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(54) **BI-HEATING WATER TANK**

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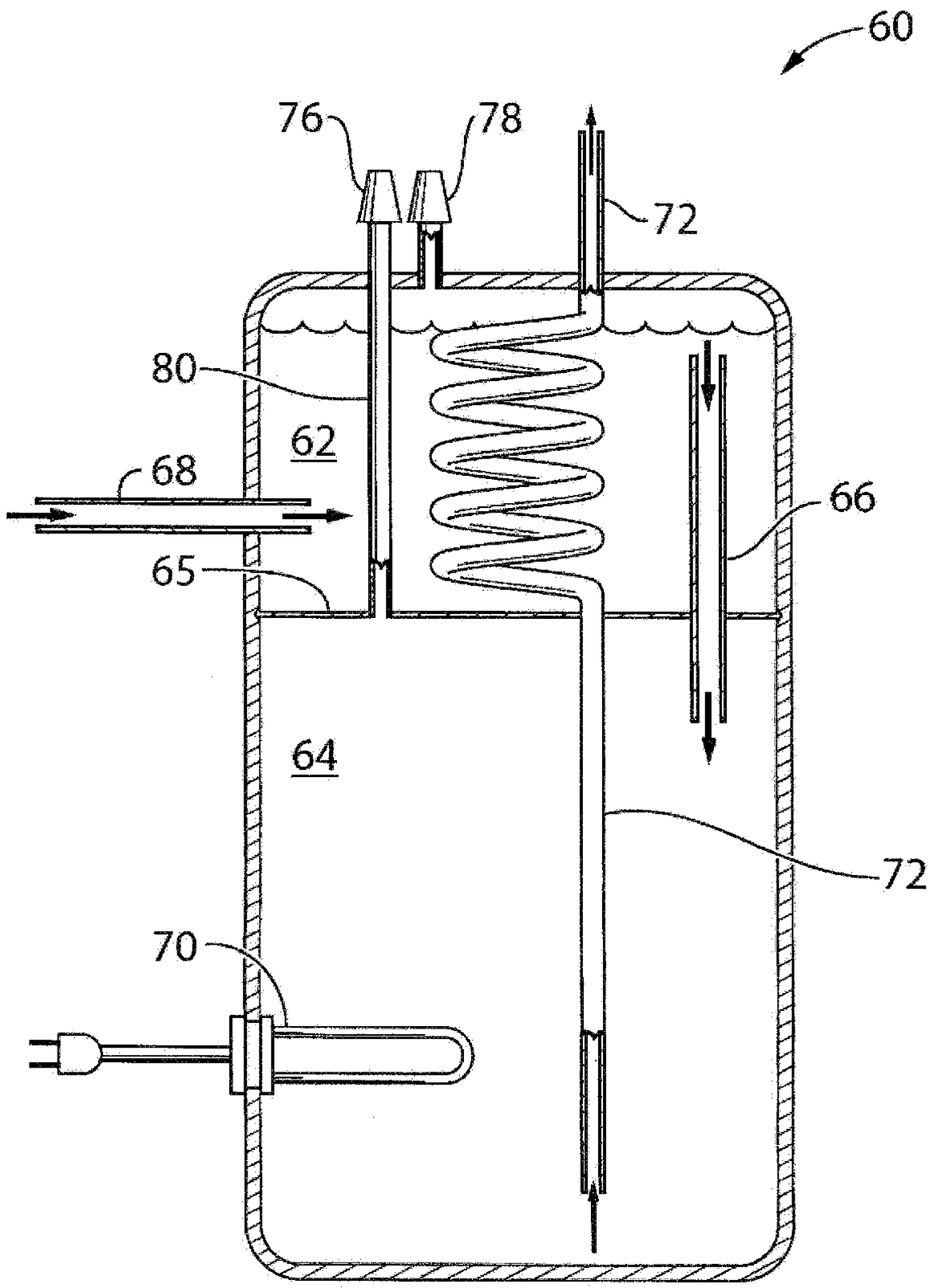
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(57) **ABSTRACT**

A bi-heating hot water tank comprising a first compartment including a water inlet for receiving cold water, and a second compartment including a heating element for heating water. The two compartments are in fluid communication with each other whereby the second compartment receives the water from the first compartment. The hot water is discharged from the second compartment using a conduit that passes within the first compartment prior to exiting the water tank to preheat the water in the first compartment prior to entering the second compartment. This arrangement allows for reducing the operation time of the heating element, and for providing hot water at higher temperatures and for longer periods of time.



