April 12, 1938. H. J. MOLONEY 2,113,896

AIR CONDITIONING SYSTEM

Filed March 20, 1934 3 Sheets-Sheet 1

Fig. 1.

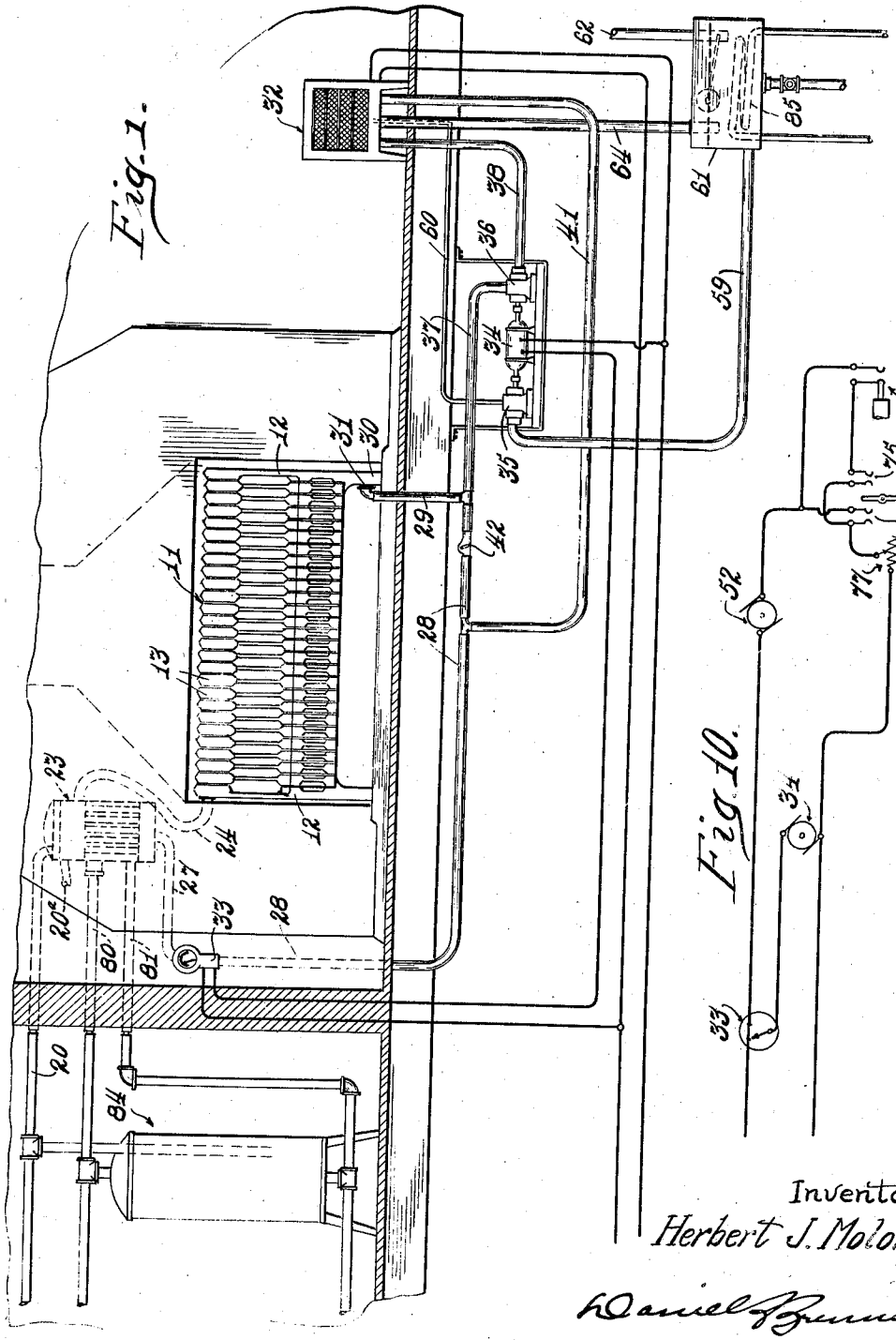


Fig. 10.

Inventor.
Herbert J. Moloney.
Daniel Bauman
Attorney

April 12, 1938. H. J. MOLONEY 2,113,896

AIR CONDITIONING SYSTEM

Filed March 20, 1934 3 Sheets-Sheet 2

Fig. 5.

