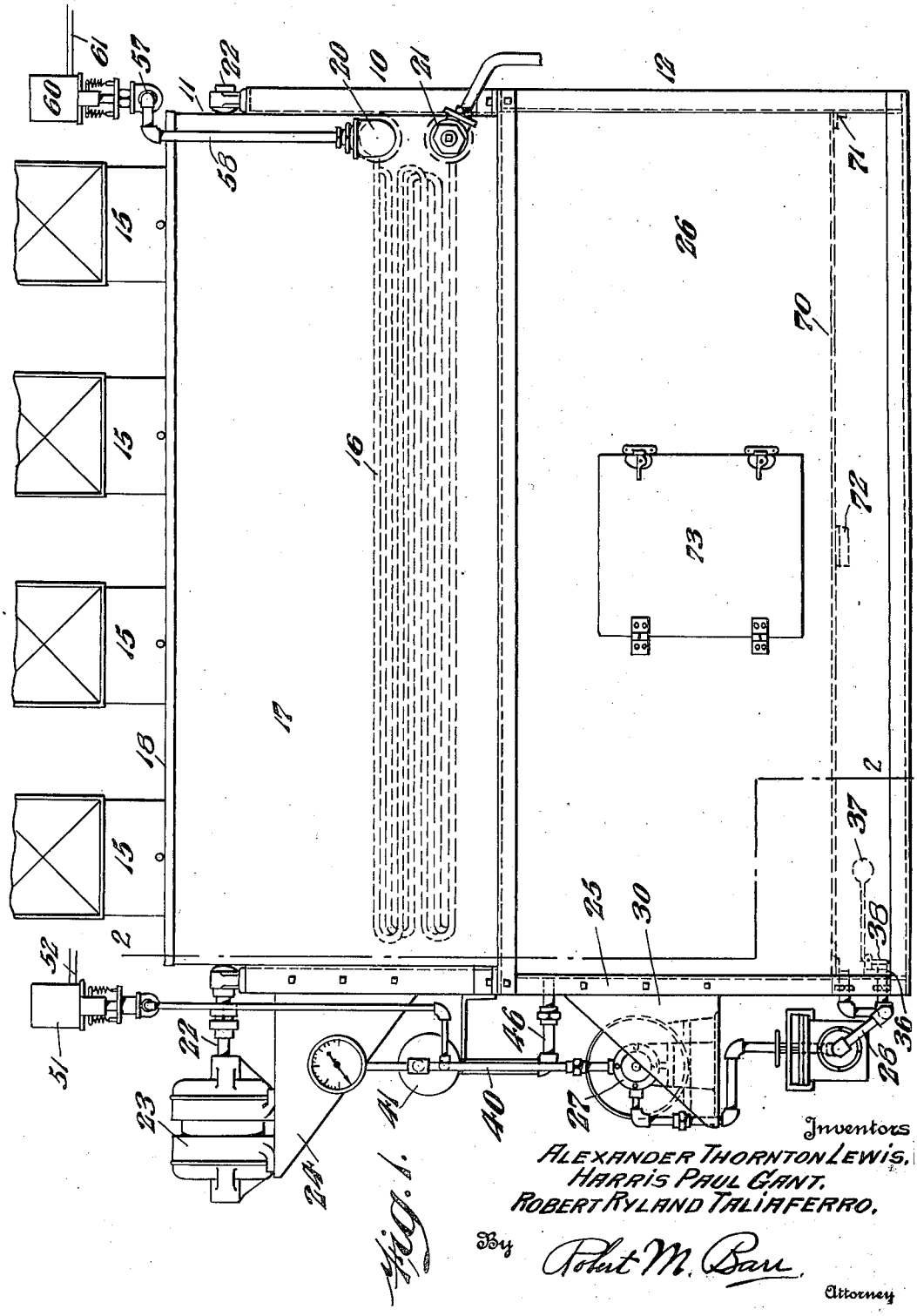
March 18, 1930. A. T. LEWIS ET AL 1,751,043

AIR CONDITIONING APPARATUS

Filed May 10, 1927 3 Sheets-Sheet 1



Inventors
ALEXANDER THORNTON LEWIS,
HARRIS PAUL GANT,
ROBERT RYLAND TALIAFERRO,
By Robert M. Barr
Attorney

March 18, 1930. A. T. LEWIS ET AL 1,751,043

AIR CONDITIONING APPARATUS

Filed May 10, 1927 3 Sheets-Sheet 2

Fig. 2.

