Aug. 23, 1966 B. E. McCLANAHAN 3,267,909

WATER HEATING APPARATUS

Filed April 20, 1964 3 Sheets-Sheet 1

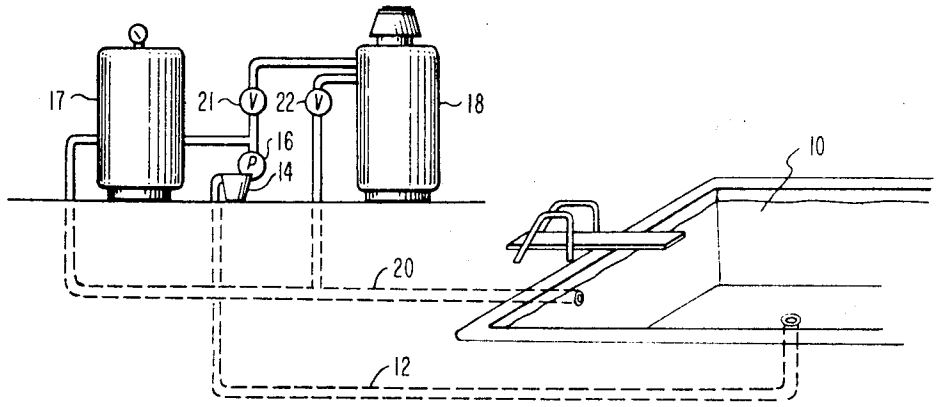


FIG.—1

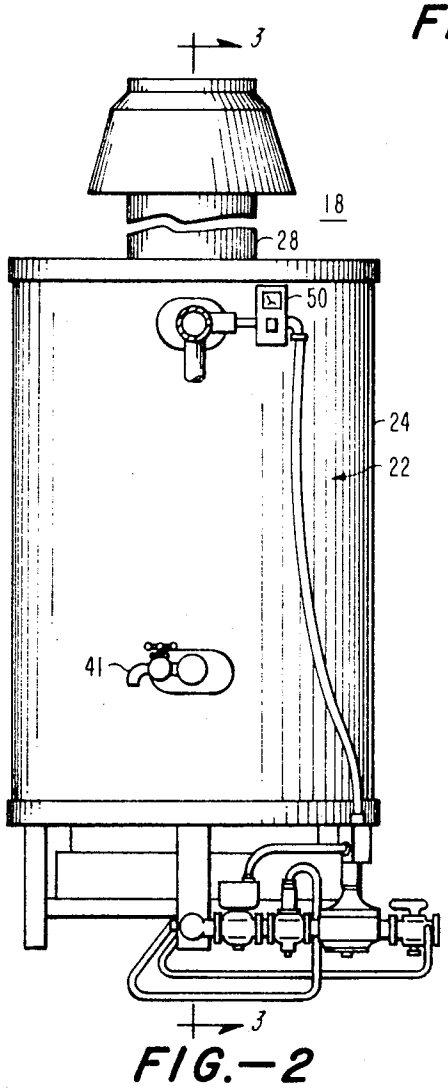


FIG.—2

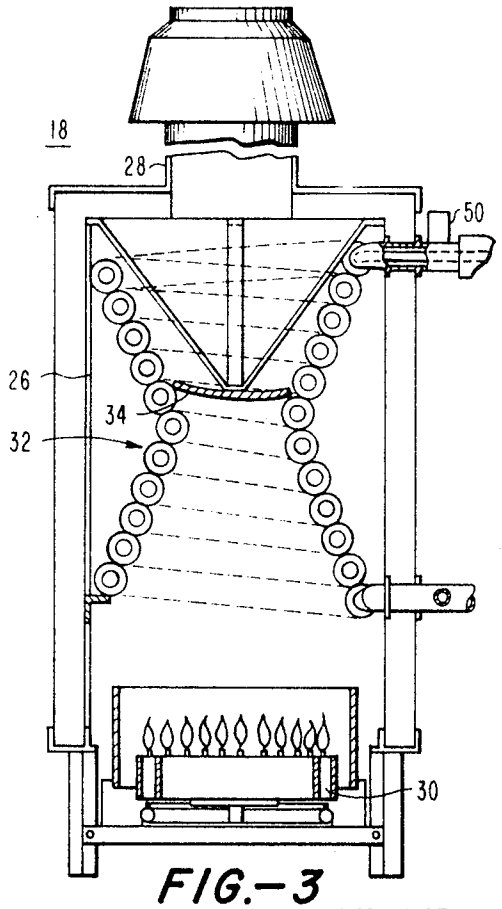


FIG.—3

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WATER HEATING APPARATUS