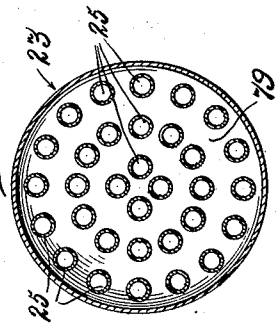


Fig. 6.

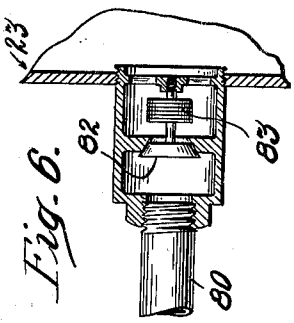


Fig. 4.

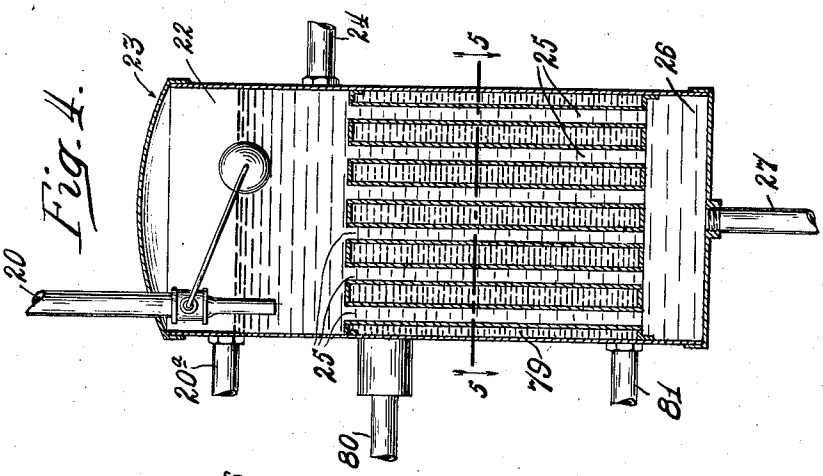


Fig. 2.

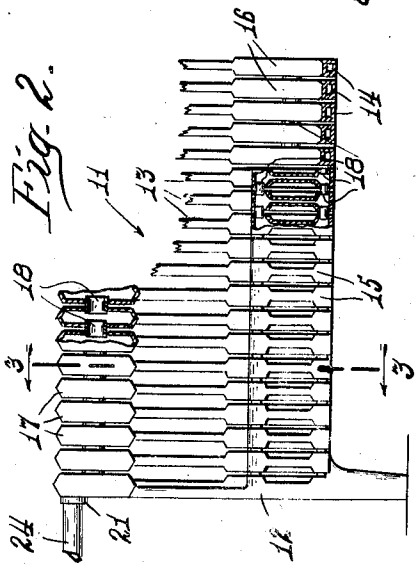
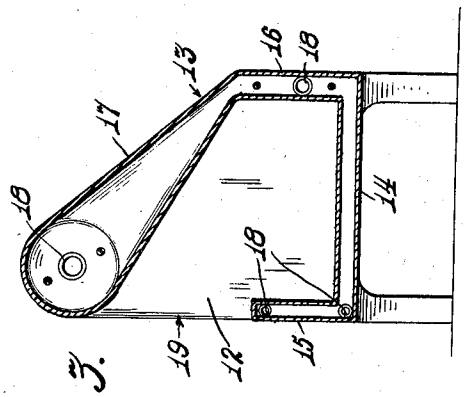


Fig. 3.



Inventor.
Herbert J. Moloney.
Daniel F. Brennan
Attorney.

