Jan. 2, 1934. L. J. BLACK 1,941,734

AIR CONDITIONER

Filed Dec. 22, 1932 2 Sheets-Sheet 1

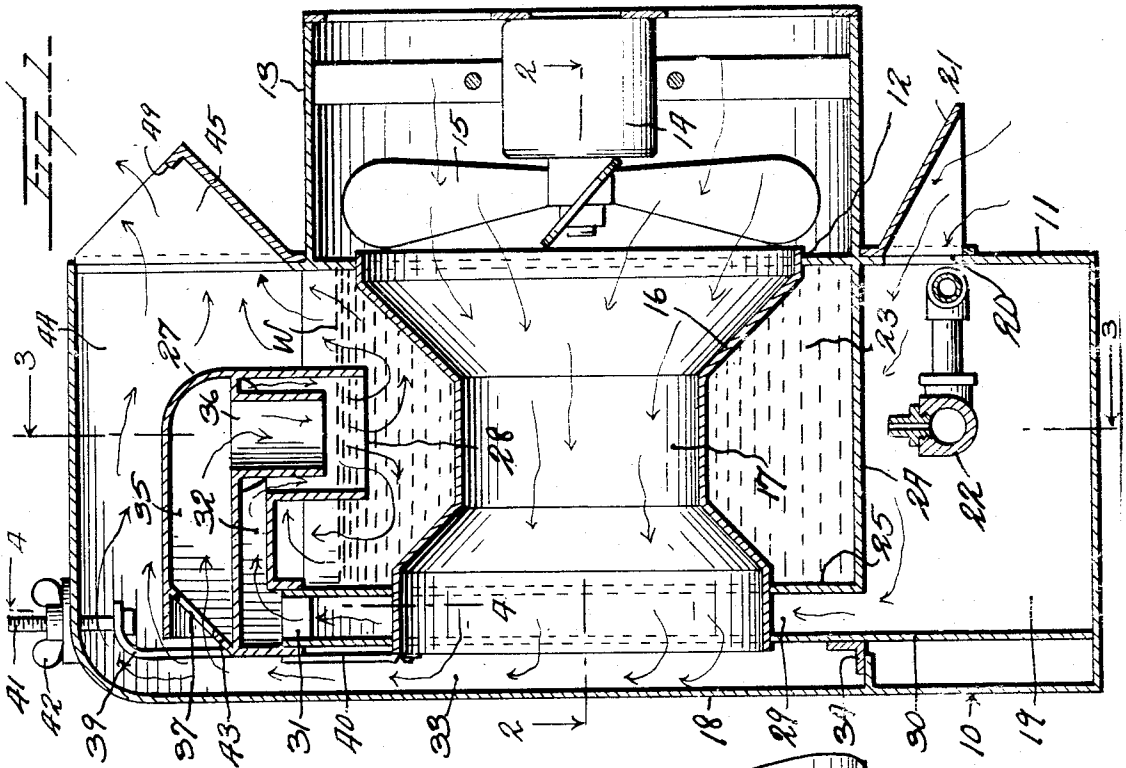


Fig. 1

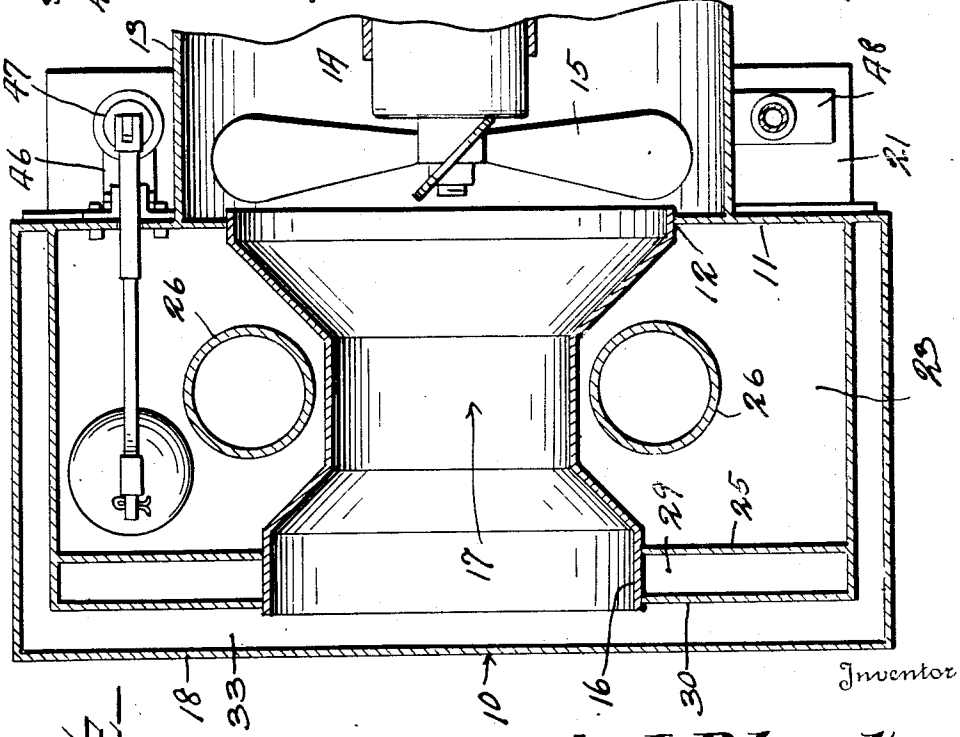