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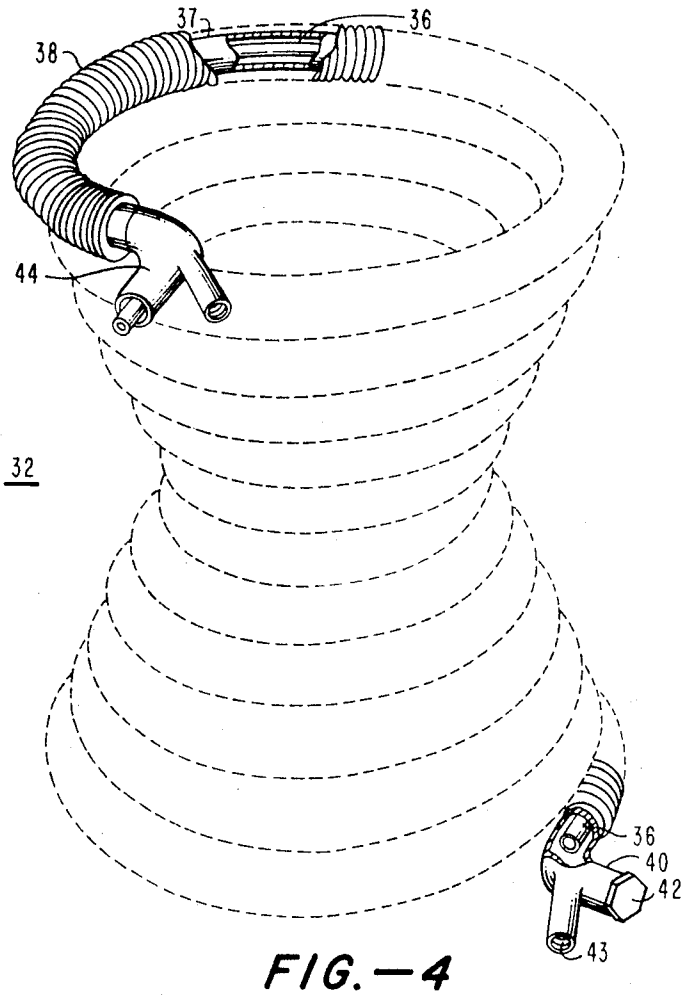


FIG.—4

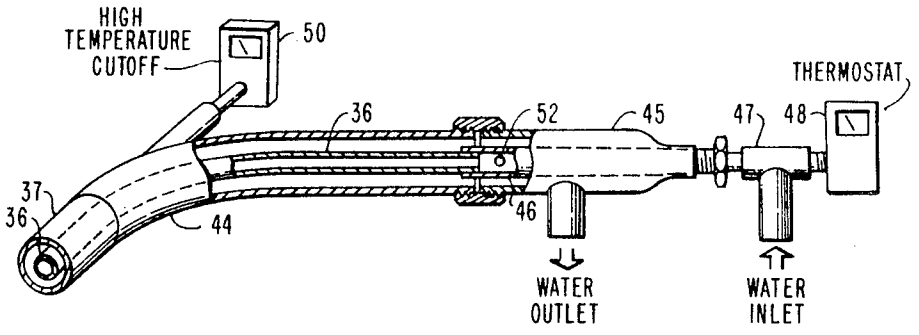


FIG.—5

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WATER HEATING APPARATUS

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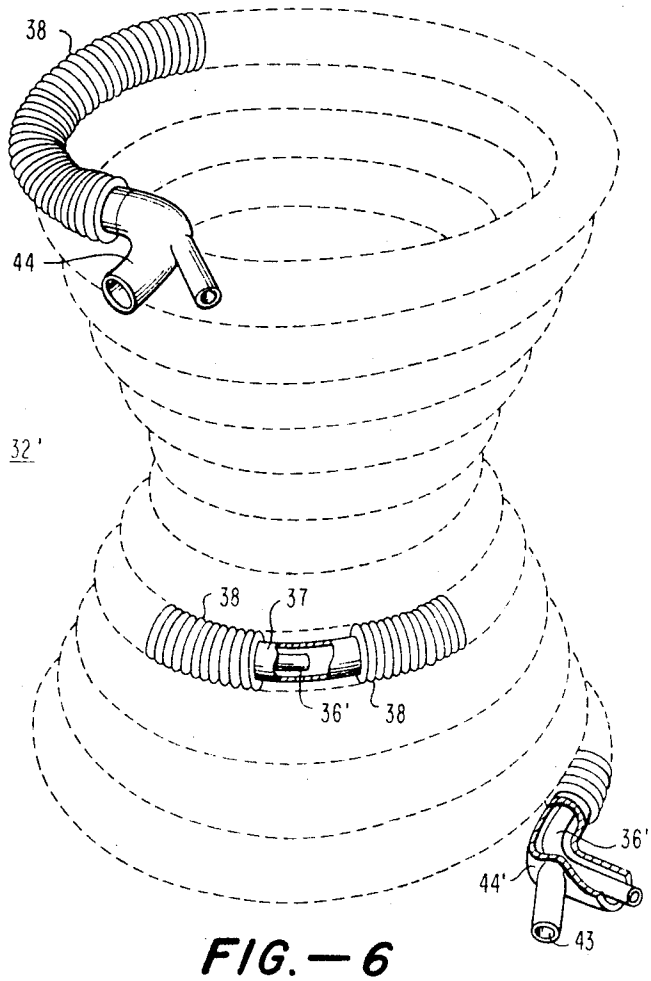