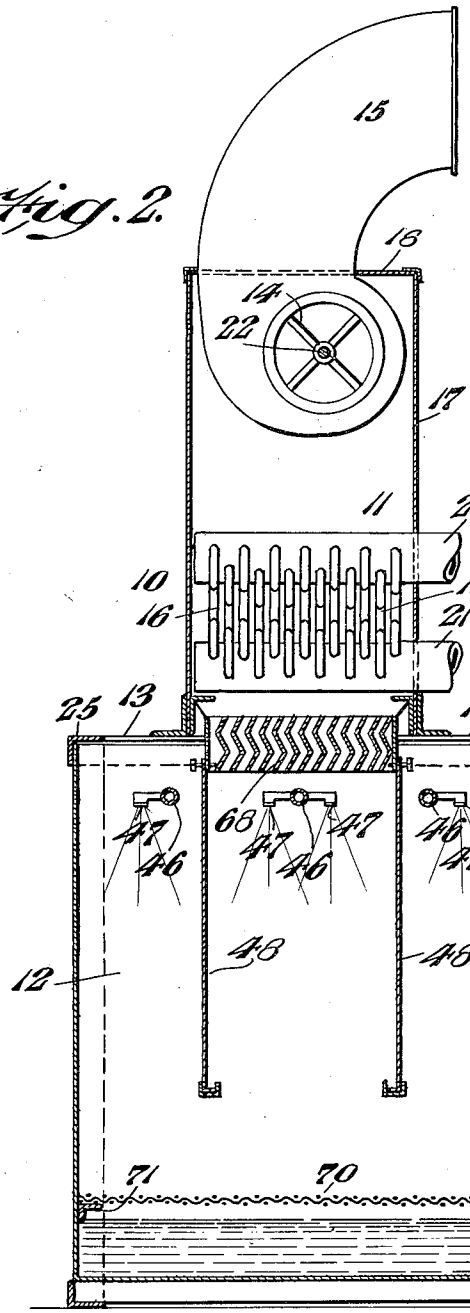
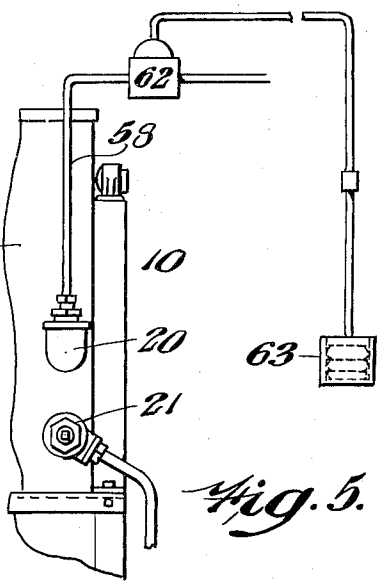


Fig. 5.



Inventors
ALEXANDER THORNTON LEWIS,
HARRIS PAUL GANT,
ROBERT RYLAND TALIAFERRO.

By Robt M. Barr

Attorney

March 18, 1930. A. T. LEWIS ET AL 1,751,043

AIR CONDITIONING APPARATUS

Filed May 10, 1927 3 Sheets-Sheet 3

Fig. 3.

