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FLUID HEATER

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Fig. 1.

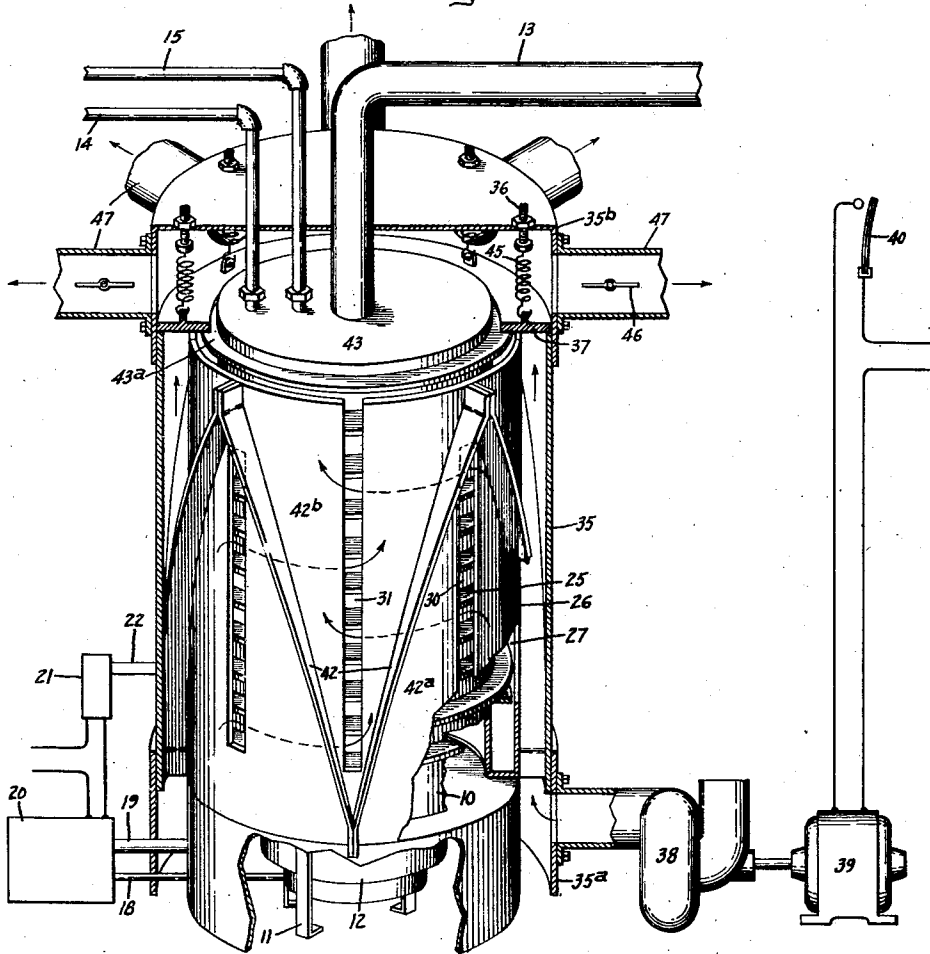
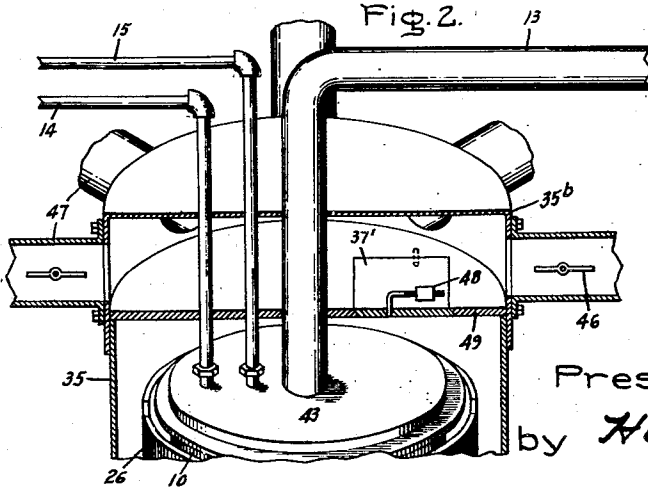


Fig. 2.



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FLUID HEATER

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10 Claims. (Cl. 257—232)

The invention relates to fluid heaters, particularly dual fluid heaters wherein heat is stored in one fluid and transferred to another fluid in response to flow thereof.

One of the principal objects is to provide an improved water and air heating unit capable of automatically supplying the year round domestic hot water requirements as well as the winter house heating requirements of homes.

