temperature of 40° or 50° F. helps to save energy cost for both users and power utility providers. In case of a power failure, alternate power will activate and maintain the power of first heating element **18**.

(40) As can be seen from FIG. **1**, the flow path of inlet source water is through the top of the water inlet connection and downward around first power wire **20** to first heating element **18** is used to heat the water in tank/housing **12**. Inlet pipe **14** has two connections that are on top of each other and located outside the top of water heater **10**. The bottom connections allows the source water to enter inlet pipe **14**. A second connection above the water inlet connects first power wire **20** (armored power wire) that runs through both connections. First power wire **20** is connected to first heating element **18** (cal-rod) located near the bottom of inlet pipe **14**. There is a flow path just about four inches below the top of inlet pipe **14** (about 2 3/16″ holes) that allows hot water from lower first heating element **18** to create flow between the top and bottom circulation ports on inlet

pipe **14** by migration of water or applied heat. The flow path of inlet source water is through the top of the water inlet connection and downward around the cable to first heating element **18** used to heat the water in tank/housing **12**. In one implementation, first heating element **18** has a flow path created by holes or slots **24** for heating the water around the middle of first heating element **18**. The open end of inlet pipe **14** allows water flow and any sediment to exit inlet pipe **14**. Further, sediment falls to the bottom of tank/housing **12**. In addition, first heating element **18** can be latched to the bottom of inlet pipe **14** to prevent fluid from moving first heating element **18** up or down inside inlet pipe **14**. It should be understood that it may not be possible to attach first heating element **18** to inlet pipe **14** as all water forces under normal operations would be downward to keep first heating element **18** in place. As first heating element **18** in inlet pipe **14** is supplied with AC power supplied by the utility company, down first power wire **20** to first heating element **18** with alternative power, if needed. The Temperature setting of 125 degrees F. or as needed is maintained throughout water heater **10** by heating element **18**, **32**, **50**. The lower temperature which is less than the final temperature results in savings of energy cost for the consumer and the utility company. In some implementations, a gas fired burner (not shown) and controls can be used in place of first heating element **18** as a heat source in inlet pipe **14**.
(41) A small amount of cool water enters hot water when hot water is flowing out of the tank. When water reaches a pre-set temperature say 50° F., first heating element **18** shuts down and other flow paths with second heating element **32** and/or third heating element **50** increase and maintain constant temperature to maximum. Once hot water begins to flow from the tank, first heating element **18** turns ON to quickly maintain heat at maximum temperature.
(42) FIG. **1** shows three different openings, a first opening **60**, a second opening **62**, and a third opening **64** in inlet pipe **14** to allow flow from inlet pipe **14** to the water between the water tank inside the wall and the outside of the inlet pipe **14**. First opening **60** has two 3/16″ holes to allow some inlet water out of inlet pipe **14**. Second opening **62** is a larger opening close to the bottom of the water tank and is positioned about even with the halfway mark of second heating element **32**. This allows easy flow out to the total volume of the water tank. The last flow path via third opening **64** is the end of inlet pipe **14** and allows water to flow toward or away from first heating element **18** to enhance heat exchange. In the present invention, the flow paths FP**2**, and FP**3** allow water or heated water to migrate to the top of the tank to maximum temperature.
(43) In one embodiment, first heating element **18** is set with a temperature of 50° F. plus 75-85° F. for a total of 125° F. from an alternate source, say renewable energy (solar energy). Here, second heating element **32** is adjusted to a total of 90° F. which would be the maximum tank pressure for second heating element **32** to achieve. A person skilled in the art understands that when water temperature reaches 125° F., third heating element **50** located in the outside flow path increases water temperature to the final temperature of 120-130° F., if needed. The maximum temperature is maintained for a longer period of time by water flowing from the bottom of third pipe **52** to the top of the hot water heater **10**.
(44) A person skilled in the art understands that it is possible to heat water by running converted solar/battery energy to AC and replacing AC from the utility company to AC from an alternate energy source. This would allow all controls of the heating elements to operate as if connected to the utility company. The connection to the utility company would not be operational nor involve only alternate energy resulting in energy savings and money spent. It would be possible to eliminate any utility company electricity to be used.
(45) FIG. **18** shows a method **200** of heating water, in accordance with one embodiment of the present invention. The order in which method **200** is described should not be construed as a limitation, and any number of the described method blocks can be combined in any order to implement method **200** or alternate methods. Additionally, individual blocks may be deleted from method **200** without departing from the spirit and scope of the invention described herein. Furthermore, method **200** can be implemented in any suitable hardware, software, firmware, or