Fig. 2

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AIR CONDITIONER

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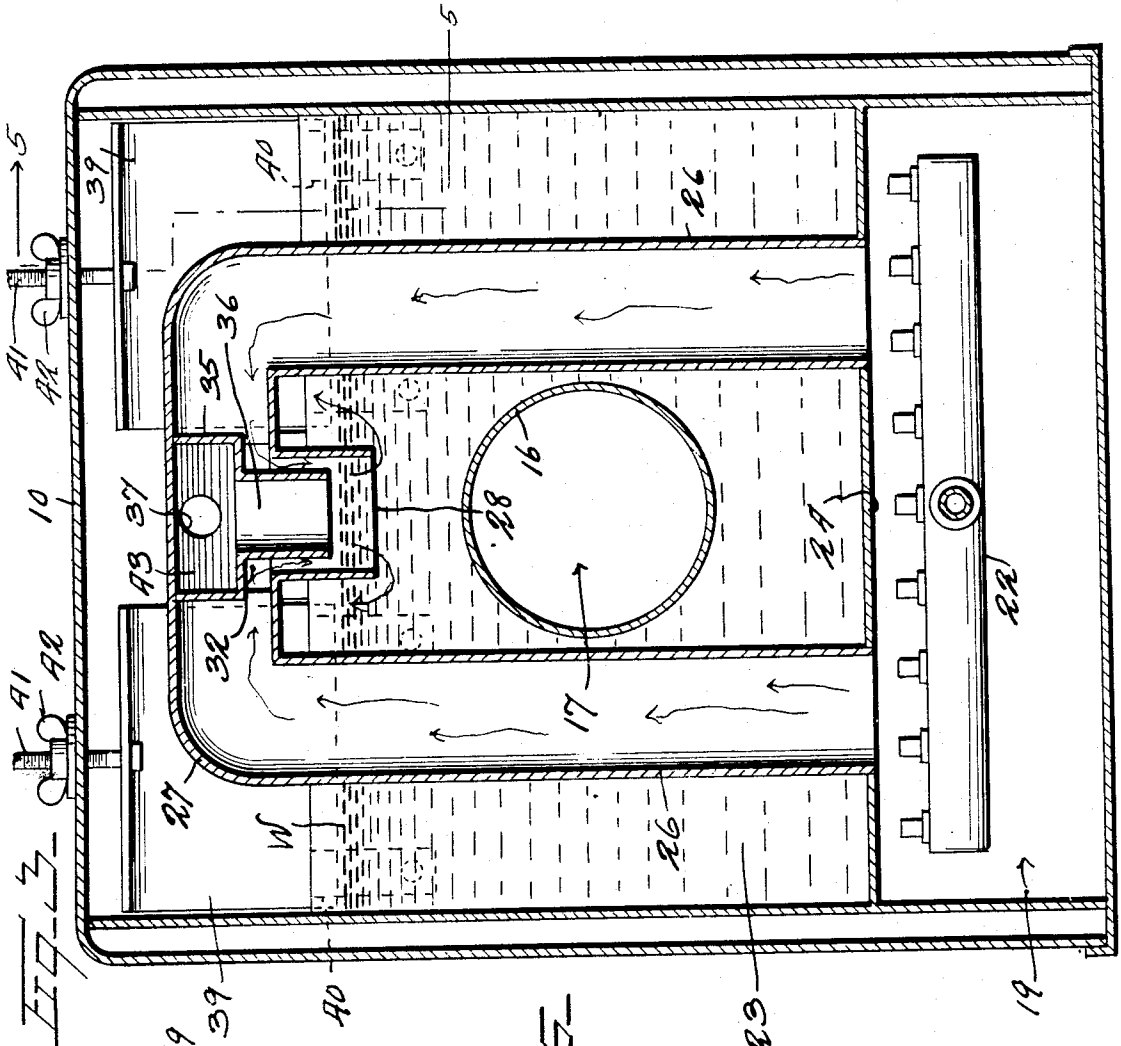