FIG.—6

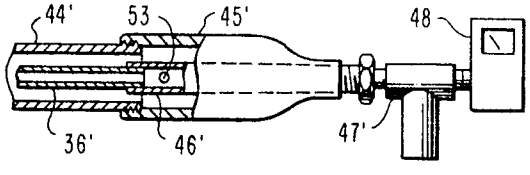


FIG.—7

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WATER HEATING APPARATUS

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12 Claims. (Cl. 122—250)

This invention relates to liquid heating systems and more particularly to water heating apparatus for the heating of swimming pools and the like.

Most swimming pools have incorporated therewith, in the installed equipment associated with the pool for the proper maintenance thereof, one or more pool heaters. Such heaters are needed in all but the warmset of climates in order to heat the pool in cool weather, notably in the spring and fall, so that the useful period of swimming pool enjoyment may be extended beyond the more or less limited summer season. A typical arrangement involves a water heater which may utilize a gas burner in conjunction with tubing or a similar arrangement for transferring heat from the burning fuel to the water flowing through the heater. The heater is usually mounted in a pump house in conjunction with the usual pumping and filtering apparatus associated with the swimming pool installation. The heater is coupled to the pumping and water recirculating system by means of suitable valving arrangements and is generally thermostatically controlled for automatic operation. With the valve coupling the heater to the water recirculating portion of the system set to pass a portion of the water being recirculated by the pump through the heater, the recirculated water is warmed thereby and returned to the pool.

It will be clear that the heating of a pool of even moderate size requires a considerable amount of heat, and it is therefore very important that a water heater structure of efficient design be provided. For example, a typical swimming pool of dimensions 15 feet by 36 feet with a depth of 8 feet at one end sloping to 3 feet at the other end may contain approximately 25,000 gallons. Without considering the loss of any heat from the pool, it requires the absorption of 200,000 British thermal units (B.t.u.'s) of heat to raise the temperature of such a quantity of water 1° Fahrenheit. With the additional consideration of the heat losses by conduction to the ambient surroundings and by evaporation, it will be seen that a very substantial amount of heat must be injected into a normal swimming pool in order to raise the temperature by any suitable extent, as when the pool is first used at the beginning of the summer or merely to replace the heat which is lost overnight. Even in summertime, the temperature of the normal uncovered swimming pool may drop by 2° F. overnight due to heat transfer and evaporation. It is not unusual that the water heater employed for heating a typical backyard swimming pool may require a greater capacity than the residential heating unit employed for the residence associated therewith. In order that the cost of operating a swimming pool heating unit will not be prohibitive, it is essential that the pool heating apparatus be as efficient as possible.

Heretofore there has been one particular problem which has plagued the designers of apparatus for use in heating swimming pools. When such heating apparatus is coupled to the recirculating system for a swimming pool, it will be appreciated that the water entering the heating apparatus from the pool is at swimming pool temperature, conventionally 75° or less. In passing through the swimming pool heater, the water is typically heated to a temperature between 100° and 120° and returned to the portion of the recirculating system leading back to the pool, where it becomes mixed with the recirculating water and the pool

and itself becomes cooled as it gradually raises the temperature of the pool. The combustion process in the water heater apparatus develops a significant amount of water vapor which undesirably exhibits a tendency to condense on the cooler portion of the water tubing conducting the relatively cold water being received from the pool. Such condensation is quite undesirable, as it tends to foul the water heating apparatus from the collection of dirt and trapped deposits on the burner and also contributes to the corrosion of the water heating apparatus and any other equipment with which it comes in contact. In addition, the condensation dripping off and running out of the water heater gives rise to complaints that the heater has developed a leak when such is not the case. Various attempts have been made to solve the particular problem of condensation in water heating apparatus of the type described without notable success. For example, some structures provided for this purpose incorporate fire tube, as contrasted with water tube, construction, but it has been found that the efficiency of heat transfer with such an arrangement is less than the water tube type. Other attempts have been made to employ siphoning tubes or the like which will mix a portion of the heated water leaving the water heater with the cold water entering the heater, thus raising the temperature of the inlet water above the point at which condensation is likely to form. These attempts have not been particularly effective and they involve the installation of additional piping and other apparatus which undesirably increases the cost and complexity of the water heating apparatus provided. In cases where condensation is controlled by reducing the rate of water flow through the heater, the water is heated to an unnecessarily high temperature, thereby increasing the heat losses and reducing the efficiency of operation.