April 12, 1938. H. J. MOLONEY 2,113,896

AIR CONDITIONING SYSTEM

Filed March 20, 1934 3 Sheets-Sheet 3

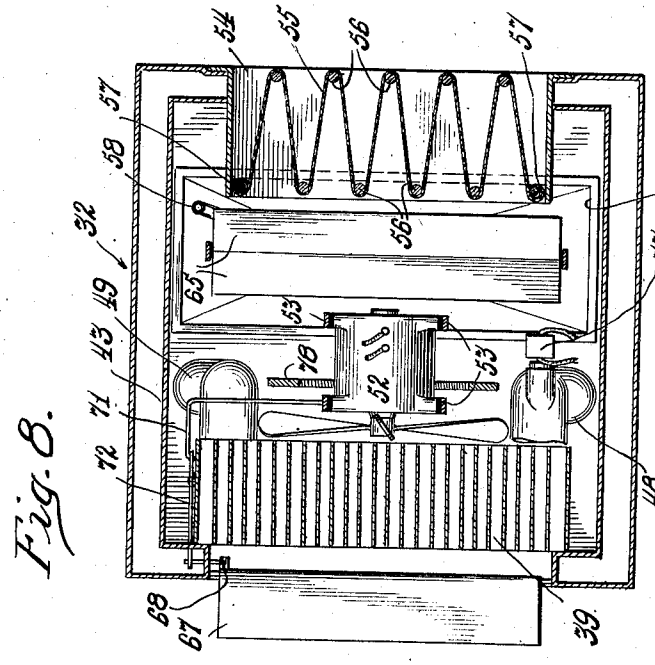


Fig. 8.

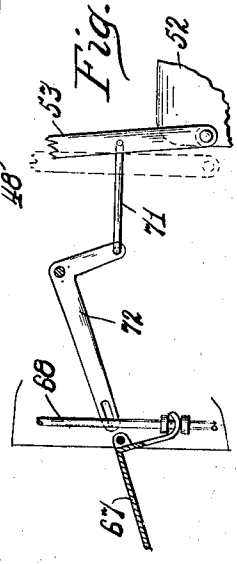


Fig. 9.

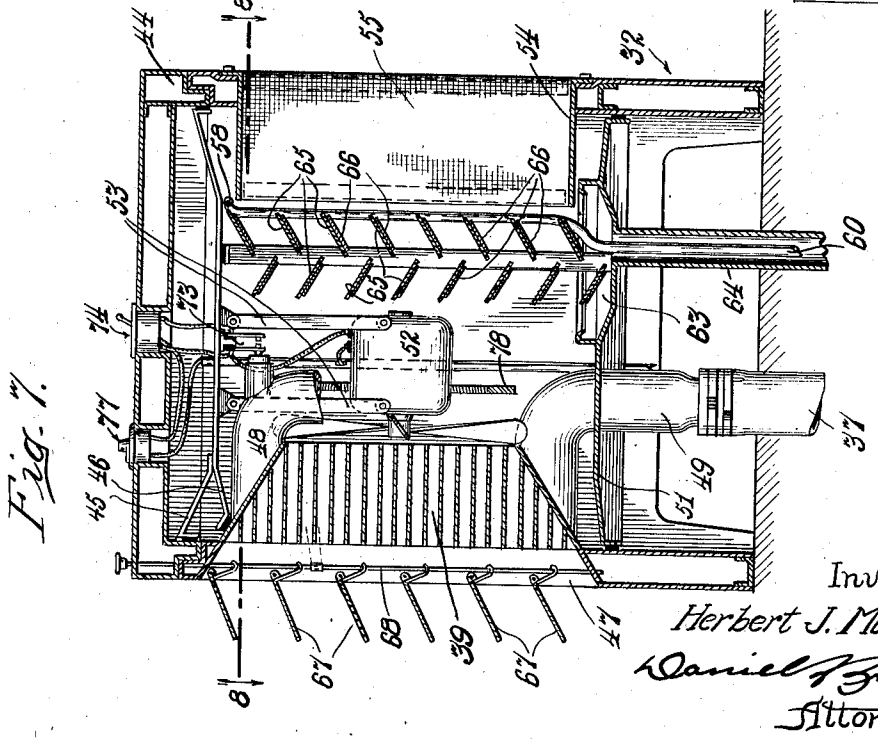


Fig. 7.

Inventor.
Herbert J. Moloney.
Daniel Brennan
Attorney.

Patented Apr. 12, 1938

2,113,896

UNITED STATES PATENT OFFICE

2,113,896

AIR CONDITIONING SYSTEM

Herbert J. Moloney, Chicago, Ill.

Application March 20, 1934, Serial No. 716,514

15 Claims. (Cl. 257—138)

The invention relates to improvements in air conditioning systems and particularly to an inexpensive system incorporating means to heat or cool pre-washed, filtered, medicated air and effect uniform controlled distribution thereof.

An object of the invention is to provide an improved arrangement of heating, cooling and humidifying units including novel automatic control elements wherein such units cooperate to effect rapid and efficient conditioning of atmosphere.

Another object is to provide an improved air conditioning system with novel, flexible, self-contained, insulated hot water conduits.

Another object is to provide an air conditioning system with selective means to heat or cool air and efficiently filter, wash, medicate, and distribute such heated or cooled air to the atmosphere.