FIG. 4

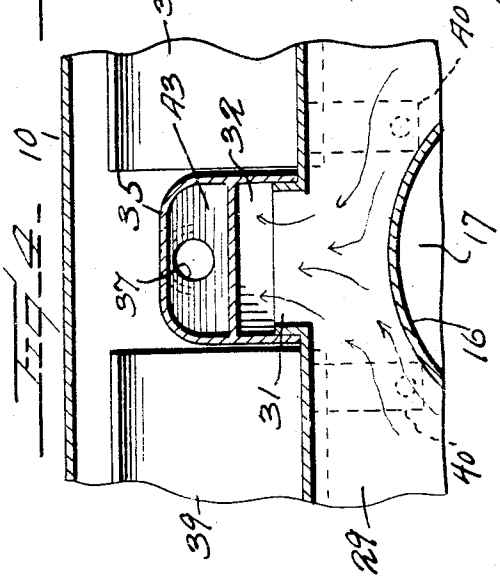


FIG. 2

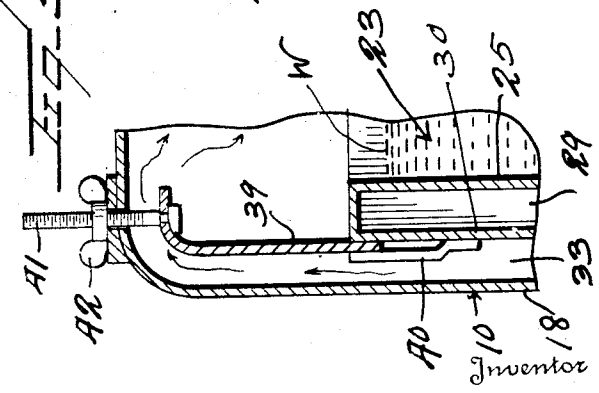


FIG. 5

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UNITED STATES PATENT OFFICE

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AIR CONDITIONER

Lee J. Black, Beaumont, Tex.

Application December 22, 1932
Serial No. 648,476

12 Claims. (Cl. 261—121)

This invention relates to air conditioners and particularly to an air conditioner in which air from the room is forced through a passage surrounded by water and then discharged again into the room, means being provided whereby the water may be heated if it is desired to warm the room or whereby air may be cooled by the water in case it is desired to cool the air.

The general object of the present invention is to provide an air conditioner of this character which is very simple, which has relatively few parts, in which back pressure on the air is reduced as much as possible and in which the carbon dioxide generated by the heating element is absorbed before the air is discharged into the room.

A further object is to provide an air conditioner of this character including a water tank, a heating element for heating the water in the tank, hot gas passages passing through the tank in one direction, an air passage passing through the tank at right angles to the hot gas passage, and means for discharging the air and hot gases back into the room, means being provided, as before stated, for removing the carbon dioxide from the hot gases before they are discharged into the room.