It is therefore a general object of the present invention to provide an improved water heating apparatus for swimming pools and the like.

It is a more specific object of the present invention to eliminate the condensation of water from the combustion gases in a swimming pool water heater.

It is a further object of the present invention to provide an improved type of water heater apparatus for swimming pools and the like which eliminates the problem of water condensation normally encountered therein.

A still further object of the present invention is to improve the efficiency of heat transfer in water heating apparatus designed for use with swimming pools or the like.

In brief, particular arrangements in accordance with the present invention comprise a water tube member of a particular shape mounted within an enclosure adjacent a fuel burner. The water tube member incorporates a plurality of fins over a substantial portion of its length, and it may be coiled in what may be described as an hourglass shape with the central portion of the hourglass configuration substantially blocked by a baffle member and the outer portions of the hourglass configuration at opposite ends thereof being positioned adjacent the walls of the enclosure. With such an arrangement, the combustion gases from the burner are forced to pass outwardly between adjacent coils of the finned tubing member in the lower section of the hourglass configuration, since the passage directly through the center of the configuration is blocked by the baffle member. In the upper section of the hourglass configuration, the combustion gases are forced to pass inwardly between adjacent coils of the finned tubing member because the uppermost coil is positioned adjacent the interior wall of the enclosure and thus blocks the passage of the combustion gases past this region on the outside of the hourglass configuration. The combustion gases in passing from the burner to the exhaust stack of the water heater are thus forced to pass

back and forth twice through the water tube structure while being maintained in intimate contact with the fins and tubing of the structure for maximum heat transfer.

The tubing member comprises over at least a portion of its length a double walled structure adapted for the flow of water within an interior section separated from the outer, finned wall by a space which is also filled with water. In one particular arrangement in accordance with the invention the double walled structure extends throughout substantially the entire length of the tubing member and may be fabricated by inserting a length of relatively small diameter tubing within the length of relatively larger diameter tubing to which the fins are affixed. The interior section of the tubing is closed for substantially its entire length except at the lower end thereof where it is permitted to communicate with the interior of the larger diameter tubing by means of a header or blind manifold which blocks the orifice of the larger diameter tubing while permitting reversal of water flow from the smaller diameter tubing to the larger diameter tubing at that point. At the upper end of the water tube configuration, a T-shaped coupling arrangement is provided which permits separate coupling to the inner and outer tube sections from associated water conduits. With this arrangement, water from the recirculating pump is introduced into the smaller tubing so as to flow downwardly through the smaller tubing as it is coiled within the outer tubing member in the hourglass configuration to the lower end thereof where it reverses direction and flows back upwardly through the outer tubing member between the outer wall of the smaller diameter tubing and the inner wall of the larger diameter tubing to the T-section member and then through piping which will return the heated water to the pool. In accordance with an aspect of the invention, siphoning of the water tube is prevented by providing a small hole in the coupling to the inner tube so that air which may get into the recirculating system is permitted to bypass the water tube. This protects the water tube from being emptied inadvertently and thereby damaged when the heater is lit.

In a second particular arrangement in accordance with the invention the double walled structure of the tubing member extends over only a minor portion of the length thereof and may be fabricated by inserting approximately ten feet of relatively smaller diameter, inner tubing within the lower end of an approximately thirty-foot length of larger diameter, outer finned tubing coiled in the hourglass configuration as described. In this arrangement, water to be heated is introduced for full flow at the lower end of the inner tube. A suitable coupling member is employed having an aperature providing a small passage between the inner tube and the outer tube at the water inlet portion. This small passage permits a limited flow of water in the region between the inner and outer tubes, thus ensuring that this water is heated to the proper elevated temperature without overheating when the burner is operating. This relatively slower moving water in turn conducts heat to the more rapidly flowing water in the inner tube and effectively preheats the main flow of water in the inner tube which is maintained out of contact with the walls of the outer tube until its temperature has been raised above the condensation point.