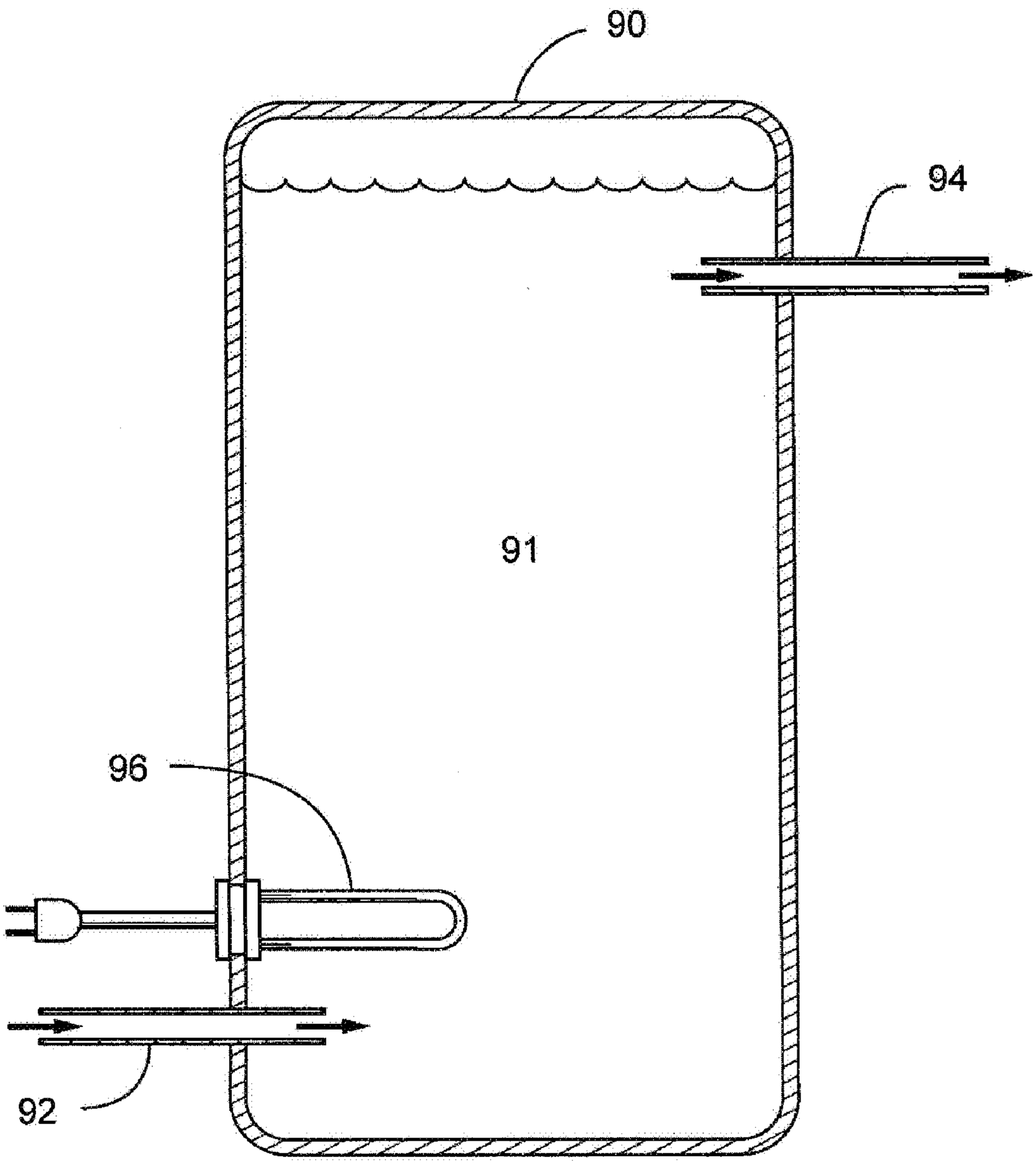


FIGURE 1

PRIOR ART

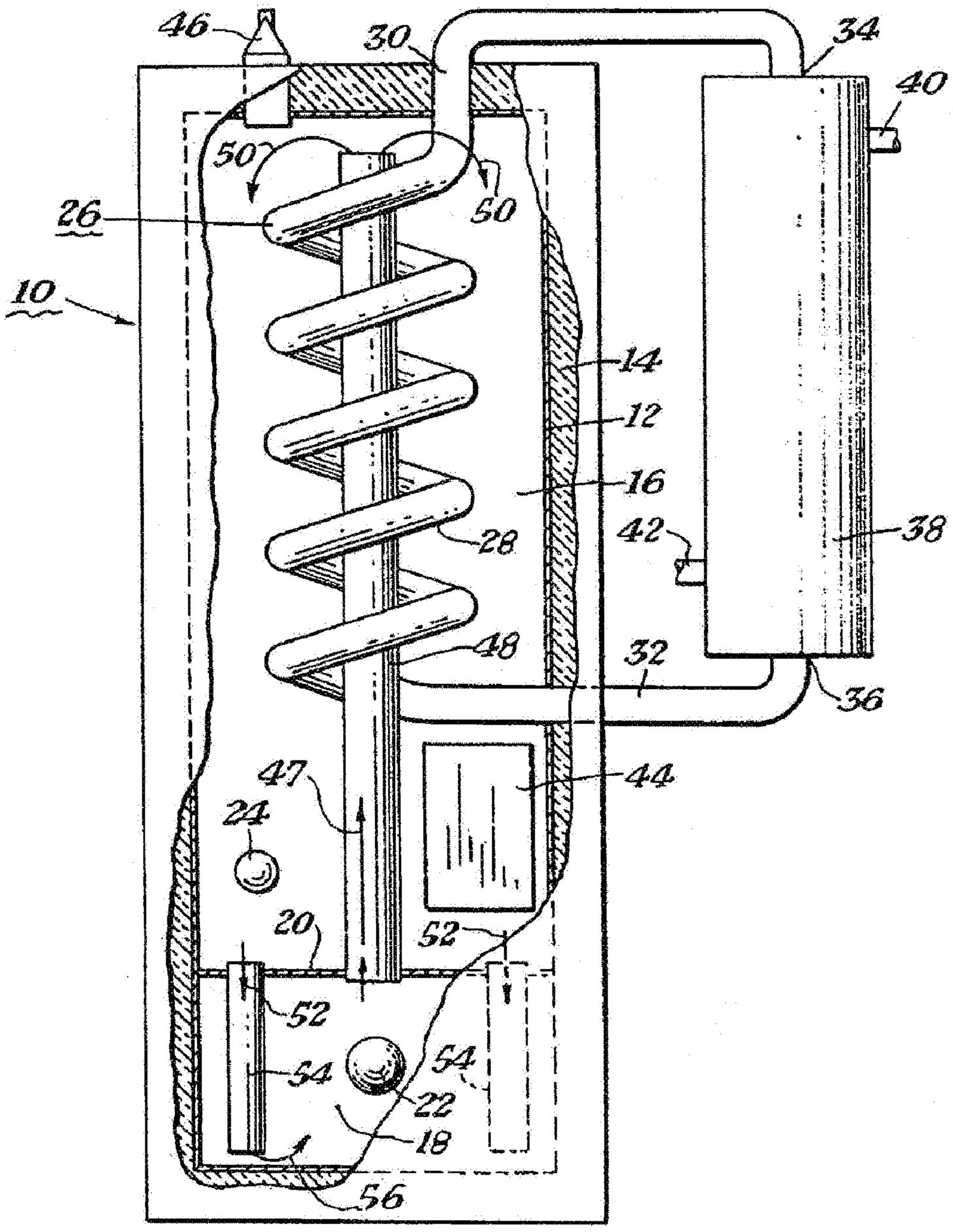


FIGURE 2