Other objects will appear in the course of the following description.

My invention is illustrated in the accompanying drawings, wherein:—

Figure 1 is a vertical section through an air conditioner constructed in accordance with my invention;

Figure 2 is a section on the line 2—2 of Figure 1;

Figure 3 is a section on the line 3—3 of Figure 1;

Figure 4 is a fragmentary section on the line 4—4 of Figure 1;

Figure 5 is a fragmentary section on the line 5—5 of Figure 3.

Referring to these drawings, 10 designates an outer casing having in one wall 11 thereof the air inlet opening 12. Extending from this wall 11 and surrounding this inlet opening is a fan casing 13 within which is supported the electric motor 14 and the fan 15, which fan discharges through the opening 12. Extending inward into the casing 10 from the opening 12 is an annular wall 16 which defines an air passage 17. This wall has its ends larger in diameter than the middle of the wall so that the middle of the wall is contracted. The wall 16 of this air passage 17 terminates short of the wall 18 of casing 10, which wall 18 extends parallel to the wall 11.

The lower portion of the casing 10 is formed to provide a burner chamber 19 having an opening 20 with a hood 21 through which air may pass into the chamber 19. Disposed within this chamber is a heating element 22, which may be a gas burner, an oil burner or a burner of any suitable character or an electrically energized heating element. Disposed above the chamber 19 within which the burner is disposed is a water tank 23. One wall of this water tank is formed by the wall 11, the bottom of the water tank is formed by the wall 24 which constitutes the top of the water chamber and the outer end of the water tank is formed by the wall 25 which extends upward to a point above the annular wall or tube 16. This tank is filled with water to the water level designated W. Extending upward from the heating chamber 19 are two hot gas pipes or flues 26 which extend upward on each side of the discharge end of the air passage 17 exteriorly of the tubular member 16. At their upper ends, these flues 26 discharge into a transverse manifold 27. This manifold has a downwardly discharging and medially disposed outlet nipple or nozzle 28 which is disposed below the water level W. Extending upward from the forward end of the chamber 19 is a hot gas passage or flue 29 defined by the wall 25 and by an outer wall 30, which outer wall 30 is spaced from the wall 18 of the casing. The discharge end of the wall 16 of air passage 17 extends through the walls 25 and 30 and, therefore, extends through the hot gas passage or flue 29. This passage 29 at its upper end is contracted as at 31, this contracted portion extending upward and discharging into the manifold 27 by means of a rearwardly extending branch or continuation 32.

Between the wall 30 and the wall 18 is an air passage 33, the bottom of which is designated 34. This air passage opens into the upper portion of the casing above the manifold 27.

Disposed above the gas passage 32 is an air duct 35 which extends rearward and at its rear end has the downwardly extending discharge nozzle or terminal portion 36 which is smaller in diameter than the discharge nozzle 28 of the manifold and terminates short of the lower end of this portion 28 of the manifold and terminates short of the water level W. This air duct or passage 35 at its forward end has an air opening 37 opening into the air space or passage 33 so that a certain amount of air moving upward in

the passage 33 will be discharged laterally into the passage 35 through the opening 37 and will be discharged downward through the nozzle 36. For the purpose of controlling the pressure of the air passing through the opening 37, I provide the laterally disposed air gates 39 which operate in the guides 40. Each of these gates 39 at its upper end is angularly bent or curved rearward and it is engaged by an adjusting screw 41 which extends out through the top wall of the casing 10 and is provided with the wing nut 42. If these gates are drawn fully upward so that the upper ends of the gates bear against the top of the casing 10, it is obvious that all the air forced through the air passage 17 by the fan 15 must pass through the space between these gates 39 and upward around the opening 37 over the inclined plate 43 and, of course, a greater amount of air must pass through the opening 37 and downward through the nozzle 36.

While I have heretofore referred to the gates 39 as possibly being drawn up so as to entirely close the upward passage of air into the upper portion of the casing, through the space on each side of the duct 35, as a matter of actual practice, these gates will never be entirely closed but some air will always pass over the top of the gates.