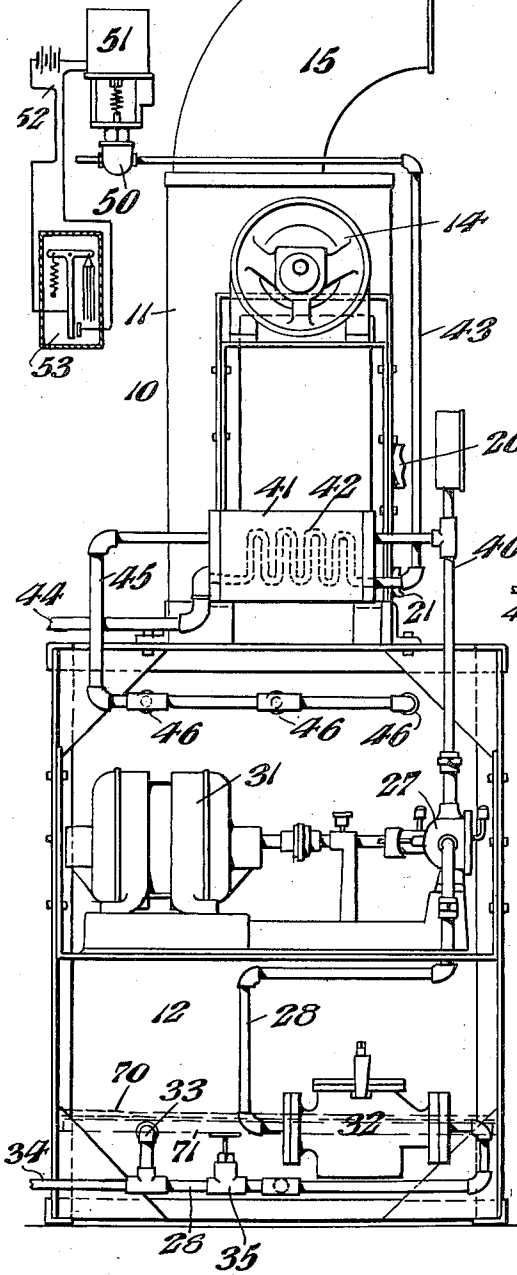
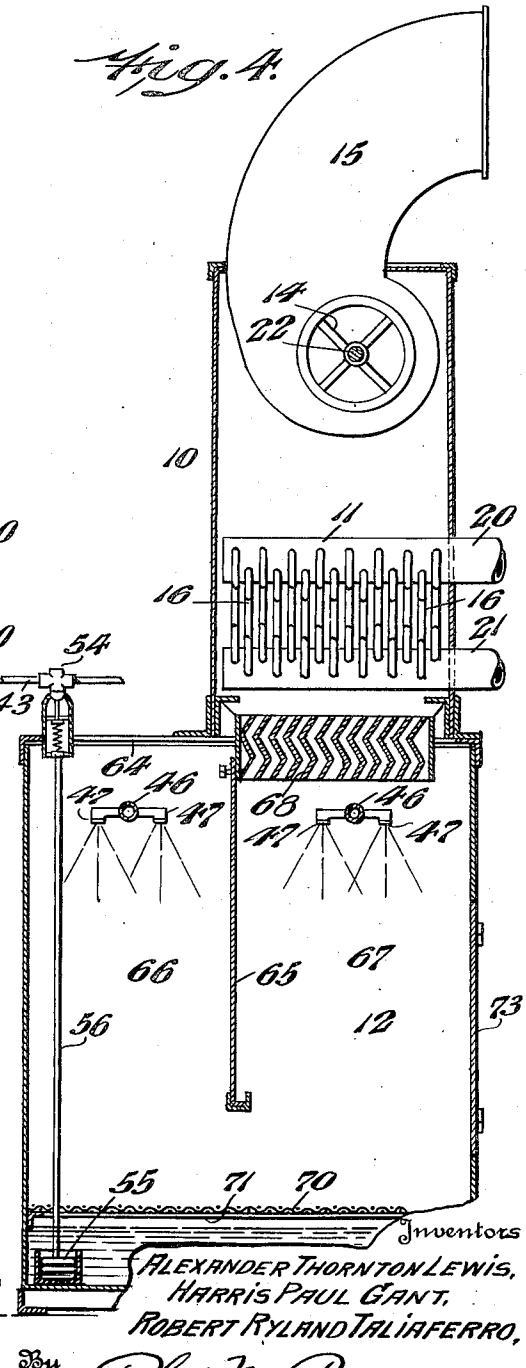


Fig. 4.