PRIOR ART

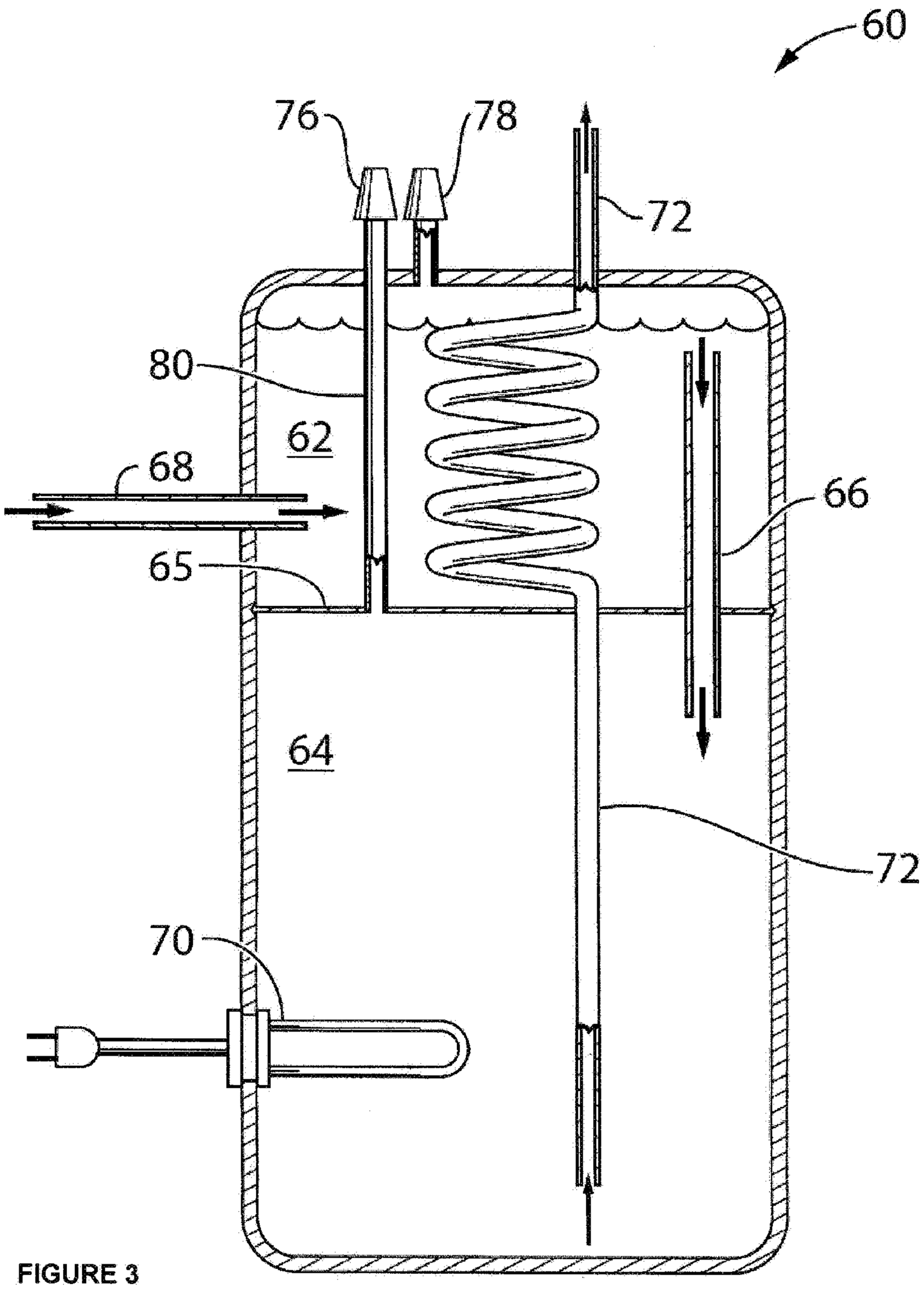


FIGURE 3

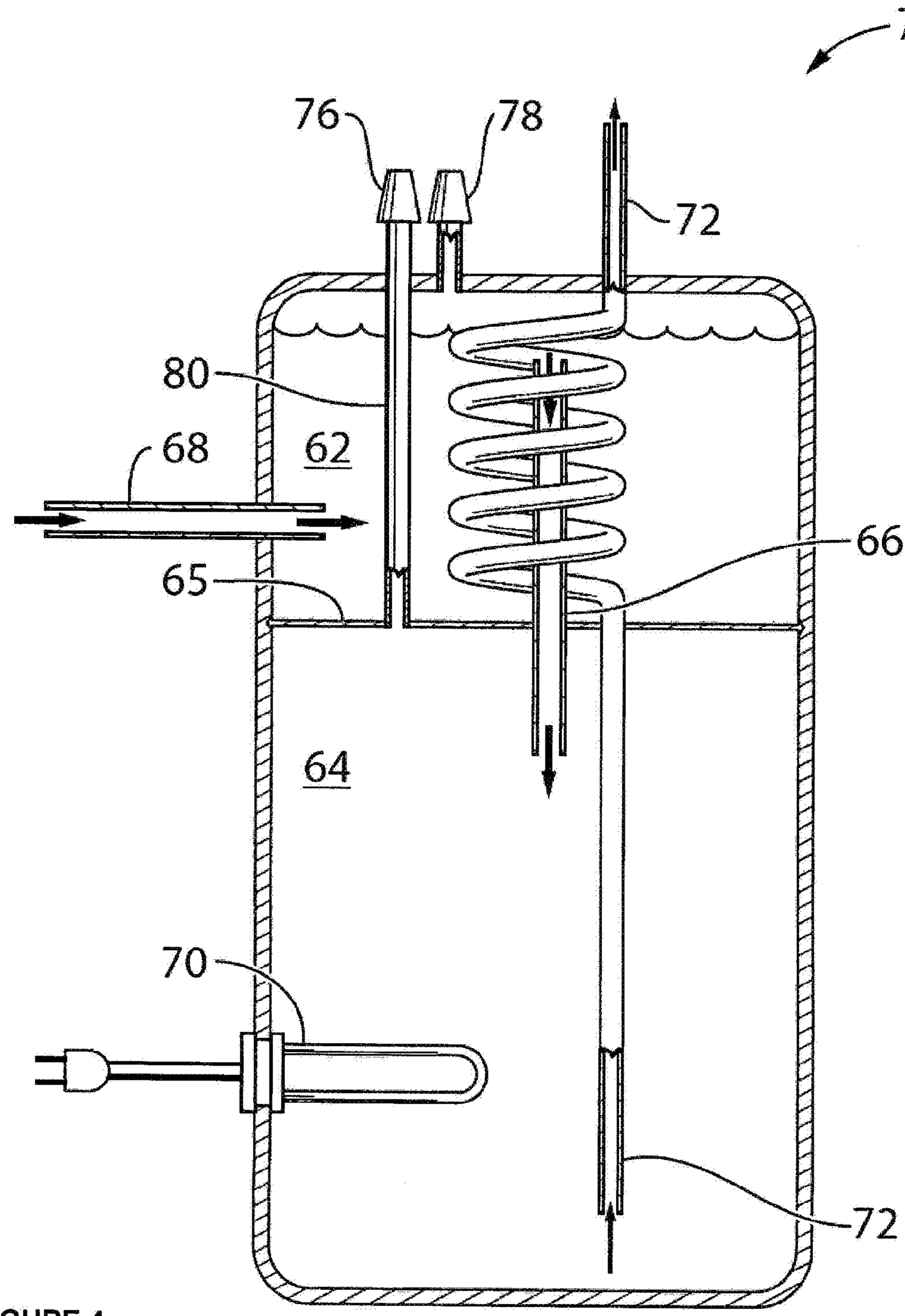


FIGURE 4

BI-HEATING WATER TANK

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims priority from U.S. provisional application No. 61/414554 filed on Nov. 17, 2010, which is incorporated herein by reference in its entirety.