The air passing over the top of the gates will, of course, be discharged into the chamber 44 formed in the upper portion of the casing above the water level and be discharged out through the upwardly inclined discharge passage 45. By adjusting these gates 39 a greater or less amount of air may be caused to pass into the duct 35 and downward through the nozzle 38.

It will be seen that the fan will blow air from the room into the air passage 17, that the air in moving through this passage 17 will be heated from the heat contained within the water in tank 23 and that this air will further be heated because the forward end of the wall 16 passes through the hot gas space 29. The air after it is discharged from the air passage 17 is discharged into the air space 33 and moves upward to the upper portion of the casing and is eventually discharged through the outlet 45. The hot gases from the heating element pass upward through the space 29 and are discharged into the manifold 27 and downward through the nozzle 28. That portion of the air which is forced by the fan downward through the nozzle 36 acts on the injector principle to draw the hot gases upward through the tubes 26 and downward through the manifold and the air from the nozzle 36 and the gas from the manifold nozzle 28 is discharged into the water in the tank. It then rises up through the water in the tank and is discharged into the space 44 and out through the outlet 45. Inasmuch as carbon dioxide is soluble in water, it is obvious that the carbon dioxide in the gases will be removed, the gases cleaned and discharged into the room along with the air entirely free of carbon dioxide or other deleterious matter so that there will be no smell nor impurity from the burned gases.

It will be seen that I have provided, therefore, a unit discharging the combined hot gases and air from a common outlet, that this unit discharges products of combustion below the water level removing the odors and the soluble carbon dioxide therefrom and that I have provided a unit using the air blast from a fan to drive the products of combustion from the hot gas tubes below the surface of the liquid in the tank. It will further be seen that I have provided gates adjustable in the air passage to raise or lower the air stream above the liquid level in the tank to thus control the moisture content of the air entering the room.

For the purpose of controlling the level of water in the tank and maintaining this level at all times and for the purpose of controlling the heat supplied by the heating element 22, I provide a supply pipe 46 and a float valve designated generally 47 for the purpose of controlling the amount of water allowed to flow in the tank 23, the float valve being controlled by the water level in the tank in an obvious manner. Where gas and oil is used for heating and is conducted to the heating element 22, the fuel supply will be controlled by a thermostatically controlled valve 48, which thermostat will be located within the tank 23 and acting to reduce the fuel supply when the water in the tank has reached the proper temperature to give the proper temperature to the air circulating through the apparatus. Where electric current is used, however, for the heating element 22, the thermostat will be controlled by the temperature of the water in the tank or the thermostat might be controlled by the room temperature. Any usual or ordinary form of thermostat can be used in any case and the room temperature can be controlled within close elements with either type of fuel.

It is desirable, of course, to control the humidity of the air discharged into the room and this is controlled by the gates 39. By raising or lowering these gates, the air current may be raised or lowered. If the gates are lowered, more air will come in contact with the water in the tank and if the gates are raised, the lower will pass out more directly without coming in so great a contact with the water in the tank. If too much moisture is carried over, the wet air being heavy will travel over the lower part of the outlet chamber 44 and up through the outlet 45 and will come in contact with a moisture baffle 49 which extends upward from the lower wall of the outlet 45. The water will be separated by this moisture baffle 49 and return down the incline to the tank. This baffle will prevent water being blown from the tank 23 by the air blast and thus prevent damage to the room or its contents.

It will be obvious that this apparatus can also be used for the purpose of cooling air, in which case, of course, the heating element is not used, all fuel being shut off thereto. In the normal city water supply, the temperature of the water seldom goes below 65° F. in the mains. Therefore, the constant circulation of the water at a normal temperature around the air passage 17 and the discharge of the air close to the surface of the water will reduce the room temperature to a point nearly that of the water because of the heat absorbing capacity of the water in the tank.

It will be seen that I provided means for recycling air, that is, constantly circulating it through the apparatus and out again, cooling the air, if desirable, heating the air, if desirable, removing the poisonous carbon dioxide from the hot gases, increasing or decreasing the humidity and controlling the temperature, all of this being accomplished in a single unit that can be set up in a room and operated at a minimum of expense.

