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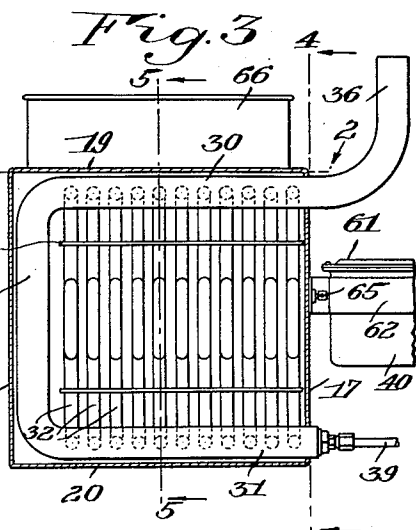
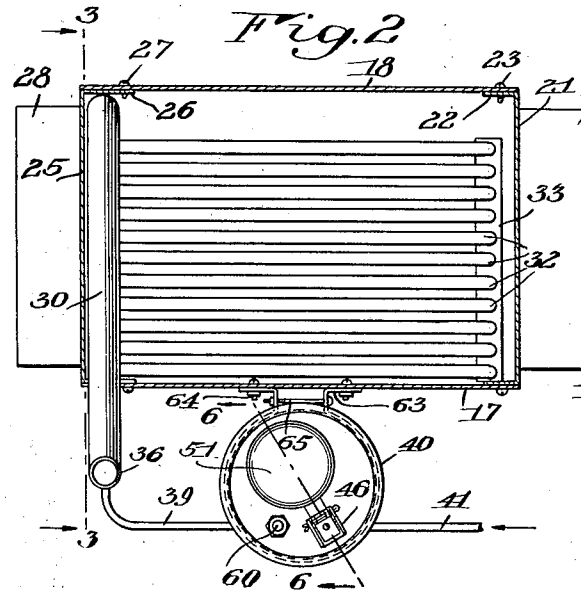
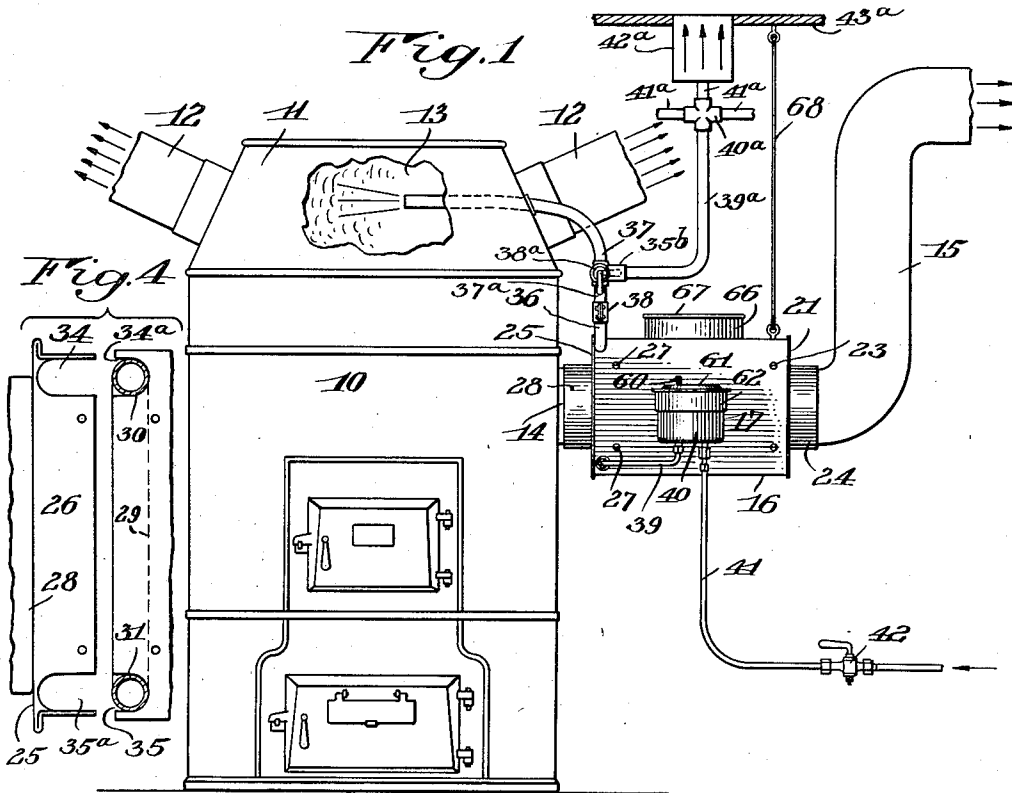
H. HASTINGS ET AL