Inventors
ALEXANDER THORNTON LEWIS,
HARRIS PAUL GANT,
ROBERT RYLAND TALIAFERRO,
By Robert M. Barr.
Attorney

Patented Mar. 18, 1930 1,751,043

UNITED STATES PATENT OFFICE

ALEXANDER THORNTON LEWIS, OF MERION, HARRIS PAUL GANT, OF PHILADELPHIA, AND ROBERT RYLAND TALIAFERRO, OF BEECHWOOD PARK, PENNSYLVANIA, ASSIGNORS TO YORK HEATING AND VENTILATING CORPORATION, OF PHILADELPHIA, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA

AIR-CONDITIONING APPARATUS

Application filed May 10, 1927. Serial No. 190,312.

The present invention relates to an apparatus for controlling the condition of the air in buildings and more particularly to individual units for the respective rooms of a building.

In air conditioning apparatus heretofore in use, the general practice, as well as the only known successful manner of control has been to construct, usually as a part of the heating plant for the building, a complete air conditioning installation designed and arranged to automatically take care of the air requirements as to cleansing and humidity for the building, that is to say, all the rooms of the buildings were supplied with air which initially traversed and was treated by the single relatively large and expensive air conditioning apparatus. This apparatus as installed was designed to perform one particular function, namely, that of either a humidifier, or a de-humidifier or an air washer, though, of course, at great expense it could be reconstructed to the new function if desired.

Some of the objects of the present invention are to provide an improved air conditioning apparatus; to provide an apparatus whereby the air in the several rooms of a building is subject to independent control so that the humidity condition can be different in all the rooms, or alike in some rooms and different in others, or any desired arrangement can be obtained; to provide an improved air conditioning apparatus which can be used at will for either humidifying or dehumidifying the air in a room; to provide a humidifying apparatus capable of producing one hundred per cent saturation of the air; to provide an air conditioning apparatus arranged to automatically maintain a predetermined humidity condition of the air in a room; to provide an air heater and conditioning apparatus arranged as a complete operable unit which is so constructed that both parts cooperate to a common end, or, if desired, one part can be operated without the other; to provide a unitary apparatus for heating and conditioning air having a removable water receptacle or tank for humidifying purposes; to provide an air heating and conditioning unit for use in one room only of a building; to provide a self contained air washer, removable tank, and a self contained humidifying or dehumidifying unit; to provide a unitary humidifying apparatus wherein the humidity condition of the air in a room is controlled by the temperature of the collected water in the apparatus as distinguished from control by the temperature of the humidifying spray; and to provide other improvements as will hereinafter appear.

In the accompanying drawings Fig. 1 represents a side elevation of an air conditioning apparatus embodying one form of the present invention; Fig. 2 represents a section on line 2—2 of Fig. 1; Fig. 3 represents an end elevation of the apparatus of Fig. 1; Fig. 4 represents a sectional elevation of a modified form of the apparatus and Fig. 5 represents a detail of a modified form of automatic temperature control.

Referring to the drawings one form of the present invention comprises an air conditioning apparatus 10 arranged as a complete control unit embodying an air heater apparatus 11, an air conditioning apparatus 12, and an air circulating mechanism including air inlets 13, fans 14 and air discharge outlets 15. In the preferred arrangement the air heater apparatus 11 is mounted upon the humidifier apparatus 12 and in turn the discharge outlets 15 are mounted upon the heater apparatus 11, though within certain limitations the arrangement can be varied without departing from the scope of the invention.