BACKGROUND

[0002] (a) Field

[0003] The subject matter disclosed generally relates to a hot water tank.

[0004] (b) Related Prior Art

[0005] Conventional hot water tanks define a compartment in which water is heated. A typical hot water tank includes a water inlet for receiving the cold water, a water outlet from which the hot water exits the tank, and a heating element for heating the water to a pre-determined temperature.

[0006] FIG. **1** illustrates a conventional hot water tank **90**. The tank **90** defines a water compartment **91**, a water inlet **92**, a water outlet **94** and a heating element **96**. The heating element is controlled by a thermostat (which is not shown). Although simple, this design has several drawbacks.

[0007] In a conventional hot water tank, such as that shown in FIG. **1**, the hot water discharged through the outlet **94** is replaced by cold water through the inlet **92**. The difference in temperature between the hot water exiting the tank **90** and the cold water entering the tank **90** is significant (may reach up to 60°), and thus, the temperature of the water within the compartment **91** decreases faster. With this type of conventional heaters, the user is obliged to either wait for sometime before being able to use the hot water again, or to use the water at mild temperatures. Therefore, the energy becomes diluted and the user does not obtain a return of water that is equal to the amount of energy spent in heating the water.

[0008] Another problem associated with the conventional tanks is that, due to the water becoming cold faster, the heating element **96** operates for long and continuous periods of time, which reduces the life of the heating element, and results in an in-efficient use of energy.

[0009] Several attempts have been made to address this issue. For instance, U.S. Pat. No. 3,468,292 (Ferraro et al.) describes a heat exchange system **10** including a hot water tank through which a pipe **26** circulates to heat the water passing through the pipe **26**. An example of this system is illustrated in FIG. **2**. As shown in FIG. **2**, the hot water tank **10** of Ferraro includes two compartments **16** and **18** including heating elements **24** and **22**, respectively. The water contained in the hot water tank **10** does not leave the hot water tank **10** in a pipe to be used, but rather circulates up and down between the two compartments **16** and **18** following arrows **52** and **47** for exchanging heat between the two compartments and with the circulating pipe **26**. Cold water is injected in the pipe **26**, and becomes heated upon circulating within the upper compartment **16**.

[0010] In the system of Ferraro, only a fraction of the energy spent in heating is being used through heat exchange with the pipe **26**. Furthermore, there is always a tradeoff between the temperature of the hot water output from the pipe **26** and the size of the water tank **10**. In particular, the pipe **26** has to circulate for a long distance within the upper compartment **16** in order to increases the surface of contact between the pipe **26** and the hot water to heat the water passing within the pipe. When the volume of the pipe within the upper compartment **16** increases, the overall volume of the upper compartment has to increase to keep the ratio of volumes between the hot water and pipe high. Otherwise, the water temperature in the upper compartment **16** would significantly drop and cease from heating the water passing through the pipe **16**.

[0011] Therefore, there is a need for a water tank heater which provides hot water for longer periods of time in an efficient manner and without operating the heating element for long periods of time.

SUMMARY

[0012] According to an embodiment, there is provided a water heater comprising: a first compartment comprising a water inlet for receiving water from a water source; a second compartment; a first conduit for connecting between the first compartment and the second compartment for filling the second compartment with water received from the first compartment; a heating element provided in the second compartment for heating the water in the second compartment; a second conduit for discharging hot water from the water heater, said second conduit having a hot water inlet provided in the second compartment; said second conduit extends through the first compartment prior to exiting the water heater; wherein the heated water exiting the water heater in the second conduit preheats the water in the first compartment prior to entering the second compartment.

[0013] In an embodiment a portion of the second conduit that circulates within the first compartment defines a helix.

[0014] In another embodiment, a portion of the second conduit that circulates within the first compartment defines a helix. It is also possible to provide the first conduit within an inner circumference of the second conduit. For example, the first conduit may be coaxial with the helix defined by the second conduit.

[0015] In an embodiment, the first compartment has a first volume which is smaller than a second volume of the second compartment. The first volume may form about 35% to about 40% of a sum of the first volume and the second volume.