Another object is to provide saturation means for a filter curtain which efficiently backwashes said curtain to prevent the accumulation of foreign matter thereon.

Another object is to provide means to cool a fluid by dehydrating and cooling air and subjecting said fluid to the temperature of said dehydrated cooled air.

Another object is to provide an air conditioning unit with a novel mounting for a fan motor including means to effect automatic mechanical opening or closing of shutters therein.

The foregoing, and such other objects of the invention as will appear hereinafter as the description proceeds, will be more readily understood from a perusal of the following specification, reference being had to the accompanying drawings, in which:—

Figure 1 is a diagrammatic view of the air conditioning system showing the relative arrangement of the various units thereof.

Figure 2 is a fragmentary elevational view, partly in section, of the fireplace boiler.

Figure 3 is a vertical sectional view taken on lines 3—3 of Figure 2.

Figure 4 is a vertical sectional view through the safety expansion tank.

Figure 5 is a horizontal sectional view taken on lines 5—5 of Figure 4.

Figure 6 is a sectional view of the thermostatic control valve in the high pressure water system of the safety expansion tank.

Figure 7 is a vertical central sectional view through the improved air-conditioning unit.

Figure 8 is a horizontal sectional view taken on line 8—8 of Figure 7.

Figure 9 is a fragmentary elevational view showing the mechanical connection between the blower fan and shutters in the air conditioning unit.

Figure 10 is a wiring diagram of the electrical circuit in the improved system.

The improved air conditioning system is particularly designed for use under various climatic conditions and includes means to heat prewashed, filtered, medicated moist or dry air before distribution; or to efficiently cool such air before it is distributed to the atmosphere. Its efficiency as a heating unit is particularly appreciated where building and climatic conditions do not warrant the installation of expensive heating plants. In such climates it is customary to provide heat when necessary by means of an open fireplace but it has been found objectionable in that such means fails to provide efficient heat radiation and is otherwise inefficient in that most of the heat units are lost through the smoke outlet of the fireplace. The foregoing objections to known methods of heating are avoided by the improved system which includes provision of a novel hot-water boiler grate in immediate contact with the fire in the fireplace whereby the heat units are transferred with slight loss to the hot water in the system and rapidly dissipated through novel air conditioning units positioned where most efficient.

The improved boiler 11, illustrated in Figures 1, 2, and 3, may be of any suitable type cast or otherwise constructed in one piece, or built up, as shown, of a plurality of sections in a manner similar to the construction of known types of hot water radiators. The boiler grate 11, as shown, consists of end section 12 and like intermediate sections 13, each preferably being formed with a substantially horizontal grate-bar 14 and vertical upwardly extending tubular portions 15 and 16 respectively at each end. The grate-bar 14 preferably is hollow and in communication with said upwardly extending sections 15 and 16 and the said section 15 is closed on its free end while the extension 16 has an upwardly inclined crosshead 17 which terminates in vertical alignment with the closed section 15 but spaced thereabove. The end sections 12 provide end walls and they and the intermediate sections 13 are joined together in any approved manner known to radiator construction. The joined sections are interconnected at suitable points by nipples 18 to provide a unitary hollow structure having a large opening 19 to receive fuel for burning on the grate formed by grate bars 14. In installations where

a fire-place is not available, the hot-water boiler grate may be encased in a fire-brick housing having a fuel supply opening, providing access to the opening 19 and a suitable ash removal opening below the grate bars.

The outlet 21, provided in one of the end sections 12 of the hot-water boiler grate 11 is connected with an expansion chamber 22 in expansion tank 23, through flexible conduits 24, said tank preferably being built within or otherwise concealed behind the walls of the fire-place or building. The water entering the expansion tank 22 from the boiler flows downwardly through a plurality of flues 25 into a lower chamber 26 which is connected, through flexible conduits 27, 28 and 29, with the inlet opening 31 provided in one of the legs 30 of the opposed end section 12 of the boiler. The tank is provided with the usual float controlled water supply inlet line 20 and overflow 20a.

The hook-up described allows thermo-syphon circulation of water through the boiler 11 and expansion tank 23 during the initial application of heat and such circulation continues until the temperature of the water reaches a predetermined degree, preferably 180 degrees Fahrenheit, at which time, means is actuated to stop the thermo-syphon circulation and cause forced water circulation through air conditioning units 32. This change in circulation of the water is effected by means of a thermostatic switch 33 connected between conduits 27 and 28 which, upon operation, closes the electric circuit to an electric motor 34 which operates water pumps 35 and 36.