The air heater apparatus 11 consists of heating coils 16 arranged in certain staggered relation in the path of a moving column of air passing from bottom to top of a casing 17 which encloses the coils 16. Preferably this casing 17 is of generally rectangular shape closed on sides and ends but open at its bottom while its top is closed by a cover plate 18 mounting the plurality of discharge outlets 15. The heating coils 16 are supplied with a heating medium such as exhaust steam by a supply header 20 and the return is made by way of a header 21.

The fans 14 serve to draw air through the casing 17 and discharge it by way of the out-

lets 15 to the room to be heated, and in this particular unit there are four such fans mounted upon a common shaft 22 which projects from one end of the casing 17 for connection to an electric motor 23 for driving purposes. For convenience this motor 23 is mounted upon a bracket 24 attached to the casing 17.

For the purpose of conditioning the air, the casing 17 is mounted upon a skeleton frame 25, preferably of angle iron type and preferably wider than the casing 17 so that when the latter is bolted or otherwise made fast to its top, at the central portion thereof, both sides of the casing 17 will be spaced from the corresponding sides of the frame 25 to form slots which serve as the aforesaid air inlets 13. The frame 25 is arranged to receive an open-top tank 26 which in assembled condition with the frame 25 gives the appearance of a solid frame-bound unit while in reality the tank is removable and can be taken out through a side of the frame 25. When the tank 26 is in assembled position in the frame 25 its open top forms a communication between the inside of the tank 26 and the outside air by way of the inlets 13. For operating purposes the tank 26 is filled to a predetermined level with water which is used for conditioning the air which is to pass through the heater casing 17 and thence to the room.

In order to bring this water into contact with the air entering by way of the inlets 13, a pump 27, preferably of the rotary type, is mounted at a convenient place with its suction pipe 28 leading to a point adjacent the bottom of the tank 26. As here shown, the pump 27 is mounted upon a bracket 30 at one end of the tank and is driven by an electric motor 31 as will be understood. The suction pipe 28 preferably includes a strainer 32 to filter sediment and the like tending to clog the supply line or damage the pump. An overflow 33 is located at a predetermined liquid level and establishes communication with the drain pipe 34 beyond the drain control valve 35. Preferably also the water is automatically replenished by a supply line 36 which is controlled by a float 37 and valve 38. The discharge pipe 40 from the pump 27 leads to a water heater 41 of the closed tank type having a heating coil 42 therein supplied with steam by a supply pipe 43 and having a return pipe 44, as will be understood. The water entering the heater 41 from pipe 40 preferably circulates about the heated coils 42 and discharges by way of pipe 45, which leads downward and terminates opposite the top portion of the tank 26 in a plurality of pipes 46 provided with spray nozzles 47. These spray pipes 46 and nozzles 47 extend transversely lengthwise of the tank 26 in such positions as to subject the entering air to a thorough treatment by the water sprayed from the aforesaid pipes 46 before it enters the heating chamber 11. In the present arrangement two of the pipes 46 are located in the path of the air entering through the inlets 13 while the third pipe 46 is located between the others and at substantially the central portion of the tank 26.

In order to cause the entering air to travel a relatively long path exposed to moisture, two baffle plates 48 are supported within the tank 26 to form partitions between the respective air inlets 13 and the bottom opening of the casing 17. These plates 48 terminate above the level of the water in the tank 26 so that the air enters the tank 26 at two opposite sides is drawn down the outer sides of the baffle plates 48 and then the two air currents meet and pass upward through the common central passage, being at all times in intimate contact with the water sprayed first in the same direction and then counter to its travel. Thus when the free edges of the baffle plates 48 is reached the air is caused to reverse its direction and travels upward into and through the heater casing 17 for discharge to the room by the outlets 15. It will be noticed that not only does the air have a greatly increased path of travel by reason of the baffle plates 48, but by first traveling with the water spray, and then in a direction against such spray the degree of humidity can be raised to the point of one hundred per cent saturation if necessary or desirable.