In most modern homes the ratio of the hot water requirements to the house heating requirements is considerably greater than in the past. Hence, provision must be made for automatically heating a great deal more hot water than formerly. Moreover, because of the smaller size of the home in which the average family now lives and also the heat insulated construction now generally used, the house heating requirements have been materially reduced.

Thus a specific object of the present invention is to provide an automatically heated year round domestic hot water storage heater tank of ample capacity with improved forced air circulation heat transfer means for supplying the winter house heating requirements of the home.

Another object is to enable the winter air heating means to trap air around the hot water heater storage tank in the summer so as to minimize the heat loss.

A still further object is to control the air heat transfer and heat trapping action of the improved water and air heating unit by starting and stopping an air circulating fan or blower preferably under the control of a room thermostat.

A special object is to provide an improved form of fluid flow responsive heat transfer apparatus having a series of spaced apart fins with multiple fluid inlets and outlets to the flow spaces therebetween provided by a transversely slotted fluid flow baffle and an inlet and outlet segregating fluid flow barrier interposed between the slotted baffle and an enclosed flow casing so as to produce an efficient, rapid and readily controlled transfer of heat between a heat conducting body that carries the fins and a fluid. While the improved fin and multiple inlet and outlet slotted baffle heat transfer means of the present invention is of particular advantage in selectively transferring or minimizing the escape of heat from the exterior of a hot water storage tank to air, still it can be used with equal advantage in other fluid heat transfer service if desired.

Further objects and advantages of the invention will appear in the following description of the accompanying drawing in which Fig. 1 is a

perspective view of a combined hot water and warm air heating unit embodying the improvements of the present invention with the enclosing air flow casing and slotted air flow baffle partly cut away to reveal more clearly the detailed construction of the improved fluid flow responsive finned heat transfer apparatus, and Fig. 2 is a modification.

As shown in Fig. 1, the hot water storage tank 10 is of cylindrical form and is provided with a plurality of legs 11 extending from the bottom thereof for supporting the tank above the floor level. The water in the tank 10 is heated by means of a suitable automatic heater 12 which may use gas or oil or other fuel. As shown, the heater 12 is mounted centrally under the tank 10 and is provided with suitable heat exchange tubes or pipes (not shown) extending upwardly through tank 10 for passing the products of combustion into heat exchange relation with the water in the tank 10. The products of combustion from the heater 12 are exhausted into the flue pipe 13 which extends upwardly from the top of the tank 10.

The hot water storage tank 10 is provided with a suitable cold water inlet pipe 14 and a hot water outlet pipe 15 which may be connected to supply the domestic hot water requirements of the home.

The automatic burner 12 is shown as of the oil burning type with the oil supplied thereto through pipe 18 and combustion air supplied thereto through pipe 19 from suitable electrically controlled oil and air supply means 20. The oil and air supply means 20 may be of any well-known type adapted for operation under the control of a thermostat 21 having a temperature sensitive element 22 suitably enclosed and extending into the side of the hot water storage tank 10 so as to be responsive to variations in the temperature of the water therein. As shown, the thermostat 21 is of the electric circuit controlling type so as to control the energization and deenergization of the electrically operated oil and air supply means 20 to automatically maintain the temperature of the water in the tank 10 at a desired value sufficient to supply all normal hot water requirements of the home both winter and summer.

In accordance with the present invention, the domestic hot water storage tank 10 is provided with improved heat transfer apparatus for collecting enough of the heat from the water stored in the tank 10 through a wall of the tank to take care of the room heating requirements of the

home in the winter. As shown, a series of external annular heat transfer fins 25 are mounted in spaced apart relation on the exterior of the cylindrical wall of the tank 10 so as to be in intimate heat conducting relation therewith for heating air. Then in order to produce an air flow in intimate heat transfer relation with the fins 25 and the cylindrical wall of tank 10, a cylindrical air flow baffle 26, preferably formed of thin metal or other heat conducting material, is mounted in engagement with the exposed edges of the series of fins 25 so as to form restricted air flow passages 27 therebetween. The baffle 26 is provided with a plurality of air flow inlet slots 30 and a plurality of air flow outlet slots 31 which extend transverse the series of fins 25 so as to communicate with the air flow passages 27 therebetween. It will be understood that the fins 25 and baffle 26 structure need not be extended as near to the bottom of the water storage tank as indicated in the drawing. If desired, the fins 25 may begin about one-quarter of the height up from the bottom so as to allow for the drawing off of more hot water for domestic use. In such case the bottom of the tank may become too cold for effective heat transfer.