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LIQUID VAPORIZING AND AIR HUMIDIFYING APPARATUS

Filed Sept. 20, 1935

2 Sheets-Sheet 1



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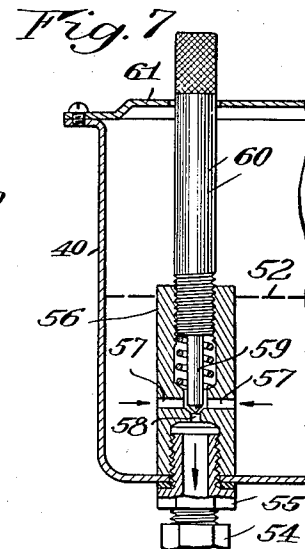
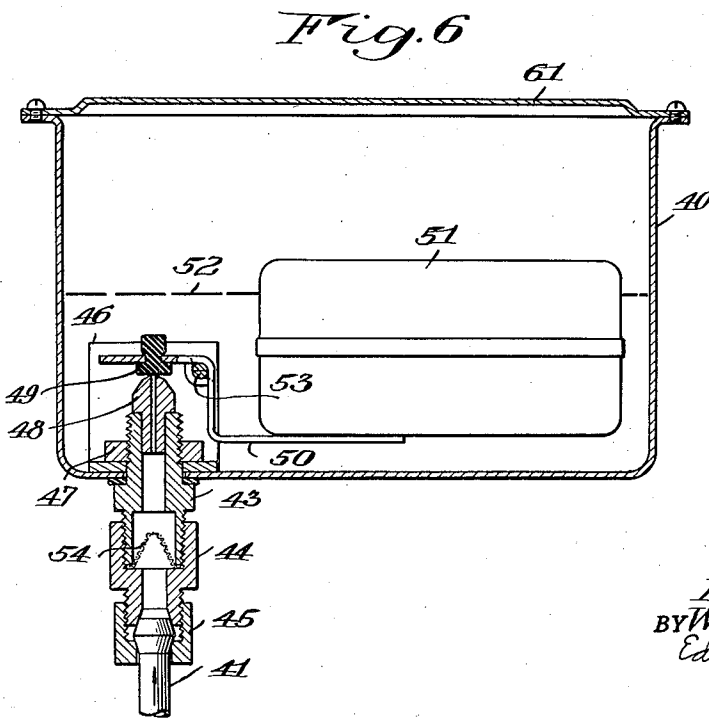
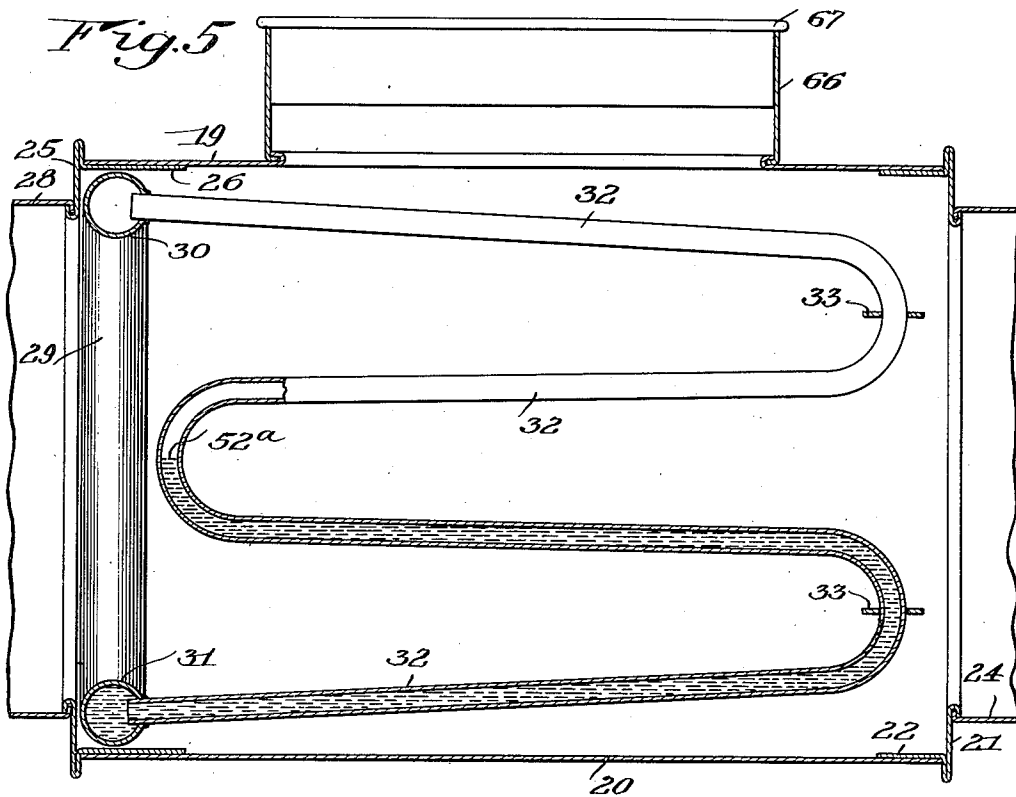
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2 Sheets-Sheet 2