For the purpose of automatically regulating the degree of saturation, the temperature of the water sprayed into the entering air, may be controlled by any one of a number of control devices. In Fig. 3 one type of control is shown employing a valve 50 of the solenoid operated type 51, wherein the circuit 52 for the electrical control leads to a hydrostatic element 53, which is placed at a convenient point in the room. The valve 50 is located on the steam line 43, leading to the water heater and the amount of steam passing through the coil 42 is thus directly controlled by the humidity of the room air. In Fig. 4, another type of automatic control is illustrated wherein a valve 54 is located in the steam line 43 leading to the water heater and this valve is opened and closed mechanically by the expansion and contraction of a sylphon thermostatic 55, located in submerged relation in the water of the tank 26 and operating through a tube 56 which connects with the valve 54 and causes operation thereof. With either of these automatic controls, the system functions automatically and if the water temperature rises above the predetermined working temperature, the action of the thermostatic control is to cut down the supply of steam to the water heater 41, and thereby cause the temperature of the spray water to lower again to the selected or working temperature. Should the temperature of the water in the tank 10 fall below the predetermined work-

ing temperature, then the thermostatic elements bring about the opposite effect and increase the amount of steam supplied to the water heater in order to raise the temperature of the spray water.

For the purpose of automatically maintaining a substantially constant room temperature, an automatic control is provided for the steam which is supplied to the heater sections 16. In Fig. 1, one form of such control is shown wherein a valve 57 is located in the steam supply pipe 58 to the coil 16 and is arranged to be automatically actuated by an electro-magnetic unit 60, which is included in an electrical circuit 61 leading to any suitable type of circuit closing thermostat located in the room, the temperature of which is to be automatically controlled. In Fig. 5 another form of automatic room temperature control is shown wherein a mechanically controlled valve 62 is located in the steam line 58 to the coils 16, and is arranged to be operated through connection with a sylphon thermostat 63 located in the room the temperature of which is to be automatically maintained at a predetermined degree of heat.

In the form of the invention shown in Fig. 4, the relative arrangement of the air heater and the conditioning apparatus is changed and the former is positioned upon the rear portion of the frame 25 so as to provide a single air inlet 64 at one side only of the casing 17 for delivering air to the tank 26. In this construction one baffle plate 65 is used to form a down passage 66 for air at one side of the tank and an up passage 67 at the other side of the tank 26. The two passages 66 and 67 each have one of the spray pipes 46 arranged to discharge therein so that the air passing down the passage 66 moves with the spray, but when passing up the passage 67 travels against the spray.

In both the form of the invention shown in Fig. 2, and in Fig. 4, it is desirable to provide for the removal of extraneous water carried along with the air and to that end irregular shaped baffles 68 are mounted across the inlet to the heater casing 17 to intercept the column of moving air and cause it to alter its path so that free water is separated and falls back into the tank while the saturated air continues its travel.

For the purpose of filtering the spray water and preventing separated particles of dust, lint and the like from becoming a water soaked mass which would clog the inlet to the pump line, a screen plate 70 of relatively fine mesh is removably supported upon brackets 71 and a centrally supported rib 72 so that it lies just above the normal water level in the tank 26. Preferably this plate 70 is made in sections so that it can be readily taken out for cleaning and then replaced. In this way sediment, dust and other foreign matter in the air collects upon the top surface of the screen plate 70 and in no way can interfere with the proper circulation of the water.

For cleaning, inspection and repair purposes the tank 26 is provided with a door 73 which is normally closed and sealed against leakage by any well known packing means but can be opened whenever access to the interior of the tank is desired or necessary.