Where an electric heating element is used for heating the water in the tank, the air passing over or around this heating element will be carried up through the passage 29 and forced down

through the water in the tank and then will be discharged into the room through the outlet 45. This air while it is not contaminated by products of combustion will be at too great a temperature to be discharged directly into the room and should be humidified and this is accomplished by my apparatus. This is particularly of value because humidified air is more capable of securing comfortable heat in a room than dry air while at the same time an undue dry heating effect caused by the direct discharge of overheated air into the room is prevented. This is also true of highly heated combustion products, that is, highly heated air contaminated with combustion products and gases of combustion which will be discharged downward below the surface of the water in the tank, the temperature thereof modified, the air humidified and the carbon monoxide absorbed.

The gates 39 act to raise the level of the air current so that excessive moisture will not be picked up. The manifold 27 has a tendency with the gates 39 adjusted to the lowest position to force part of the air below or underneath the manifold as the air passes around it. By raising these gates, however, I prevent this condition and keep out excessive moisture. Preferably, there will be a damper in the opening 37 or in the passage leading therefrom so that just the proper amount of air can be passed into the manifold. I do not wish to be limited to the use of a damper for this purpose, however, I do not wish to be limited to the use of a single passage 17 except as defined in the claims nor to the use of a fan as a means for discharging the air and hot gases below the surface of the water in the tank except as expressly defined in the claims.

It is obvious also that many changes might be made in the details of construction and arrangements of the parts without departing from the spirit of the invention as defined in the claims.

I claim:—

1. An air heating unit including a water tank, a heating element therefor, an air passage passing through the tank in one direction, a fan for forcing the air through said passage, hot gas passages passing through the tank at right angles to the air passages and carrying burned combustion gases, a manifold connecting the hot gas passages and discharging to a common outlet, said outlet discharging downward into the water in the tank, and an air inlet admitting air to the manifold and discharging air downward with the hot gases into said water tank.

2. An air conditioning unit including a water tank, means for heating the water in the tank, an air passage extending through the tank in one direction, a fan discharging air into said passage, hot gas passages carrying off the products of combustion and extending through the tank and discharging downward through a nozzle having its lower end submerged in the water of the tank, and means for conducting a portion of the air discharged through said air passage to said nozzle and discharging air downward through the nozzle into the water of the tank.

3. An air conditioning unit including a casing, an air passage extending thereinto, a power operated fan blowing air into the air passage, a water tank through which the air passage extends, a heating chamber disposed below the water tank, a heater therein, an air passage extending upward to the upper portion of the casing and discharging above the water tank, the casing having an outlet for the air and hot gas passages extending upward through the water tank and having a nozzle directed downward into the water in the tank, the hot gas passage being connected to the heating compartment, and means for directing some of the air downward through the center of the nozzle to carry the hot gases from the nozzle downward into the water in said tank and thereby clean the gases of carbon dioxide.

4. In an air conditioning unit including a casing, a water tank therein, a heating compartment disposed below the water tank, heating means in said compartment, an air passage extending through the tank, a power operated fan at one end of said air passage causing the discharge of air pressure, the fan drawing air from the exterior of the casing, an air passage extending upward within the casing and discharging into the upper portion of the casing above the water in the tank, and having an outlet, hot gas passages extending upward from the heating compartment and through the water tank, a manifold into which the hot gas passages open, the manifold having a downwardly extending nozzle having its lower end submerged in the liquid in the tank, an air pipe opening from the last named air passage extending into the manifold and having a nozzle extending downward concentrically to the nozzle of the manifold whereby air forced through the air nozzle will cause the hot gases to be forced down through the water and purify it, and means for controlling the amount of air passing through the upper portion of the casing.