The pressure side of the pump 36 is connected by flexible conduit 37 with line 28, and flexible conduit 38 connects the negative pressure side with a radiator 39 provided in the air conditioning unit 32 which receives its water supply through flexible conduit 41 which is connected with line 28. Operation of the pump 36 closes a check valve 42 provided in conduit 28 between the connection of conduits 29 and 41 therewith, and allows the hot water leaving the boiler grate through conduit 24 to pass through the expansion tank 23, conduit 27, thermostatic switch 33, conduits 28 and 41, through the radiator 39 and to the pump 36 through conduit 38, from where it is returned to the inlet side of the hot water boiler through conduits 37 and 29. As noted, the various conduits are flexible and to this end it is preferable to utilize a specially constructed rubber composition tubing which may be readily fished through existing walls of a building and which is in itself a sufficient insulator to prevent loss of heat units. Such tubing has been found more serviceable than metal pipe under certain climatic conditions.

It can readily be understood that the use of a thermo-syphon circulation system of the type described, at the initial heating, insures rapid heating of the water to the desired temperature, which preferably is approximately 180 degrees, before said water is circulated through the air conditioning units 32, which are effective at temperatures of approximately 150 degrees Fahrenheit to provide sufficient heat under normal atmospheric temperatures. One feature of the present invention resides in the provision of means to supply warm conditioned air and this is insured by maintaining the average temperature of the air conditioning units at 150 degrees Fahrenheit. At such temperatures there is no cooking of dust which is the present source of irritant in heated air.

Any suitable type of heat dissipating radiator may be used in this system, however, it is preferable that an air conditioning unit substantially like that illustrated in Figures 7 and 8 be used whereby the air may be filtered, washed, medicated, and forcibly discharged therefrom in a predetermined volume and direction to insure efficient distribution of conditioned air where most desired.

As shown in Figures 7 and 8, the air conditioning unit 32 preferably is contained within a suitable heat-insulated metal cabinet 43 including a removable cover 44 from which the various elements contained therein preferably are suspended. The radiator element 39 preferably of the "honeycomb" type, is shown suspended from straps 45—46 carried on the cover 44 preferably adjacent an opening 47 in one wall of the cabinet 43. Inlet and outlet pipes 48 and 49 respectively extend rearwardly and downwardly therefrom through the bottom 51 of the cabinet for connection with the flexible conduits 41 and 38 respectively. An electrically operated blower fan 52 preferably is suspended from straps 45—46 in the cover 44 by suitable links 53 (for a purpose to be described later) which, when in operation, will draw air through an opening in the opposed wall in the cabinet 43 and force it through the passages in the radiator 39 for distribution throughout the room in which the air conditioning unit is placed.

It is preferable that air entering the cabinet 43, upon operation of the blower fan 52, be filtered and to this end a filter curtain cabinet 54 having a muslin filter 55 trained over suitable rollers or bars 56 alternately positioned adjacent opposed edges of the filter cabinet 54 is provided. It is desirable that the end rollers 57 be operable manually to draw the filter muslin from one roller to the other whereby a clean surface may be presented upon rolling a previously exposed surface upon one or the other of the rollers of 57. To further cleanse air and to increase the humidity thereof when necessary, a spray 58 is provided immediately adjacent the inner end of the filter cabinet 54, said spray receiving its supply through pump 35 and conduits 59 and 60, the former being connected with a suitable reservoir tank 61 having a float controlled water supply inlet pipe 62 therein. Excessive water from the spray not deposited on the filter 55 or carried away by the passage of air through the cabinet, is received in a suitable drain pan 63 provided in the bottom 51 of the cabinet 43 which returns the excessive water through drain 64 to the tank 61. Should medication of the air be desired, as when the system is installed in hospitals or the like, small quantities of formaldehyde may be supplied to the water in the spray supply tank 61, which will be supplied to the air passing through the spray. After passing through the filter cabinet 54 the air passes over a plurality of hydrating or dehydrating elements including copper plates 65 suitably spaced apart and preferably suspended from straps 45—46 on the cover 44. Moisture absorption material 66 preferably a pure linen pad is provided on the upper face of each plate whereby the excessive moisture is positively removed from the air and may drop by gravity into the drain pan 63. The plates 65 preferably are staggered as shown and slightly tilted whereby any excess of moisture deposited thereon by the spray drips onto the next succeeding plate and finally is deposited in the drain pan 63.