By means of such arrangements in accordance with the invention, the cold water as it enters the water heater is substantially surrounded by heated water near the inlet end of the water tube structure so that no contact with the combustion gases is possible and the problem of condensation of water therefrom is entirely obviated. A further advantage accruing from this particular arrangement in accordance with the invention is an increase in the efficiency of heat transfer to the water being heated by the water heating apparatus. It is well known that the efficiency of heat transfer between two media is a function of the absolute temperature difference between the two. Thus, the lower the temperature of the water in the water tube structure, the more efficient the transfer of heat from the combustion gases to the water being heated. There is no advantage in raising the water in the water tube structure to a high temperature (such as near the boiling point) since this will increase the heat losses encountered as the water is returned to the pool, and the hot water is immediately cooled anyway as it is mixed with the main body of water in the pool. Therefore, particular arrangements in accordance with the invention which provide for the preheating of the inlet water by means of double-walled passages which are in heat transfer relationship permit the more rapid flow of water through the heater and thus serve to prevent the water near the outlet portion of the structure from being raised to such an elevated temperature. As a result, more heat is extracted from the combustion gases, thus increasing the efficiency of apparatus in accordance with the invention while positively preventing the formation of moisture by condensation on the water tube by ensuring that the temperature of the tube at all exposed portions is maintained above the condensing temperature.

A better understanding of the invention may be had from a consideration of the following detailed description, taken in conjunction with the accompanying drawings, in which:

FIG. 1 depicts generally a typical swimming pool installation with a recirculating filtration and heating system in which the invention may be employed;

FIG. 2 is an elevation view of a particular water heater arrangement in accordance with the invention;

FIG. 3 is a sectional view of the particular arrangement in accordance with the invention shown in FIG. 2, taken along the line 3—3 thereof;

FIG. 4 is a perspective representation, partially broken away, of a portion of the arrangement in accordance with the invention depicted in FIGS. 2 and 3 and showing particular details thereof;

FIG. 5 is a representation of a particular portion of the arrangement shown in FIGS. 2 and 3;

FIG. 6 is a representation, partially broken away, of a second particular arrangement in accordance with the invention which may be employed in the water heater of FIG. 2; and

FIG. 7 is a view, partially broken away, of a particular portion of the arrangement of FIG. 2 for use in conjunction with the structure of FIG. 6.

FIG. 1 represents schematically a general installation of a swimming pool and the associated water filtration and heating equipment normally installed therewith. As shown in FIG. 1, a swimming pool **10** is coupled by a drain line **12** to a trap **14**, a pump **16**, a filter **17**, a heater **18**, and a return line **20**. A pair of valves **21** and **22** are shown in the lines to and from the heater **18** in order to regulate or cut off the flow of water to and from the heater **18** as desired. Other valves, drain lines, electrical connections and the like which may be associated with typical installations have been omitted for the sake of simplicity. In the arrangement shown in FIG. 1 the heater **18** is connected directly to the pump **16** and in parallel with the filter **17**. The purpose of this arrangement is to develop the maximum available pressure across the heater **18** so that a more rapid flow of water through the heater **18** may be achieved, thereby enhancing the efficiency of heat transfer within the heater **18**. However, an alternative arrangement may be employed, as is customary, wherein the heater **18** is connected downstream from the filter **17** and a bypass line with a valve in it is provided so that water may be made to flow through the heater after passing through the filter or it may be permitted to bypass the heater as desired.

One particular embodiment in accordance with the invention which may be utilized as the heater **18** in the arrangement shown in FIG. 1 is depicted in FIGS. 2 and 3, FIG. 3 being a sectional view of FIG. 2 taken along line 3—3. As shown in FIGS. 2 and 3, the water heater

18 may comprise a housing 22 in the form of a substantially upright cylinder having an outer jacket 24 and an inner jacket 26, with a flue 28 connected to the upper side of the housing 22. The inner jacket 26 defines a combustion chamber containing a burner 30 in a central location at the bottom of the housing 22 and a water tube member 32 coiled in a substantially hourglass configuration. The water tube member 32 is arranged with its uppermost and lowermost coils substantially against the inner jacket 26 to prevent combustion gases from passing outside the water tube member at these points. A baffle member 34 in the form of a dished plate is positioned near the narrow diameter of the hourglass configuration of the water tube member 32 and serves to block combustion gases from passing directly through the center of the hourglass configuration. Thus, by means of this arrangement, combustion gases from the burner 30 are directed upwardly and forced to pass between adjacent coils of the water tube member 32 in the lower portion of the hourglass configuration to the outside thereof, then past the position of the baffle member 34 and back to the inside of the hourglass past the adjacent coils of the water tube member 32 in the upper portion of the hourglass configuration from whence they are exhausted through the flue 28. The water tube member 32 is shown in greater detail in FIG. 4 as comprising an inner tube 36 positioned within an outer tube 37 and arranged for the bi-directional flow of water through the water tube member 32. The outer tube 37 is covered with a plurality of fins 38 which project into the region of the combustion gases in the water heater 18 for improved efficiency of heat transfer to the water passing within the tube 37. The lower end of the water tube member 32 is closed off by a blind manifold 40 which permits the free passage of water from the inner tube 36 to the outer tube 37 and provides for the reversal of flow therein. The blind manifold 40 is provided with a cap 42 which blocks the end of the manifold 40. An auxiliary outlet is provided by a threaded section 43 to which a valve 41 (such as is shown in FIG. 2) may be coupled to provide a means for draining or cleaning the water tube member 32 as desired.