An outer cylindrical enclosing casing 35, preferably formed of heat insulating material or at least suitably heat insulated to prevent the escape of heat, is provided for enclosing the entire water and the air heating unit. For convenience the enclosing casing 35 may be provided with separately removable top and bottom portions 35a and 35b in order to provide ready access to the automatic burner 12 at the bottom of the unit and to the automatic air flow control valve 37 which is provided at the top of the unit. The cylindrical air flow casing 35 and the cylindrical air flow baffle 26 are in spaced apart relation and thus form an annular air flow passage therebetween. A forced supply of air into this passage is provided by a suitable blower 38 which may be connected, as shown, to the bottom section 35a of the enclosing casing and operated by an electric motor 39 under the automatic control or a room thermostat 40.

An annular zigzag air flow barrier 42 extends between the outer enclosing casing 35 and the air flow baffle 26 and is of a suitable form for segregating all of the air flow inlet slots 30 and all of the air flow outlet slots 31 on opposite sides of the barrier 42. Thus the zigzag barrier 42 divides the air flow space between the outer casing 35 and the flow baffle 26 into oppositely tapering inlet sections 42a and outlet sections 42b each having a corresponding inlet slot 30 or outlet slot 31 centrally communicating therewith. Consequently, when air is supplied under pressure into the bottom of the air flow space between the casing 35 and baffle 26, the resulting air flow is directed by each inlet section 42a formed by the zigzag barrier 42 through a corresponding one of the inlet slots 30 into the air flow passages 27 between the heat transfer fins 25. The air flow into each of these passages 27 then divides so as to pass laterally in intimate heat transfer relation over the fins and the tank 10 toward the two adjacent outlet slots 30. Thereupon the air flows into a tapering outlet air flow section 42b formed by the zigzag barrier 42. In this way the total forced air flow is subdivided into a plurality of small streams, each having substantially the same air flow resistance and each effective to sweep heat from the fins 25 and surface of the tank 10 due to the relatively high

velocity of flow through the restricted air passages 27 between the fins.

The top of the domestic hot water storage tank 10 is shown provided with a suitable heat insulating cover 43 formed to cooperate with the automatic air flow control valve 37 so as to entirely close the outlet end of the annular air flow space between the outer casing 35 and the tank. This valve 37 enables the flow of air over the fins 25 and tank 10 to be entirely stopped when the blower 38 is stopped and thereby trap the air in all the passages around the tank so as to prevent the escape of heat therefrom.

The flow control valve 37 preferably is of heat insulating material and of annular form adapted to engage with the exposed upper edge of the central section of the enclosing casing 35 and the groove 43a formed in the heat insulating cover 43 that extends over the top of the water tank 10. The weight of annular valve 37 is suitably balanced by the tension springs 45 which are provided with adjusting screws 36 so that the flow valve 37 will be raised by the air pressure produced upon operation of the blower 38. Thus whenever the blower 38 is started into operation in response to a call for heat from the room thermostat 40, the valve 37 will be raised so as to permit the air, after passing in intimate heat transfer relation with the fins as previously described, to flow into the upper part 35b of the enclosing casing and thence be distributed through suitable distributing pipes 47 to the various rooms in the home. The flow balancing dampers 46 may be provided in order to obtain the desired distribution of the heated air to the rooms.

When the operation of the blower 38 is stopped due to the opening of the room thermostat 40, the flow control valve 37 will return to the closed position in which it is shown so as to prevent any thermosiphon circulation of the heated air to the rooms. Thus in the summer the flow control valve 37 will remain closed to trap the air around the domestic hot water tank 10 so as to minimize the escape of heat therefrom.

If desired, a tilting damper type of air flow responsive valve 37' biased to the closed position and substantially balanced by an adjustable weight 48 may be provided in a horizontal partition 49 of insulating material extending above the top of tank 10 as indicated in Fig. 2. In this case the valve 37 will open when the blower is started and close when the blower is stopped similar to the annular spring balanced valve 27.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. Fluid flow responsive heat transfer apparatus including a fluid flow conduit having a heat conducting wall provided with a series of heat transfer fins extending transversely into said conduit, a zigzag flow barrier extending from the opposite wall into said conduit athwart said fins, and a flow directing baffle interposed between said fins and said barrier and provided with a series of flow restricting slots alternately extending transverse said fins on opposite sides of said barrier.

2. Fluid flow responsive heat transfer apparatus including an annular fluid flow conduit having a heat conducting wall provided with a series of annular heat transfer fins extending transversely into said conduit, an annular zigzag flow barrier extending from the opposite wall into said conduit, an annular flow baffle interposed between said fins and said barrier and provided with a series of flow restricting slots alternately

extending transverse said fins on opposite sides of said barrier.