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LIQUID VAPORIZING AND AIR HUMIDIFYING APPARATUS

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6 Claims. (Cl. 122-451)

The present invention relates to liquid vaporizing and air humidifying apparatus and has for its object to provide improvements in apparatus of this class for effectively and economically heating and vaporizing the liquid and for mixing the vapor with air or other gases, and particularly the air employed for heating buildings and various living quarters.

A further object of the invention is to provide a simplified and improved liquid evaporating device for supplying steam or vapor for heating or humidifying purposes.

A further object of the invention is to provide a compact liquid heating or evaporating device adapted to be associated with the flue of a hot air heater or furnace, or with that of a steam or hot water heater, through which the waste gases are discharged for heating said device whereby to economically supply steam or vapor for discharge to the hot air chamber of the furnace, or for direct discharge to one or more rooms or compartments to be humidified.

A further object of the invention is to provide a unitary and efficient heater for vaporizing water or other liquids and one designed to be heated by the discharge of hot air or other gases there-through and with which automatic means is associated for controlling the level of the liquid therein.

A further object is to provide an efficient liquid vaporizing device for supplying steam or vapor for various purposes and one having structural improvements rendering it economical to manufacture and operate.

To these and other ends the invention resides in certain improvements and combinations of parts, all as will be hereinafter more fully described, the novel features being pointed out in the claims at the end of the specification.

In the drawings:

Fig. 1 is a view in elevation of apparatus embodying the invention;

Fig. 2 is a sectional plan of the liquid evaporating means taken on line 2-2 of Fig. 3;

Fig. 3 is a transverse sectional elevation on line 3-3 of Fig. 2;

Fig. 4 is a fragmentary sectional elevation on line 4-4 of Fig. 3;

Fig. 5 is a fragmentary sectional elevation drawn to an enlarged scale and taken on line 5-5 of Fig. 3;

Fig. 6 is a sectional elevation through the liquid holding receptacle containing the valve controlled float and taken substantially on line 6-6 of Fig. 2, and

Fig. 7 is a fragmentary sectional elevation through the receptacle shown in Fig. 6 and the adjustable valve for regulating the discharge of the liquid therefrom.

The same reference numerals throughout the several views indicate the same parts.

The present apparatus embodies generally a hot air furnace or heater, or a steam or water heater of any preferred design for supplying heat to the various rooms of a building. With the flue, which carries off the smoke and waste gases resulting from the burning of the fuel, in either type of heating plant mentioned, is associated an improved device for heating, evaporating or vaporizing liquid such as water, and through which device such waste gases are discharged for the purpose of heating or converting the water into steam or vapor for delivery through suitable pipes to the dome or bonnet of the furnace for absorption by the heated air accumulating therein during operation of the furnace, or for direct discharge into the room or compartment to be humidified.

Referring to the drawings, 10 represents a steam or water heater or a hot air heater or furnace having a dome or bonnet 11 provided with a plurality of upwardly extending pipes or flues 12 for discharging the heated air accumulating in the chamber 13 of the bonnet to the different rooms or compartments to be heated.

The body of the furnace has a short pipe 14 extending from the opening through which the waste gases are discharged. The pipe or flue 15, which would ordinarily be fitted upon the short pipe 14, is shown spaced therefrom to permit the heater casing 16 to be interposed between said pipes. The casing is in the form of a tubular box-like section having side walls 17 and 18 and top and bottom walls 19 and 20, respectively. The casing has an outer end wall 21 provided with a flange 22 inserted within the casing and secured therein by a suitable number of screws 23. The end wall 21 has a tubular extension 24 for receiving the flue 15, as shown in Fig. 1. The casing also has an opposite end wall 25 provided with a flange 26 projecting within the casing and secured therein by the screws 27, the end wall 25 having a tubular extension 28 fitted upon the short pipe 14 of the furnace.