combination thereof. However, for ease of explanation, in the embodiments described below, method **200** might be implemented using the above-described water heater **12**.
(46) Method **200** begins at step **202**. At step **202**, water is received via an inlet pipe **14**. The water is heated and the temperature of water is maintained at a first temperature say at 40° F. by drawing energy from a first power source, say via grid (supplied by a utility company). Alternatively, water is heated and the temperature of water is maintained at a first temperature say at 100° F. by drawing energy from a first power source, say via grid (supplied by the utility company). At step **204**, water heater **10** checks if second power source **32**, say solar energy is available to heat water from the first temperature i.e., from 40° F. to 125° F. using a second heating element **32**. Alternatively, water heater **10** checks if second power source **32**, say solar energy is available to heat water from the first temperature i.e., from 100° F. to 140° F. using a second heating element **32**. If second power source **32** is available, then method **200** moves to step **208**. At step **208**, water heater **12** employs second heating element **32** to heat the water from 40° F. to 125° F. using solar energy.
(47) If the solar energy is not available or the energy from the solar energy is insufficient, then water heater **12** continues to employ first heating element **18** to draw power from first power source **19** and maintain the temperature at the first temperature, as shown at step **204**. Further, water heater **12** checks additional power source i.e., a third power source is available to heat the water from 40° F. to 125° F., as shown at step **210** in the absence of the second power source. If the third power source is not available, then water heater **12** continues to employ first heating element **18** to draw power from first power source **19** and maintain the temperature at the first temperature, as shown at step **204**. If the third power source is available, say in the form of batteries or a wind turbine, the water heater **10** employs second heating element **32** to heat the water from 40° F. to 125° F. using the batteries or wind turbine, as shown at step **212**.
(48) The presently disclosed water heater provides several advantages over the prior art. The heating elements can be removed for repair or replacement by disconnecting power and water pass through fittings and this will allow the heating elements to be pulled out using the armored electric wire. This ensures the inlet or outlet or both to be fully open for inspection by small camera or gauge ring. The second heating element allows water inside the outlet pipe to be at operating temperature quickly due to water volume inside hot water heater since the outlet valve is small and easy to bring to operating temperature by second heating element from 40° F. and 125° F. The third heating element installed near the bottom of the outside outlet/inlet pipe allows the hot water to flow/migrate upward to aid in maintaining temperature at top of the hot water tank outlets.
(49) A person skilled in the art appreciates that the water heater can come in a variety of shapes and sizes depending on the need and comfort of the user. Further, many changes in the design and placement of components may take place without deviating from the scope of the presently disclosed water heater.
(50) In the above description, numerous specific details are set forth such as examples of some embodiments, specific components, devices, methods, in order to provide a thorough understanding of embodiments of the present invention. It will be apparent to a person of ordinary skill in the art that these specific details need not be employed, and should not be construed to limit the scope of the invention.
(51) In the development of any actual implementation, numerous implementation-specific decisions must be made to achieve the developer's specific goals, such as compliance with system-related and business-related constraints. Such a development effort might be complex and time-consuming, but may nevertheless be a routine undertaking of design, fabrication, and manufacture for those of ordinary skill. Hence as various changes could be made in the above constructions without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.
(52) The foregoing description of embodiments is provided to enable any person skilled in the art

to make and use the invention. Various modifications to these embodiments will be readily apparent to those skilled in the art, and the novel principles and invention disclosed herein may be applied to other embodiments without the use of the innovative faculty. It is contemplated that additional embodiments are within the spirit and true scope of the disclosed invention.