[0016] In an embodiment, the first conduit and the second conduit extend through a surface that is common between the first compartment and the second compartment. The surface may be made of a heat conductive material.

[0017] In a further embodiment, an outlet of the first conduit is provided at an upper region of the second compartment; the heating element is provided at a lower region of the second compartment; and an inlet of the second conduit is provided adjacent the heating element.

[0018] According to another aspect, there is provided a water heater comprising: a first compartment comprising a water inlet for receiving water from a water source; a second compartment comprising a heating element for heating water received from the first compartment; the second compartment being greater in size than the second compartment; and a hot water conduit for discharging hot water from the second compartment; wherein the hot water conduit circulates within the first compartment prior to exiting the water heater for pre-heating the water in the first compartment prior to entering into the second compartment.

[0019] Features and advantages of the subject matter hereof 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 subject matter disclosed and claimed is capable of modifications in various respects, all without departing from the scope of the claims. Accordingly, the drawings and the description are to be

regarded as illustrative in nature, and not as restrictive and the full scope of the subject matter is set forth in the claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0020] Further features and advantages of the present disclosure will become apparent from the following detailed description, taken in combination with the appended drawings, in which:

[0021] FIG. **1** illustrates a conventional water heater;

[0022] FIG. **2** illustrates an example of another conventional water heater;

[0023] FIG. **3** illustrates a bi-heating water tank in accordance with an embodiment;

[0024] FIG. **4** illustrates another example of a bi-heating water tank, in accordance with another embodiment.

[0025] It will be noted that throughout the appended drawings, like features are identified by like reference numerals.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0026] The present application describes a bi-heating hot water tank comprising a first compartment including a water inlet for receiving cold water, and a second compartment including a heating element for heating water. The two compartments are in fluid communication with each other whereby the second compartment receives the water from the first compartment. The hot water is discharged from the second compartment using a conduit that passes within the first compartment prior to exiting the water tank to preheat the water in the first compartment prior to entering the second compartment. This arrangement allows for reducing the operation time of the heating element, and for providing hot water at higher temperatures and for longer periods of time.

[0027] FIG. **3** illustrates an example of a bi-heating water tank in accordance with an embodiment. As shown in FIG. **3**, the bi-heating water tank **60** in accordance with the present embodiment comprises a first compartment **62**, and a second compartment **64**. In the present example, the compartments **64** and **66** are separated by a surface **65**. The two compartments are in fluid communication using a conduit **66**. The first compartment **62** includes an inlet **68** for receiving cold water from an external source. The hot water tank **60** may include an insulating jacket provided around the two compartments for reducing heat losses with the outside environment.

[0028] The second compartment comprises a heating element **70** for heating the water, and a thermostat (not shown) for controlling the operation of the heating element **70**. The hot water is discharged from the second compartment **64** using a conduit **72**. The conduit **72** receives the hot water from an opening provided in the second compartment **64** and circulates the hot water within the first compartment in a helix (or any other suitable shape) to preheat the water in the first compartment **62** when hot water is being discharged from the hot water tank **60**.

[0029] In operation, when hot water is being discharged from the second compartment **64** via the conduit **72**, the hot water preheats the water in the first compartment **62** due to the circulation of the conduit **72** within the first compartment **62**. Whereby, the water transferred from the first compartment **62** becomes preheated prior to entering the second compartment **64**, and thus, the water may be supplied to the user at higher temperatures for longer periods of time.

[0030] In an embodiment, the surface **65** may be made of a heat conductive material that allows heat to be exchanged between the two compartments **62** and **64**, whereby the water in the two compartments may reach the same/similar temperature over time when the system stabilizes. When hot water is discharged through the conduit **72**, pre-heated water enters into the second compartment **64** which is replaced by cold water received from the inlet **68**. In this case, the heat exchanged from the hot water in the conduit **72** compensates for the cold water entering via the inlet **68** to keep providing the second compartment with pre-heated water, whereby the water may be provided to the user at higher temperatures for longer periods of time.