The outlet opening 47 in the cabinet 43 normally is closed by a plurality of pivotally mounted shutters 67 which are connected for operation in unison by a rod 68 slidably mounted in the cabinet. Upon operation of the blower fan 52 the shutters are adapted to open, and to this end the fan motor 52 is, as previously indicated, suspended by parallel straps 53 which are connected by link 71 and bell-crank 72 to the shutter rod 68. The motor 52 normally hangs with the straps 53 substantially vertical while out of operation, but upon operation air resistance urges the motor rearwardly, as shown in Figure 9, and opens the shutters. The motor will remain in this position during operation hence the shutters will remain open to direct air passing from the unit downwardly across the floor of the room in which the unit is placed. To minimize noise in operation, the fan and various other units making up the air conditioning unit are suitably cushioned in any manner such as, by providing rubber washers at all pivotal or fixed connections.

The unit 33 has been described as an air heating and conditioning unit receiving heat from the fireplace boiler 11, and in such an arrangement the operation is substantially as follows. Following circulation of the hot water through the radiator 39, upon operation of thermostatic switch 33 to operate pump 36, the temperature of the water flowing through the radiator 39 will rapidly increase. When said temperature reaches approximately 150 degrees Fahrenheit, a thermostatic switch, indicated in Figures 7 and 10 at 73, is closed. Another switch 74 preferably mounted in the cover 44 of the cabinet, having previously been positioned to close the circuit between contacts 75, the circuit to the motor 52 is completed and operation of the blower fan opens the shutters 67 and provides forced air circulation. The switch 74 is provided with additional contacts 76 which, when closed, operates the blower fan independently of the temperature of the water in the fireplace boiler radiator system. A rheostat 77 also is provided in the fan motor circuit to provide means to regulate the rate of air-flow through the radiation unit. This is essential to efficient operation because the air temperature is dependent upon the amount of heat in the air, and its moisture and velocity. The cabinet 43 also contains an electric heating element 78 which may be placed into operation to heat the air passing through the cabinet should no hot water be available at the time heat is required.

Novel means are provided in the expansion tank 23 to dissipate excessive heat in the hot water system. As clearly illustrated in Figure 4, the expansion tank 23 includes a high pressure chamber 79, built around flues 25, which is connected with the usual water service supply system through pipes 80—81. Circulation of water through the high pressure chamber 79 normally is prevented by a valve 82 provided in the outlet conduit 80. However, when the temperature of the water in the expansion tank reaches approximately 200 degrees Fahrenheit a thermostatic control 83 on said valve 82 actuates to open said valve thus permitting water to circulate therethrough and convey the excessive heat therefrom into the service supply system 84. Immediately upon the water reaching a safer lower temperature the valve 82 closes. In this manner heat is not lost to the heating system except when heat is generated in excess of the rate of dissipation through the air conditioning units 32, and said excessive heat is utilized to heat the water in the service supply system.

When utilizing the improved system to humidify and cool hot dry air, cold water is flowed through the radiator element 39 and the spray 58 is relied upon, the sprayed water normally being substantially cooler than air temperature. If desired said water may be cooled by providing a coil 85 (Fig. 1) in tank 61 which is suitably connected with any standard refrigerator unit (not shown). The dry air passing through the cabinet under these conditions is cooled immediately upon flowing through the saturated filter curtain 55 and is partially hydrated by evaporation of moisture therefrom. As the air passes over the absorption elements including pads 66, which also are saturated by the spray supply 58, it is further hydrated. The evaporation of water from the moisture absorption pads 66 on plates 65 cools the copper plates 65 considerably below the temperature of the air coming in contact therewith, hence the plates aid in removing heat from the air flow and inasmuch as they are mechanically connected with the metallic cabinet walls the cabinet also is cooled and the efficiency of the unit as a whole is increased. The temperature of the air flowing through the cabinet is reduced by the absorption of the water inasmuch as temperature is dependent upon moisture content.

Obviously the improved air conditioner unit can be operated successfully as a de-humidifying unit particularly in a room requiring a high temperature but having excessive humidity. An example of such use is as follows: With the unit positioned in say, for example, a laundry drying room having a temperature of 100° F. and a relative humidity at the dew point, the water fed to the filter curtain and baffle plates is held at a 60° F. temperature, by the refrigeration coil 85, and fed fast enough to maintain the temperature of said filter and plates at 60° F. As the hot humid air enters the unit it is suddenly cooled about 40° at the filter and baffles. Its excess moisture thus is condensed at the filter and baffles and carried off through the drain pan. The dehydrated air then passes over the heating unit 39 and is raised to the desired temperature.