Claims

1. A water heater, comprising: a housing, comprising: an inlet pipe positioned within said housing for receiving water; a first heating element positioned in said inlet pipe, wherein said first heating element heats the water to a first temperature, and wherein said first heating element is powered by a first power source; an outlet pipe positioned within said housing and operatively connecting said inlet pipe, wherein said outlet pipe discharges the water; and a second heating element positioned within said outlet pipe, wherein said second heating element further heats the water from said first temperature to a second temperature, wherein said second heating element is powered by a second power source, and wherein said second power source is different from said first power source; an outlet line positioned outside of said housing; a third heating element positioned within said outlet line, wherein said third heating element positions between a pressure relief valve and a drain valve, and wherein said third heating element installs at the bottom of the outside of said inlet pipe and said outlet pipe; and a controller operatively connecting said first heating element said second heating element, and said third heating element, wherein said controller determines the energy needed from said second power source to maintain heat of the water at said second temperature, and wherein said third heating element allows the hot water to flow upward to maintain the temperature of the water at said second temperature.
2. The water heater of claim 1, wherein said first heating element heats the water to said first temperature of 40 to 100 degrees Fahrenheit.
3. The water heater of claim 1, wherein said second heating element heats the water to said second temperature of 125 to 140 degrees Fahrenheit.
4. The water heater of claim 1, wherein said first power source comprises an alternating current (AC) power source or direct current (DC) power source.
5. The water heater of claim 1, wherein said second power source comprises a renewable energy source.
6. The water heater of claim 1, wherein the third pipe is insulated to reduce heat loss.
7. The water heater of claim 1, wherein said first heating element has a first flow path created by first slots at said inlet pipe for heating the water around said first heating element.
8. The water heater of claim 1, wherein said second heating element has a second flow path created by second slots at said outlet pipe for heating the water around said second heating element.
9. The water heater of claim 1, wherein said first heating element is powered by said first power source via a first power wire.
10. The water heater of claim 1, wherein said second heating element is powered by said second power source via a second power wire.
11. The water heater of claim 1, further comprises a heat exchanger having a return line connected to said housing via a duct for recovery of the heat from the discharged water.
12. The water heater of claim 1, further comprises a third power source, wherein said third power source powers said second heating element when the second power source is unavailable.
13. The water heater of claim 12, wherein said third power source comprises batteries.
14. A water heater, comprising: a housing, comprising: an inlet pipe positioned within said housing for receiving water; a first heating element positioned in said inlet pipe, wherein said first heating element heats the water to a first temperature, and wherein said first heating element is powered by a first power source; an outlet pipe positioned within said housing and operatively connecting said inlet pipe, wherein said outlet pipe discharges the water; and a second heating element positioned

within said outlet pipe, wherein said second heating element further heats the water from said first temperature to a second temperature, wherein said second heating element is powered by a second power source or a third power source, wherein each of said second power source and said third power source is different from said first power source, and wherein said third power source powers said second heating element when the second power source is unavailable; an outlet line positioned outside of said housing; a third heating element positioned within said outlet line, wherein said third heating element positions between a pressure relief valve and a drain valve, and wherein said third heating element installs at the bottom of the outside of said inlet pipe and said outlet pipe; and a controller operatively connecting said first heating element said second heating element, and said third heating element, wherein said controller determines the energy needed from said second power source or said third power source to maintain heat of the water at said second temperature, and wherein said third heating element allows the hot water to flow upward to maintain the temperature of the water at said second temperature.
15. The water heater of claim 14, wherein said first heating element heats the water to said first temperature of 40 to 100 degrees Fahrenheit, and wherein said second heating element heats the water to said second temperature of 125 to 140 degrees Fahrenheit.
16. The water heater of claim 14, wherein said first power source comprises an alternating current (AC) power source or direct current (DC) power source, wherein said second power source comprises a renewable energy source, and wherein said third power source comprises batteries.
17. A method of heating water in a water heater, said method comprising the steps of: providing a housing having an inlet pipe, said inlet pipe configured for receiving water; providing a first heating element positioned in said inlet pipe, said first heating element heating the water to a first temperature, said first heating element being powered by a first power source; providing an outlet pipe positioned within said housing and operatively connecting said inlet pipe, said outlet pipe configured for discharging the water; providing a second heating element positioned within said outlet pipe, said second heating element configured for further heating the water from said first temperature to a second temperature, said second heating element being powered by a second power source, said second power source being different from said first power source; providing an outlet line positioned outside of said housing; providing a third heating element positioned within said outlet line, said third heating element positioned between a pressure relief valve and a drain valve, said third heating element installed at the bottom of the outside of said inlet pipe and said outlet pipe; and operating said first heating element said second heating element and said third heating element such that the energy needed from said second power source is maintained to heat the water at said second temperature, said third heating element allowing the hot water to flow upward to maintain the temperature of the water at said second temperature.
18. The method of claim 17, further comprising heating the water between 40 to 100 degrees Fahrenheit using said first heating element, and heating the water between 125 to 140 degrees Fahrenheit using said second heating element.