The heater for evaporating or vaporizing the liquid is made up as a unit and inserted as such within the tubular section 16. The heating unit comprises a bent tube 29 of substantially U-shape construction, the upper and lower legs 30 and 31 of which constitute tubular heads for receiving

the upper and lower ends, respectively, of the individual heating coils or tubes 32, said ends being extended within the heads through openings formed therein, as shown in Fig. 5, and secured by brazing or otherwise, as desired. The shape of the tubes may be varied as preferred, but they are preferably bent upon themselves to form a plurality of loops each extending longitudinally within the casing, the sides of each of the loops being inclined to the horizontal to permit the rapid return to the supply line of the unevaporated water without producing undue back pressure or disturbance within the supply line. This arrangement of tubes tends to keep the intake of the heater relatively cool. Any water reaching the upper section 30 will return to the lower section 31 through the portion 29 connecting said sections.

Before attaching the tubes to the heads the perforated upper and lower spacing strips 33 are threaded thereon and moved to the position shown in Figs. 2, 3, and 5, at which point they serve to hold the rear ends of the loops in proper spaced relation.

The heater unit when thus constructed can be readily inserted within the casing or tubular section 16 by moving it through one end thereof, preferably the inner end. To make this possible, however, it is necessary to form the upper and lower slots 34 and 35 in the side wall 17 of the casing at the inner end thereof for receiving the upper and lower legs 30 and 31 of the U-shaped tube 29, as shown in Fig. 4. Furthermore, in order to permit the flange 26 of the end wall 25 to be inserted within the casing, it is necessary to provide the corresponding slots 34a and 35a in said flange so that it will clear the upper and lower legs of the U-shaped tube 29 when applying said end wall to the casing.

The upper leg 30 of the tube is provided with an upturned extension 36 which is connected with the short pipe 37a by means of a suitable coupling 38. The pipe 37a has secured thereon a valve head 35b from which a pipe 37 is extended into the air receiving chamber 13 of the dome 11 of the furnace for discharging the steam or vapor to said chamber for mixture with the heated air therein.

When it is desired to discharge the steam or vapor of a steam or hot water heater directly to one or more rooms or compartments to be humidified, this can be done by extending the pipe 39a from the valve head 35b and connecting it with a manifold 40a, from which extended a plurality of outlet pipes 41a for discharging the steam or vapor to the different rooms. Each of the pipes 41a is preferably connected with a register 42a, only one of which is shown. The register may be of any preferred design and is adapted to be connected with and to discharge through a wall of the room such, for example, as the floor 43a. A valve 38a is carried by the head 35b for closing either of the pipes 37 and 39a when desired.

Suitably connected with the end of the lower tubular head 31 is the short section 39 of the liquid supply pipe, the outer end of which is connected with the receptacle 40 to which the water is discharged through the section 41 of the supply line which is provided with a valve 42 for closing the same when desired.

The supply pipe 41 is connected with the receptacle by means of the coupling members 43 and 44 and the nut 45, the upper end of the coupling member 43 being extended through the wall of the receptacle and through the intermediate por-

tion of a U-shaped bracket 46 and clamped in position by a nut 47. The coupling member 43 has secured thereon a nozzle 48, the upper end of which forms a seat for the valve 49 secured on one end of an arm 50, on the opposite end of which is disposed a float 51 for operating the arm to close the valve when the liquid is at a predetermined level within the receptacle as indicated, for example, by the dotted line 52. The arm is pivoted intermediate its ends upon a pin 53, the opposite ends of which are suitably connected with the upstanding portions of the U-shaped bracket 46. A strainer 54 is secured within the coupling member 43 for straining the liquid before permitting it to pass through the nozzle 48.

The discharge pipe 39 leading from the receptacle is suitably attached thereto by means of the connections 54 and 55, the latter of which is extended through the wall of the receptacle and threaded within the short outlet pipe or tube 56.

The tube 56 is provided with a plurality of laterally extending outlet ports 57 connected with the central discharge port 58 of the tube which is controlled by the adjustable valve 59 provided for regulating the flow of the liquid from the receptacle to the heater. The valve is fixed on the inner end of an operating stem 60 which is threaded within the tube 56 for the purpose of adjusting the valve and which has its upper end extending through the cover 61 of the receptacle so that it can be operated without having to remove the cover.