[0031] While it is possible to have the two compartments **62** and **64** equal in size, it is preferable to have the first compartment **62** smaller than the second compartment **64**. The concept being that with the extended use of hot water, the temperature of the water in the first compartment **62** starts to decline. Therefore, to a certain extent, the amount of water in the first compartment should be smaller than that in the second compartment for an efficient preheating of the first compartment water. Experiments have shown that optimal results may be obtained when the size of first compartment forms 35% to 40% of the overall size of the two compartments.

[0032] FIG. **4** illustrates an example of a hot water tank **74** in accordance with another embodiment. In the embodiment of FIG. **4**, the conduit **66** is provided within the inner circumference of the helix defined by the conduit **72** and preferably coaxial with that helix. Whereby, first compartment water that has been preheated by the conduit **72** is sent to the second compartment **64** for reheating prior to being diluted by the cold water received from the inlet **68**. This allows for a constant stream of mild-hot water to be sent to the second compartment **64** for reheating to the desired temperatures using the heating element **70**.

[0033] In an embodiment, it is possible to use a second heating element (not shown) and a second thermostat in the first compartment. The power of the second heating element could be less than that of the second compartment. The use and power of such second heating element depends on several factors including the temperature of the water received at the inlet **68**, the amount of hot water leaving the tank, the duration of use of the hot water, and the size of the second compartment.

[0034] The water tanks **60** and **74** may also comprise pressure valves **78** and **76** for releasing pressure and air from the first and second compartments, respectively. As shown in FIGS. **3** and **4**, pressure valve **76** is connected to the second compartment **64** using a pressure conduit **80**.

[0035] In an embodiment, the inlet of the second conduit **72** is provided adjacent the heating element **70**. The heating element may be provided distant from the outlet of the first conduit **66**. In an embodiment, the outlet of the conduit **66** is provided in the upper region of the second compartment, and the heating element is provided in the lower region of the second compartment as illustrated in FIGS. **3** and **4**.

[0036] While preferred embodiments have been described above and illustrated in the accompanying drawings, it will be evident to those skilled in the art that modifications may be made without departing from this disclosure.

1. A water heater comprising:

a first compartment comprising a water inlet for receiving water from a water source;

a second compartment;

a first conduit for connecting between the first compartment and the second compartment for filling the second compartment with water received from the first compartment;

a heating element provided in the second compartment for heating the water in the second compartment;

a second conduit for discharging hot water from the water heater, said second conduit having a hot water inlet provided in the second compartment; said second conduit extends through the first compartment prior to exiting the water heater;

wherein the heated water exiting the water heater in the second conduit preheats the water in the first compartment prior to entering the second compartment.

2. The water heater of claim **1**, wherein a portion of the second conduit that circulates within the first compartment defines a helix.

3. The water heater of claim **2**, wherein the first conduit is provided within an inner circumference of the second conduit.

4. The water heater of claim **2**, wherein the first conduit is coaxial with the helix defined by the second conduit.

5. The water heater of claim **1**, wherein the first compartment has a first volume which is smaller than a second volume of the second compartment.

6. The water heater of claim **5**, wherein the first volume forms about 35% to about 40% of a sum of the first volume and the second volume.

7. The water heater of claim **1**, wherein the first compartment and the second compartment are substantially equal in size.

8. The water heater of claim **1**, wherein the first conduit and the second conduit extend through a surface that is common between the first compartment and the second compartment.

9. The water heater of claim **8**, wherein the surface is made of a heat conductive material.

10. The water heater of claim **1**, wherein:

an outlet of the first conduit is provided at an upper region of the second compartment;

the heating element is provided at a lower region of the second compartment; and

an inlet of the second conduit is provided adjacent the heating element.

11. The water heater of claim **1**, further comprising a second heater in the first compartment.

12. A water heater comprising:

a first compartment comprising a water inlet for receiving water from a water source;

a second compartment comprising a heating element for heating water received from the first compartment; the second compartment being greater in size than the second compartment; and

a hot water conduit for discharging hot water from the second compartment;

wherein the hot water conduit circulates within the first compartment prior to exiting the water heater for pre-heating the water in the first compartment prior to entering into the second compartment.

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