5. In an air conditioning unit including a casing, a water tank therein, a heating compartment disposed below the water tank, heating means in said compartment, an air passage extending through the tank, a power operated fan at one end of said air passage causing the discharge of air pressure, the fan drawing air from the exterior of the casing, an air passage extending upward within the casing and discharging into the upper portion of the casing above the water in the tank, and having an outlet, hot gas passages extending upward from the heating compartment and through the water tank, a manifold into which the hot gas passages open, the manifold having a downwardly extending nozzle having its lower end submerged in the liquid in the tank, an air pipe opening from the last named air passage extending into the manifold and having a nozzle extending downward concentrically to the nozzle of the manifold whereby air forced through the air nozzle will cause the hot gases to be forced down through the water and purify it, and means for controlling the amount of air passing through the upper portion of the casing including a pair of vertically movable gates mounted in said passage on each side of the manifold, and means for raising or lowering said gates.

6. An air conditioning unit of the character described, comprising a casing, a water tank disposed within the casing above the bottom thereof, the bottom of the water tank constituting the top of a heating compartment formed in the lower portion of the casing, the heating compartment having an air inlet, a heating element disposed within the heating compartment, an air passage extending into the casing from one side thereof but terminating short of the opposite wall of the casing, said air passage extending through the water tank, a fan casing opening to said air passage, a power operated fan therein acting to force

air through said passage, a wall extending upward at the inner end of the air passage in spaced relation to the adjacent wall of the casing to provide an upwardly extending air passage opening into the upper portion of the casing above the water in the tank, the upper portion of the casing above the water in the tank, the upper portion of the casing having an outlet, a plurality of hot gas passages extending upward from the heating compartment through the water tank, a manifold in the upper portion of the casing into which said hot gas passages open, the manifold having a downwardly extending nozzle having its lower end disposed below the level of the water in the tank, an air pipe opening to the vertically extending air passage at one end and having its other end formed with a downwardly extending nozzle disposed within and concentrically to the nozzle of the hot gas pipe, and means for regulating the passage of air from the vertical passage into the upper portion of the casing.

7. An air conditioning unit including a liquid tank, and a heating compartment below the liquid tank, an outer casing enclosing the liquid tank, there being an air passage extending into said casing and through the tank, means for forcing air into and through said passage, means for carrying off combustion products from the heating compartment, and discharging said combustion products into the liquid in the tank whereby to cause purification of said products, means for maintaining a constant level of liquid in the tank, and thermostatic means for controlling the heating element in the heating compartment.

8. In an air conditioner, a liquid tank, an air passage extending through the tank, an outer casing having an upwardly and outwardly extending outlet at its upper end, means for heating the liquid in the tank, means for forcing air into said air passage and upward through the outer casing into the upper portion thereof, and means for preventing the discharge of liquid from said outlet comprising an upwardly and inwardly extending flange on the lower wall of said upwardly and outwardly extending outlet.

9. An air conditioning unit including a liquid tank, combustion means for heating the liquid in the tank, an air passage through the tank in one direction, means for forcing air through the passage, hot gas passages carrying off the products of combustion and extending through the tank, and means for discharging said hot gases below the surface of the water in the tank.

10. An air conditioning unit including a water tank, means for heating the liquid in the tank, an air passage through the tank in one direction, means for forcing air through the passage, means for conducting air upward, and over the surface of the liquid in the tank, hot gas passages carrying off air and gases from the heating means and extending through the tank, and means for causing the hot gases to be discharged below the surface of the water in the tank.

11. An air conditioning unit for a room including a liquid tank, means below the tank for heating the liquid therein, an air passage through the tank, means for conducting air from said passage into the upper end of the tank above the surface of the liquid, and discharging it into the room, passages for conducting the air heated by said tank-heating means from the tank-heating means and discharging said heated air below the surface of the liquid in the tank before it passes into the upper end of the tank and is discharged into the room, said last named passages being disposed to transfer heat to the water in the tank.

12. An air conditioning unit for a room including a liquid tank, means below the tank for heating the liquid therein, an air passage through the tank, means for conducting air from said passage into the upper end of the tank above the surface of the liquid and discharging it into the room, a passage for conducting the air heated by said tank heating means from the tank heating means, said passage positioned to transmit heat to the first named air passage, and to discharge said heated air below the surface of the liquid in the tank before it passes into the upper end of the tank and is discharged into the room.

LEE J. BLACK.