At its upper end, the water tube member 32 is provided with a similarly shaped manifold or coupling member 44 and an associated coupling arrangement, shown in greater detail in FIG. 5. As shown in FIG. 5, a water inlet fitting 47 in the form of a T is connected directly to a pipe 46 which is arranged, upon assembly, to slip over the uppermost end of the inner tube 36. A second T 45, coupled to the first T 47 by appropriate fittings and arranged to extend around the pipe 46 is provided for coupling directly onto the threaded end of the manifold 44. Water is thus permitted to flow out of the water tube member 32 via the outlet T 45. A thermostat 48 for controlling the operation of the heater 18 in accordance with the temperature of the swimming pool water and the control setting thereof is shown connected to the water inlet T 47. A high temperature cut-off device 50 is shown coupled to the manifold 44 in a position to sense the temperature of the water leaving the water tube member 32. The high temperature cut-off device 50 is connected to a heater fuel valve in conventional fashion for cutting off the supply of fuel to the burner 30 whenever the temperature of the water in the water tube member 32 exceeds a safe limit.

In accordance with an aspect of the invention, the pipe 46 is provided with a small hole 52 as shown. The hole 52 is an anti-siphon hole and serves to prevent water from draining out of the water tube member 32 in the event that air gets into the water recirculating system. Thus, this arrangement insures that water is maintained within the water tube member 32 so that there is no danger of the burner 30 operating with a dry water tube and thereby damaging the heating apparatus.

The fabrication of the water tube member 32 may be readily accomplished by first inserting within a relatively straight length of finned outer tubing 37, a length of inner tubing 36 which is approximately 1 foot longer than the outer tubing 37. The increased length of the inner tubing 36 is to provide the desired length to be curved into the upper coupling member 44 which is attached to the upper end of the outer tube 37 so as to permit coupling of the inner tube 36 to the coupling pipe 46. It is desirable to match the water flow capacity of the inner tube 36 to that of the outer tube 37 with the inner tube 36 in place. In one preferred embodiment, a 31-foot length of one-half inch I.D. by five-eighths inch O.D. smooth copper tubing was inserted in a 30-foot length of finned tubing having an inside diameter of one inch. The entire arrangement was then coiled in the hourglass configuration shown in FIG. 4 and suitable coupling members 40 and 44 were attached to opposite ends thereof to provide the water tube member 32. Other arrangements having different dimensions may be employed for swimming pool heaters of various capacities.

In operation, water from the swimming pool 10 is supplied directly from the pump 16 to the water inlet coupling 47 where its temperature is sensed by the thermostat 48, and the burner 30 is operated in accordance with the temperature setting of the thermostat 48. Water from the water inlet coupling 47 passes directly to the pipe 46 and thence to the inner tube 36. As the inlet water flows down and around the water tube member 32 within the inner tube 36, water is simultaneously flowing upwardly and around through the outer tube 37 surrounding the inner tube 36. Assuming that the burner 30 is operating to heat the swimming pool, water adjacent the surface of the outer tube 37 receives heat directly from the fins 38 of the water tube member 32 from the burning gases in the combustion chamber within the inner jacket 26. As this water is heated, some of its heat is transferred to the inner tube 36 and the water flowing therein. Consequently, by the time the water in the inner tube 36 has reached the lower end thereof adjacent the blind manifold 40, its temperature is raised sufficiently that it is above the point of condensation of the water vapor in the combustion gases from the burner 30. Thus, as the water reverses direction at the blind manifold 40 and returns upwardly through the outer tube 37, there is no tendency for the condensation of water on the outside of the tube 37. Moreover, the effective preheating of the inlet water within the inner tube 36 before it is passed to the outer tube 37 not only eliminates the previously experienced problem of condensation of water vapor at the inlet end of the water tube member 32 but also permits a more rapid flow of water through the water tube member 32 so that heat is more efficiently transferred to the water from the combustion gases within the heater 18.