To cool a room having a 100° F. temperature and saturated air, the air dehydrated as noted above, is discharged, without heating, at about a 60° F. temperature.

It is also evident that water may be flowed through the radiator element 39 and cooled by the passage of conditioned cool air thereover and that the excess water flowing into the drain pan 63 from the curtain 55 and plates 66 also is cooled by evaporation when dry air flows through the unit. This cold water from either the radiator element or drain pan can be put to any practical use. The curtain 55 also removes gases and other impurities from the atmosphere by condensation more effectively than devices which depend upon mechanical means to effect dehydration by removal of water particles from the atmosphere.

Although exemplary embodiments of the present invention have been shown in detail in the accompanying drawings, and described herein, it is to be understood that the system is capable of embodying therein various modifications in detail structure and arrangement of units without departing from the spirit of the invention or the scope of the appended claims.

I claim:—

1. An air conditioning unit comprising, in combination, a cabinet having an air passage therethrough, shutters normally closing said passage, filter arranged over the air inlet, a liquid spray in said cabinet to wash and cool the air passing through said filter, means to remove excessive moisture from said washed air, an electrically operated fan operable to create a forced draft through said cabinet, selective means to control the speed of operation of said fan, and means operable upon operation of the fan to open said shutters.

2. An air conditioning unit comprising, in combination, a cabinet having an air passage therethrough, shutters normally closing said passage, a filter arranged over the air inlet, a liquid spray in said cabinet adapted to wash and cool the air passing through said filter, means adapted to cool said liquid spray, absorption means to remove excesssive moisture from said washed air, an electrically operated fan operable to create a forced draft through said cabinet, selective means to control the speed of operation of said fan, and means operable upon operation of the fan to open said shutters.

3. An air conditioner comprising, in combination, a cabinet having a heating unit therein, means operable upon the temperature of said unit reaching a predetermined degree to force air through said cabinet over said unit, an air filter in said cabinet, a water spray adapted to wash the air flowing through said filter, and a plurality of plates in said cabinet having moisture absorbing means thereon, said filter and baffles lowering the temperature of said air and removing by condensation excessive moisture from the washed air prior to its passage over the heating unit.

4. An air conditioner comprising, in combination, a cabinet having a heating unit therein, means operable upon the temperature of said unit reaching a predetermined degree to force air through said cabinet over said unit, an air filter in said cabinet, a water spray adapted to saturate said air filter and wash the air flowing through said filter, said saturated filter lowering the temperature of said air whereby excessive moisture therein is condensed, a plurality of plates in said cabinet, and moisture absorbing means on said plates adapted to further lower said air temperature to remove any remaining excessive moisture by condensation from the washed air prior to its passage over the heating unit.

5. An air conditioning unit comprising, in combination, a cabinet having an air passage therethrough, shutters normally closing said passage, a filter arranged over the air inlet, a liquid spray in said cabinet adapted to saturate said filter to wash and cool the air passing therethrough, means adapted to cool said liquid spray, absorption means to remove excessive moisture from said washed air, a fan operable to create a forced draft through said cabinet, and means operable upon operation of the fan to open said shutters.

6. An air conditioning unit comprising, in combination, a cabinet having an air passage therethrough, shutters normally closing said passage, a filter arranged over the air inlet, a liquid supply in said cabinet adapted to saturate said filter to purify, cool and dehydrate air passing therethrough, additional dehydrating means in said cabinet to remove excessive moisture from said washed air by condensation, an electrically operated fan operable to create a forced draft through said cabinet, and means operable upon operation of the fan to open said shutters.

7. An apparatus for conditioning air, comprising, in combination, a casing having an air inlet at one end and an air outlet at the other end, a plurality of spaced apart bars extending across said inlet, a filter curtain threaded around said bars to cover said inlet, a plurality of substantially horizontally disposed vertically spaced apart plates mounted in said cabinet inwardly of said curtain, an absorbent pad secured to each plate, a water supply pipe in said cabinet arranged to discharge water on said curtain and on said pads whereby said curtain and pads are saturated, a power operated fan in said cabinet operable to create a forced draft therethrough, and a radiator element arranged in the path of the air adjacent the outlet adapted to receive a continuous flow of water therethrough.