The receptacle is preferably attached to the side wall 17 of the tubular section 16 by means of the band 62 the opposite ends of which are bent outwardly at 63 and secured to the wall 17 by means of the bolts 64, as shown in Figs. 2 and 3. A bolt 65 is extended through the opposite portions of the band which serves to clamp the latter upon the receptacle 40.

The position of the receptacle upon the casing is such that the predetermined level of the liquid within the casing will correspond to the desired predetermined level within the tubes 32 of the evaporator, which is indicated at 52a in Fig. 5 and which will be maintained by the automatic operation of the float when the valve 59 is set at a predetermined position. However, the position of the valve may be changed to regulate the quantity of liquid discharging to the tubes 32 to control the rate of discharge from the tubes by evaporation of the liquid. It will be understood that the level of the liquid within the portion 29 of the tube which connects the legs 30 and 31 will also correspond to the level within the tubes 32 and receptacle 40 with the valve in said predetermined position.

The passage of the hot gases discharging from the furnace through the casing or tubular section 16 will so heat the tubes as to effect rapid evaporation of the liquid therein. The steam or vapor resulting from such evaporation constantly accumulates within the portions of the tubes lying above the predetermined level of the liquid for discharge through the pipes 37a and 37 to the chamber 13 of the hot air furnace for mixture with the air therein, whereby to properly humidify the air before permitting it to pass through the flues 12 to the rooms or compartments to be heated. However the steam or vapor may be discharged directly to the rooms through the pipes 37a and 39a, the branch pipes 41a, and the registers 42a, only one of which is shown.

It will also be understood that by means of the

relatively small diameters of the tubes shown that the water will be permitted to boil or percolate in the upper sections of the individual tubes to produce the steam or vapor for discharge from the heater without forcing any of the water into the vapor delivery tube, since the connecting section 29 between the upper and lower tube sections 30 and 31 will serve as a continuous drain to the lower or supply section.

As previously stated, the inclination of the loops of the tubes 32 and that of the U-shaped tube 29 with respect to the horizontal is such as to permit of a rapid return of the unevaporated liquid from the upper to the lower portions of the tubes or to the supply line without producing undue back pressure therein. Furthermore, this construction tends to keep the intake of the heater relatively cool and to prevent the forming of steam therein.

It will be understood that the cross sectional area of the tube casing 16 can readily be proportioned to compensate for the loss of area resulting from the mounting of the tubes within the casing so as not to interfere with the proper flow of the heated gases through the smoke pipe.

The upper wall of the casing has a tubular extension 66 which is provided with a removable cap 67 as shown in Fig. 5. The extension is provided in order to permit one section of the smoke pipe to be attached thereto when a different smoke pipe arrangement is employed from that shown, in which case the extension will constitute the inlet of the casing, the removable cap 67 being then used to close one or the other of the tubular ends 24 and 25 of the casing.

Means is provided for supporting the heater in addition to the support afforded by the smoke pipe of the furnace or other heating plant, this means preferably comprising one or more wires 68 having their lower ends suitably connected with the casing and their upper ends connected with suitable overhead supporting means, such, for example, as the floor 43a overlying the furnace.

It will be understood that the heater casing 16 constitutes in effect a section of the flue for carrying off the waste gases discharging from the fuel burning heater 10, which, as previously stated, may be a hot air heater or a steam or hot water heater or boiler.

It will be further understood that the term "air chamber" embodied in certain of the claims may be the hot air chamber of a furnace or other air heater, or a room or other compartment containing air to be humidified.

We claim:

1. Liquid evaporating means for supplying vapor to a source of heated air for mixture therewith, comprising a casing adapted for connection with the smoke pipe of a furnace and for the passage of the waste gases discharging from the furnace, a liquid holding device within said casing for holding liquid in position to be heated and vaporized by the heat of said gases, said device comprising upper and lower tubular heads and a plurality of individual tubes disposed approximately in vertical planes within the casing and each formed to include superimposed loop-like portions having inlet and outlet ends connected respectively with said lower and upper heads, said upper head having an outlet for the vapor, a liquid holding tank, a supply conduit for the liquid terminating within the tank, an outlet conduit leading from the tank and communicating with said lower head, a valve within the tank

for controlling flow of liquid thereinto through said supply conduit, a float within the tank for operating the valve to close said supply conduit when the liquid within said tank reaches a predetermined level at a substantial distance below the outlet ends of said tubes, and a metering valve connected with said outlet conduit and adjustable to limit the rate of flow of the liquid from said tank to said tubes to limit the amount of liquid which may be vaporized, the portions of the tubes above the level at which the liquid is vaporized constituting steam or vapor receiving conduits in position to be contacted by the waste gases flowing through the casing to cause further heating of the vapor.