Another particular arrangement in accordance with the invention is represented in FIG. 6 which shows a water tube member 32' coiled in a configuration similar to that of FIG. 4. The water tube member 32' of FIG. 6 comprises an outer tube 37 covered over substantially its entire length with a plurality of fins 38 for the efficient transfer of heat from the combustion gases within the heater 18 to the water flowing through the tube 37. The outer tube 37 is shown containing an inner tube 36' which begins near the lower end of the water tube member 32' and extends through only a portion of the outer tube 37, this extent being approximately ⅓ of the full length of the outer tube 37 in the arrangement depicted in FIG. 6. The water tube member 32' is provided with upper coupling member 44 and a lower coupling member 44'. Details of the lower coupling member 44' and the conduit elements attached thereto may be seen in FIG. 7, which shows a reducing coupling 45' connected to the coupling member 44' and having a sleeve-like conduit 46' arranged to engage the inner tube 36' at the lower end thereof. An

inlet coupling 47' to which a thermostat 48 for sensing the water temperature may be attached is shown connected to the conduit 46' extending outwardly from the reducing coupling 45'. An opening 53 is provided in the wall of the conduit 46' to permit a limited flow of water from the conduit 46' to the region outside the inner tube 36' but within the members 44' and 45'.

The water tube member 32' is designed for installation in the heater 18 of FIGS. 2 and 3 in the manner shown in connection with the water tube member 32. Thus, the flow of the combustion gases and the transfer of heat therefrom to the outer tube 37 proceeds in similiar fashion. However, in the operation of the particular arrangement of the invention including the water tube member 32' of FIG. 6, water is introduced via the coupling arrangement of FIG. 7 at the lower end of the water tube member 32', from whence it flows upwardly through the water tube member 32' and is taken from the heater 18 at the upper end of the water tube member 32' for eventual return to an associated swimming pool or other water storage arrangement. This particular arrangement in accordance with the invention presents a reduced opposition to the flow of water, since the inner tube 36' through which most of the water is directed extends for only a limited distance along the coiled configuration of the water tube member 32'. Thus a water heater utilizing this configuration may be operated under relatively less pressure differential and may advantageously be installed at the outlet of the filter in a swimming pool water recirculating system, rather than having to be coupled directly at the outlet side of the recirculating pump. In accordance with an aspect of the invention, the opening 53 permits a limited flow of water to the outer tube 37 along the outside of the inner tube 36', thus permitting water to flow through this circumferential region so that the water therein is not raised to an undesirably high temperature where hot spots or boiling may occur. At the same time, heat is transmitted through the water in the circumferential region of the water tube member 32' between the inner tube 36' and the outer tube 37 to the inlet water flowing at full capacity through the inner tube 36', where it effectively preheats this inlet water to a temperature above the condensation point. Thus, when the preheated inlet water within the inner tube 36' is introduced to the outer tube 37 at the upper end of the inner tube 36', it is above the condensation temperature so that the condensation of water vapor along the outer tube 37 is effectively eliminated. Accordingly, as in the case of the particular arrangement depicted in FIG. 4, the effective preheating of the inlet water within the inner tube 36' before it is passed to the outer tube 37 eliminates the problem of water vapor condensation on the water tube member and as a result makes possible a more rapid flow of water through the water tube member without such condensation, thus achieving a more efficient transfer of heat from the combustion gases within the heater 18 to the water being heated.

Although there have been described above particular arrangements of water heating apparatus in accordance with the invention for the purpose of illustrating the manner in which the invention may be used to advantage, it will be appreciated that the invention is not limited thereto. Accordingly, any and all modifications, variations or equivalent arrangements falling within the scope of the annexed claims should be considered to be a part of the invention.

What is claimed is:

1. Water heating apparatus for use in conjunction with a swimming pool or the like comprising a housing of substantially cylindrical form, a burner positioned at the base of said housing, a flue at the top of said housing, and a water tube member arranged in a vertically disposed hourglass configuration between the burner and the flue with the top and bottom portions of said hourglass configuration adjacent the housing to block the passage of

combustion gases thereby and having a baffle member positioned across the narrow portion of the hourglass configuration, said water tube member including concentric portions for the bidirectional conduction of water therein and having a blocking member terminating the lower end of the water tube member in a manner such as to permit the reversal of water flow thereat within the water tube member and further having a coupling member connected to the upper end thereof for admitting water to flow into an inner concentric portion of the water tube member and for permitting the flow of water out of the outer concentric portion of said water tube member.

2. Water heating apparatus in accordance with claim 1 wherein said blocking member includes a valve which may be opened for draining or cleaning said water tube member.

3. Water heating apparatus in accordance with claim 1 wherein said water tube member further comprises a plurality of fins positioned substantially along its length with said water tube member being coiled in said hourglass configuration so that the corresponding fins of adjacent coils of the water tube member are substantially touching to define the spacing between the adjacent coils.

4. The water heating apparatus in accordance with claim 1 wherein said water tube member comprises a pair of tubes one within the other, the water conducting capacity of tubes one within the other, the water conducting capacity of the inner tube being substantially matched to the water conducting capacity of the outer tube with the inner tube in position within the outer tube.