8. An apparatus for conditioning air, comprising, in combination, a cabinet having an air inlet at one end and an air outlet at the other end, a plurality of spaced apart bars extending across said inlet, a filter curtain threaded around said bars to cover said inlet, two closely related vertical rows of vertically spaced apart substantially horizontal plates mounted in said cabinet inwardly of said curtain, an absorbent pad secured to each plate, a water circulation system associated with said cabinet arranged to discharge water on said curtain and on said pads whereby said curtain and pads are saturated, a power operated fan in said cabinet operable to create a forced draft therethrough, and a radiator element adjacent the outlet adapted to receive a continuous flow of water therethrough.

9. An air conditioning unit comprising, in combination, a cabinet having an air inlet and an outlet, means in said cabinet to create an air flow therethrough, a radiator element mounted in said cabinet adjacent the air outlet adapted to have a continuous flow of cold water therethrough, a filter curtain mounted in said cabinet adjacent the air inlet, a plurality of vertically spaced apart substantially horizontally disposed cooling plates in said cabinet closely adjacent said filter curtain, absorbent elements mounted on said cooling plates, and a water supply pipe common to the filter and absorbent elements adapted to maintain said filter and absorbent elements saturated whereby said filter and cooling plates jointly cool and dehydrate the air passing through said cabinet by condensation prior to its passage around said radiator element.

10. A heat distributing unit comprising, in combination, a cabinet having an air passage therethrough, a filter curtain arranged over the inlet end of said passage, means to saturate said filter to partially dehydrate and lower the temperature of air passing therethrough, dehydrating means to condense and remove excessive moisture from said partially dehydrated air, a heating element in said cabinet through which said dehydrated air must pass on its way therethrough, an electrically operated fan operable to create a forced draft through said cabinet upon actuation of a thermo-switch responsive to the temperature of the heating element, and selective means to control the speed of operation of said fan.

11. An air conditioning unit comprising, in combination, a cabinet having .. heating unit therein, means operable upon the temperature of said heating unit reaching a predetermined degree to force air through said cabinet over said

heating element, an air filter in said cabinet, a water supply adapted to saturate said filter and partially dehydrate the air flowing therethrough, and a plurality of cooling plates in said cabinet having saturated elements thereon to lower the temperature of and condense excessive moisture remaining in the partially dehydrated air prior to its passage over the heating unit.

12. An air conditioning unit comprising, in combination, a cabinet having a heating unit therein, means operable upon the temperature of said heating unit reaching a predetermined degree to force air through said cabinet over said heating unit, an air filter in said cabinet, a water supply adapted to saturate said filter and wash and partially dehydrate the air flowing therethrough, and a plurality of cooling and dehydrating elements in said cabinet to lower the temperature of and condense the excessive moisture in the partially dehydrated washed air prior to its passage over the heating unit.

13. An apparatus for conditioning air comprising, in combination, a cabinet having an air inlet at one end and an air outlet at the other end, a plurality of spaced apart bars extending across said inlet, a filter curtain threaded around said bars to cover said inlet, two closely related vertical rows of vertically spaced apart substantially horizontal plates mounted in said cabinet inwardly of said curtain, an absorbent pad secured to each plate, a water circulation system associated with said cabinet arranged to discharge water on said curtain and on said pads whereby said curtain and pads are saturated, and a power operated fan to create a forced draft therethrough.

14. An apparatus for conditioning air comprising, in combination, a cabinet having an air inlet at one end and an air outlet at the other end, a plurality of spaced apart bars extending across said inlet, a filter curtain threaded around said bars to cover said inlet, two closely related vertical rows of vertically spaced apart substantially horizontal plates mounted in said cabinet inwardly of said curtain, an absorbent pad on each plate, a water circulation system including refrigeration means associated with said cabinet for discharging water on said curtain and on said pads, and a power operated fan for creating a forced draft through said cabinet.

15. An apparatus for conditioning air comprising, in combination, a cabinet having an air inlet and an air outlet, bars extending across said inlet, a filter curtain supported by said bars to cover said inlet, two closely related rows of spaced apart plates mounted in said cabinet inwardly of said curtain, an absorbent pad on each plate, a water circulation system including refrigeration means associated with said cabinet for discharging water on said curtain and on said pads, and means for creating a forced draft through said cabinet.

HERBERT J. MOLONEY.