In the operation of the apparatus as a heating and humidifying unit the tank 26 is supplied with water to a level of some four or five inches, or any suitable depth for that matter, and steam is admitted to the heating coils 16 and also to the coil 42 of the water heater and upon starting the fans 14 the apparatus is ready to function. The water pump 27 now circulates water from the tank 26 through the water heater 41 and discharges it through the spray 47 so that the air entering through the inlets 13 is caused to pass through the water spray and absorb moisture therefrom. Since the collected water in the tank 26 has a thermostatic element submerged in it the temperature of this water becomes a direct control for the steam supplied to water heater coils 42 and in this way provides for control of the water spray. In this way a predetermined constant water temperature can be maintained for the spray water and the desired amount of saturation be obtained for the air delivered to the room or rooms. While the humidifying unit is relatively compact and of simple construction, it nevertheless functions in a highly efficient manner because the air passes through it in a relatively long path and this path is first in one direction following the course of spray and then in another direction directly counter to the course of the spray and hence the range of saturation control can be had from minimum to maximum. As the air with its predetermined degree of saturation leaves the tank 26 it passes through the separating baffles 68 in order that free particles of moisture can be removed and returned to the tank 26. While the temperature of the collected water in the tank 26 is taken as a control for the conditioning water there is also a control for the temperature of the air discharged from the outlets 15 and this latter control is brought about by automatic devices such as a thermostatic element located in the room the temperature of which is to be controlled, and functioning to regulate the quantity of steam supplied to the heating coils 16.

Where the apparatus is to be used for dehumidifying the air no structural change in the apparatus is required because it is only necessary to shut off the steam to the water heater 41 and allow cold water to circulate to the pipes 46 and thence be discharged by way of the sprays 47.

It will now be apparent that a complete unitary air conditioning apparatus has been

devised which preferably functions as a heater plus a controlled humidifying device but essentially the apparatus is capable of considerable flexibility in operation because in addition to its combined function of heater and humidifier, it can also be quickly converted to a cooler and a dehumidifying apparatus or if desired the heater can be separably operated from the heater.

Having now described our invention, what we claim is:

1. A unitary portable air conditioning apparatus comprising a frame, an open top tank removably mounted in said frame for holding a body of water, a heater casing mounted on said frame and arranged to leave free access for air to enter said tank, heating coils in said casing, means to introduce a water spray into said tank in the path of said air, and automatic means to maintain the temperature of said spray substantially constant.

2. An air conditioning apparatus comprising a frame, an open top tank removably mounted in said frame, a heater casing mounted on said frame to leave free access for air to enter said tank, heating coils in said casing, means to introduce a water spray into said tank in the path of said air, and a strainer interposed between the entering air and the level of the collected water in said tank and covering substantially the full water area surface.

3. An air conditioning apparatus comprising in combination an air heater, a water spray chamber, water spray apparatus located in said spray chamber, and means for causing air to travel in contact with and in the direction of travel of the water spray and then travel in contact with and counter to the travel of the water spray.

4. An air conditioning apparatus comprising in combination an air heater, a water spray chamber, water spray apparatus located in said spray chamber, means for causing air to travel in contact with and in the direction of travel of the water spray and then travel in contact with and counter to the travel of the water spray, a heater for said spray water, and a temperature control device for automatically controlling said water heater.

5. An air conditioning apparatus comprising in combination an air heater, a water spray chamber, water spray apparatus located in said spray chamber, means for causing air to travel in contact with and in the direction of travel of the water spray and then travel in contact with and counter to the travel of the water spray, and a temperature control device for automatically controlling said air heater.

6. An air conditioning apparatus comprising in combination an air heater, a water spray chamber, water spray apparatus located in said spray chamber, means for causing air to travel in contact with and in the direction of travel of the water spray and then travel in contact with and counter to the travel of the water spray, a heater for spray water, and means including a thermostatic element submerged in the collected water in said chamber for automatically controlling said water heater.

7. An air conditioning apparatus comprising in combination an air heater, a water spray chamber, water spray apparatus located in said spray chamber, means for causing air to travel in contact with and in the direction of travel of the water spray and then travel in contact with and counter to the travel of the water spray, and means including a thermostatic element located in the zone to be controlled for automatically controlling said air heater.