5. A bidirectional water tube member for use in a swimming pool water heater or the like comprising a finned outer pipe containing an inner pipe along substantially its entire length, the water flow capacity of the inner pipe being substantially matched to the water flow capacity of the portion of the outer pipe with the inner pipe in place therein, the water tube member being coiled in a substantially hourglass configuration so as to control the direction of combustion gases in a predetermined flow over substantially the entire extent of said water tube member.

6. A bidirectional water tube member in accordance with claim 5 further including a blind manifold member coupled to the lower end of the water tube member so as to permit a reversal of water flow from the inner pipe to the outer pipe, and bifurcated coupling means connected to the upper end of the water tube member to permit separate coupling of associated conduits to the inner pipe and the outer pipe.

7. Water heating apparatus for use in conjunction with a swimming pool or the like comprising a housing of substantially cylindrical form, a burner positioned at the base of said housing, a flue at the top of said housing, a water tube member arranged in a vertically disposed hourglass configuration between the burner and the flue with the top and bottom portions of said hourglass configuration adjacent the housing to block the passage of combustion gases thereby and having a baffle member positioned across the narrow portion of the hourglass configuration, said water tube member including concentric portions for the bidirectional conduction of water therein and having a blocking member terminating the lower end of the water tube member in a manner such as to permit the reversal of water flow thereat within the water tube member and further having a coupling member connected to the upper end thereat for admitting water to flow into an inner concentric portion of the water tube member and for permitting the flow of water out of the outer concentric portion of said water tube member, and means connecting the inlet side of the coupling member directly to a water recirculating pump and the outlet side of the coupling member to a water return line to the swimming pool in order to promote the water flow through the heater at a maximum rate of flow.

8. Water heating apparatus for use in conjunction with

a swimming pool or the like comprising a combustion chamber having an inner wall, a burner positioned at the base of said chamber, a flue at the top of said chamber, a water tube member arranged in a vertically disposed hourglass configuration between the burner and the flue with the top and bottom portions of said hourglass configuration adjacent the inner wall of the combustion chamber to block the passage of combustion gases thereby and having a baffle member positioned across the narrow portion of the hourglass configuration, said water tube member comprising an inner tube positioned within an outer tube along substantially the entire length of the water tube member and having a blind manifold terminating the lower end of the water tube member in a manner such as to transfer water from the inner tube to the outer tube, and a coupling member connected to the upper end of the water tube member for admitting water to flow into the inner tube and for permitting the flow of water out of the outer tube.

9. Water heating apparatus for use in conjunction with a swimming pool or the like comprising a combustion chamber having an inner wall, a burner positioned at the base of said chamber, a flue at the top of said chamber, a water tube member arranged in a vertically disposed hourglass configuration between the burner and the flue with the top and bottom portions of said hourglass configuration adjacent the inner wall of the combustion chamber to block the passage of combustion gases thereby and having a baffle member positioned across the narrow portion of the hourglass configuration, said water tube member comprising an inner tube positioned within an outer tube along substantially the entire length of the water tube member and having a blind manifold terminating the lower end of the water tube member in a manner such as to transfer water from the inner tube to the outer tube, a coupling member connected to the upper end of the water tube member for admitting water to flow into the inner tube and for permitting the flow of water out of the outer tube, and means connecting the coupling member directly between a water recirculating pump and the swimming pool to permit the maximum rate of flow of water through the water heating apparatus.

10. Water heating apparatus for use in conjunction with a swimming pool or the like comprising a housing, a burner, and an exhaust stack arranged in a heater configuration, a water tube member coiled in an hourglass configuration between the burner and the exhaust stack

with the upper and lower portions of the hourglass configuration being positioned adjacent the housing to block the passage of combustion gases thereby and having a baffle member positioned across the narrow portion of the hourglass configuration, said water tube member comprising an inner tube positioned within an outer tube along at least a portion of the extent of the outer tube, and means for admitting water to said inner tube for preheating prior to its transfer to the outer tube from the inner tube comprising a conduit coupled to the inner tube and having an opening permitting a limited flow of water to the region of the outer tube outside the inner tube.

11. Water heating apparatus for use in conjunction with a swimming pool or the like comprising a housing, a burner, and an exhaust stack arranged in a heater configuration, a water tube member positioned within the heater housing between the burner and the exhaust stack and comprising an inner tube positioned within an outer tube along at least a portion of the extent of the outer tube, and means for admitting water to said inner tube for preheating prior to its transfer to the outer tube from the inner tube and to the region of said outer tube outside said inner tube at a limited rate of flow such as to prevent overheating of water in said region.

12. A water heating device for use in a swimming pool water heater or the like comprising an outer pipe containing an inner pipe, and a coupling member having means for admitting water principally to said inner pipe while admitting a limited flow of water to the region of the outer pipe outside the inner pipe to prevent overheating of water in said region.

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