2. Liquid evaporating means for supplying vapor to a source of heated air for mixture therewith, comprising a casing having walls adapted for connection with the smoke pipe of a hot air furnace or heater to provide for the passage of the waste gases discharging from the furnace through the casing, a heating unit within said casing for receiving and vaporizing the liquid comprising a substantially U-shaped conduit mounted adjacent one of the walls of the casing with its opposite portions disposed one above another and constituting upper and lower heads, a plurality of individual tubes each bent to form superimposed loop-like portions extending longitudinally of the casing in position to be contacted by the heated gases flowing through the casing, said tubes having their inlet and outlet ends connected respectively with said lower and upper heads and said U-shaped conduit and tubes being removable from the casing as a unit, a liquid holding receptacle, a supply pipe for supplying liquid to the receptacle, an outlet conduit extending from the receptacle to said lower head, a valve for controlling flow of liquid into said receptacle through said supply pipe, a float within the receptacle operatively connected with the valve and serving to move it to closed position when the liquid is at a predetermined level within the receptacle at a substantial distance below the outlet ends of said tubes, and a metering valve mounted within the receptacle for limiting the flow of liquid from said receptacle through said outlet conduit to said lower head.

3. Liquid evaporating means for supplying vapor to a source of air for mixture therewith, comprising a casing connected with the outlet of a furnace or heater through which the waste gases are discharged, liquid holding means within the casing in position to be heated by the gases discharging through the casing, said holding means having an outlet for the vapor, a liquid supply tank having an inlet and a supply connection leading from the tank to the liquid holding means, a valve for controlling said inlet, a float within the tank for operating the valve to close said inlet when the liquid is at a predetermined level within the tank, the tank being so positioned relative to the liquid holding means as to establish a maximum level within the liquid holding means materially below said vapor outlet to provide a substantial space within said holding means above the liquid level therein so that vapor may occupy said space and be subjected to the heat of the gases passing through said receptacle, and a metering valve connected with said supply connection and adjustable to regulate the flow of the liquid from said tank to the holding means to afford varying operating levels for the liquid therein below said maximum level, to vary the proportions of air and vapor

to be mixed under different operating conditions.

4. Liquid evaporating means for supplying vapor to a source of air for mixture therewith, comprising a casing connected with the outlet of a furnace or heater through which the waste gases are discharged, liquid holding means within the casing in position to be heated by the gases discharging through the casing, said holding means having an outlet for the vapor, a liquid supply tank having an inlet and a supply connection leading from the tank to the liquid holding means, a valve for controlling said inlet, a float within the tank for operating the valve to close said inlet when the liquid is at a predetermined level within the tank, the tank being so positioned relative to the liquid holding means as to establish a maximum level within the liquid holding means materially below said vapor outlet to provide substantial space within said holding means above the liquid level therein so that vapor may occupy said space and be subjected to the heat of the gases passing through said receptacle, said supply connection extending within the tank and having an inlet above the bottom of the tank and below the level of the liquid therein, and a metering valve for controlling the inlet of the supply connection and adjustable to regulate the flow of the liquid through said connection to the holding means to afford varying operating levels for the liquid within the holding means below said maximum level to vary the proportions of air and vapor to be mixed under different operating conditions.

5. Humidifying means for attachment to a

furnace or boiler having a smoke pipe, comprising a casing operatively connected to said smoke pipe in such manner that waste gases from said furnace or boiler pass through said casing, water holding means located at least partially within said casing and in the path of travel of said waste gases so as to be heated thereby, said water holding means being closed against ingress of waste gases thereinto, a water supply tank, conduit means connecting said supply tank to said water holding means so that water may flow from said supply tank into said holding means to a level not exceeding that in said tank, means for supplying water to said tank, float controlled valve means associated with said supply tank for determining the maximum level to which water may rise therein, said level being below the top of said casing and below the top of said water holding means so as to leave above the water level in said water holding means a substantial space in which vapor may accumulate and be further heated by heat from said waste gases, adjustable metering valve means for limiting the rate of flow of water from said supply tank through said conduit means to said water holding means, and means for conducting vapor formed in said water holding means to a point exteriorly of said casing.

6. Humidifying means according to claim 5, in which said metering valve means is located within said tank at an elevation above the bottom thereof.

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