3. Fluid flow responsive heat transfer apparatus including a fluid flow conduit having a heat conducting wall and a heat insulated wall and provided with a series of spaced apart heat transfer fins extending transversely in alignment from said heat conducting wall into said conduit, a zigzag flow barrier extending from said insulated wall into said conduit athwart said fins, and a flow baffle interposed between said fins and said barrier and provided with a series of flow restricting slots alternately extending transverse said fins in parallel alignment on opposite sides of said barrier.

4. Fluid flow responsive heat transfer apparatus including a fluid flow conduit having a heated wall opposite a heat insulated wall and provided with a series of heat transfer fins extending transversely into said conduit, a zigzag flow barrier extending from said opposite wall into said conduit athwart said fins, and a flow restricting baffle interposed between said fins and said barrier and provided with a series of flow restricting slots alternately extending transverse said fins on opposite sides of said barrier, and flow responsive valve means closing said conduit to prevent the escape of heated fluid when the flow therethrough decreases below a predetermined value.

5. Fluid flow responsive heat transfer apparatus including a fluid flow conduit having a heat conducting wall opposite a heat insulated wall and provided with a series of symmetrically spaced apart heat transfer fins extending transversely into said conduit, a zigzag flow barrier extending from said opposite wall into said conduit symmetrically athwart said fins, a flow baffle interposed between said fins and said barrier and provided with a series of symmetrical flow restricting slots alternately extending transverse said fins on opposite sides of said barrier, pumping means connected with one end of said conduit for forcing fluid flow therethrough to effect a transfer of heat, and automatic valve means closing the other end of said conduit when said pumping means is stopped to prevent the transfer of heat.

6. In combination, a heat conducting body having a series of spaced apart heat transfer fins extending therefrom in heat transfer relation with a fluid, a fluid flow baffle engaging the free ends of said fins to form fluid flow passages therebetween and provided with spaced apart alternate fluid inlet and outlet slots extending transverse said fins to communicate with said passages, a casing enclosing said baffle to form a fluid flow space therebetween and provided with fluid inlet means at one end thereof and fluid outlet means at the other end thereof, and a zigzag fluid flow barrier extending between said baffle and said casing for segregating said inlet slots and said inlet means from said outlet slots and said outlet means.

7. In combination, a heat conducting cylindrical body having a series of external annular

spaced apart heat transfer fins extending therefrom in heat transfer relation with a fluid, a cylindrical fluid flow baffle engaging the free ends of said fins to form fluid flow passages therebetween and provided with alternate fluid inlet and outlet slots extending transverse said fins to communicate with said passages, a cylindrical casing enclosing said baffle and provided with fluid inlet means at one end thereof and fluid outlet means at the other end thereof, and an annular zigzag fluid flow barrier extending between said baffle and said casing for segregating said inlet slots and said inlet means from said outlet slots and said outlet means.

8. In combination, a hot water storage tank having a series of heat transfer fins extending therefrom for heating air, an air flow baffle engaging the free ends of said fins to form air flow passages therebetween and provided with spaced apart alternate air inlet and outlet slots extending transverse said fins to communicate with said air passages, a casing enclosing said baffle to form an air flow space therebetween and provided with air inlet means at one end thereof and air outlet means at the other end thereof, and a zigzag air flow barrier extending between said baffle and said casing for segregating said air inlet slots and said air inlet means from said air outlet slots and said air outlet means.

9. In combination, a cylindrical hot water storage tank provided with a series of external annular spaced apart heat transfer fins for heating air, a cylindrical air flow baffle enclosing said fins and provided with a series of spaced apart alternate air inlet and outlet slots extending transverse said fins to communicate with the air spaces therebetween, a cylindrical casing of heat insulating material enclosing said baffle to form an air flow space therebetween and provided with air inlet means at one end thereof and air outlet means at the other end thereof, and an annular zigzag air flow barrier extending between said baffle and said casing for segregating said inlet slots and said inlet means from said outlet slots and said outlet means.

10. In combination, a heat conducting cylindrical water tank having means for heating the water therein and provided with a series of external annular spaced apart air heating fins, a cylindrical air flow baffle engaging said fins to form air flow passages therebetween and provided with a series of spaced apart alternate air inlet and outlet slots extending transverse said fins to communicate with said passages, a cylindrical casing of heat insulating material enclosing said baffle to form an air flow space therebetween and provided with forced air supply means at one end thereof and automatic air flow operated outlet valve means at the other end thereof, and an annular zigzag air flow barrier extending between said baffle and said casing for segregating said inlet slots and said forced air supply means from said outlet slots and said outlet valve means.

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