8. An air conditioning apparatus comprising a vertically arranged self-contained air heater and water spray chamber, an apparatus for spraying water vertically in said chamber, means to cause air to pass through said chamber and said heater, and means for causing said air to travel in contact with said water in the direction of travel of said water and also in contact with said water in a direction opposite to the travel of said water.

9. An air conditioning apparatus comprising a vertically arranged self-contained water spray chamber and a superposed air heater communicating with said chamber, a device for spraying water into said chamber towards the bottom thereof, means to cause air to pass successively through said chamber and through said air heater, and means to direct said air towards the bottom of said chamber and then towards the top of said chamber whereby the air moves at one time with the water spray and at the other time counter to said water spray.

10. An air conditioning apparatus comprising a vertically arranged self-contained water spray chamber and a superposed air heater communicating with said chamber, a device for spraying water into said chamber towards the bottom thereof, means to cause air to pass successively through said chamber and through said air heater, means to direct said air towards the bottom of said chamber and then towards the top of said chamber whereby the air moves at one time with the water spray and at the other time counter to said water spray, and means for automatically controlling the humidity of said air.

11. An air conditioning apparatus comprising a vertically arranged self-contained water spray chamber and a superposed air heater communicating with said chamber, a device for spraying water into said chamber towards the bottom thereof, means to cause air to pass successively through said chamber and through said air heater, means to direct said air towards the bottom of said chamber

and then towards the top of said chamber whereby the air moves at one time with the water spray and at the other time counter to said water spray, and means for automatically controlling the temperature of said air.

12. A self-contained air washing, cleaning and heating apparatus comprising in combination an air heater, a water spray chamber, means for causing air to pass successively and vertically through said chamber and through said air heater, and means for spraying water in said chamber in the direction of travel of said air.

13. A self-contained air washing, cleaning and heating apparatus comprising in combination an air heater, a water spray chamber, means for causing air to pass successively and vertically through said chamber and through said air heater, and means for spraying water vertically in said chamber and counter to the direction of travel of said air.

14. A self-contained air washing, cleaning and heating apparatus comprising in combination an air heater, means for causing air to pass successively and vertically through said chamber and through said air heater, means for spraying water in said chamber in the direction of travel of said air, and a removable tank constituting a water spray chamber and holding a body of water exposed to the travelling air.

15. An air conditioning apparatus comprising a self-contained water spray chamber and a superposed air heater communicating with said chamber, a device for spraying water into said chamber towards the bottom thereof, means to cause air to pass successively through said chamber and through said air heater, and means to direct said air towards the bottom of said chamber and then towards the top of said chamber whereby the air moves at one time with the water spray and at the other time counter to said water spray.

16. An air conditioning apparatus comprising a self-contained water spray chamber and a superposed air heater communicating with said chamber, a device for spraying water into said chamber towards the bottom thereof, means to cause air to pass successively through said chamber and through said air heater, means to direct said air towards the bottom of said chamber and then towards the top of said chamber whereby the air moves at one time with the water spray and at the other time counter to said water spray, and means for automatically controlling the humidity of said air.

17. An air conditioning apparatus comprising a self-contained water spray chamber and a superposed air heater communicating with said chamber, a device for spraying water into said chamber towards the bottom thereof, means to cause air to pass successively through said chamber and through said air heater, means to direct said air towards the bottom of said chamber and then towards the top of said chamber whereby the air moves at one time with the water spray and at the other time counter to said water spray, and means for automatically controlling the temperature of said air.

18. An air conditioning apparatus comprising in combination a self-contained water spray chamber, an apparatus for spraying water vertically in said chamber, and means for causing air to travel through said chamber in contact and in the direction of travel of said water and also in contact with but opposite to the travel of said water.

Signed at Philadelphia, county of Philadelphia, State of Pennsylvania, this 28th day of April, 1927.

ALEXANDER THORNTON LEWIS.
HARRIS PAUL GANT.
ROBERT RYLAND TALIAFERRO.