March 14, 1939. H. B. HULL 2,150,224

REFRIGERATING APPARATUS

Filed July 31, 1933 3 Sheets-Sheet 1

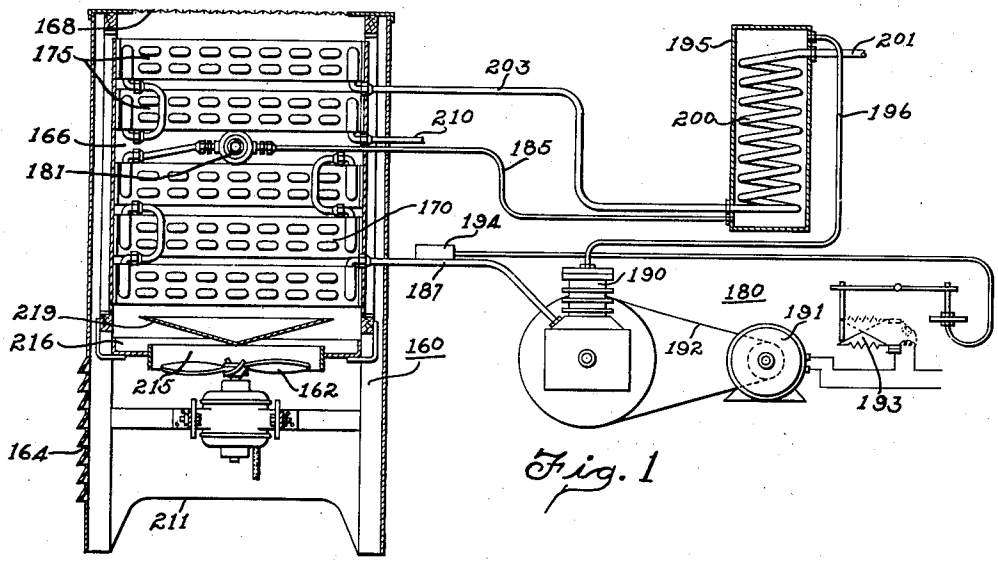


Fig. 1

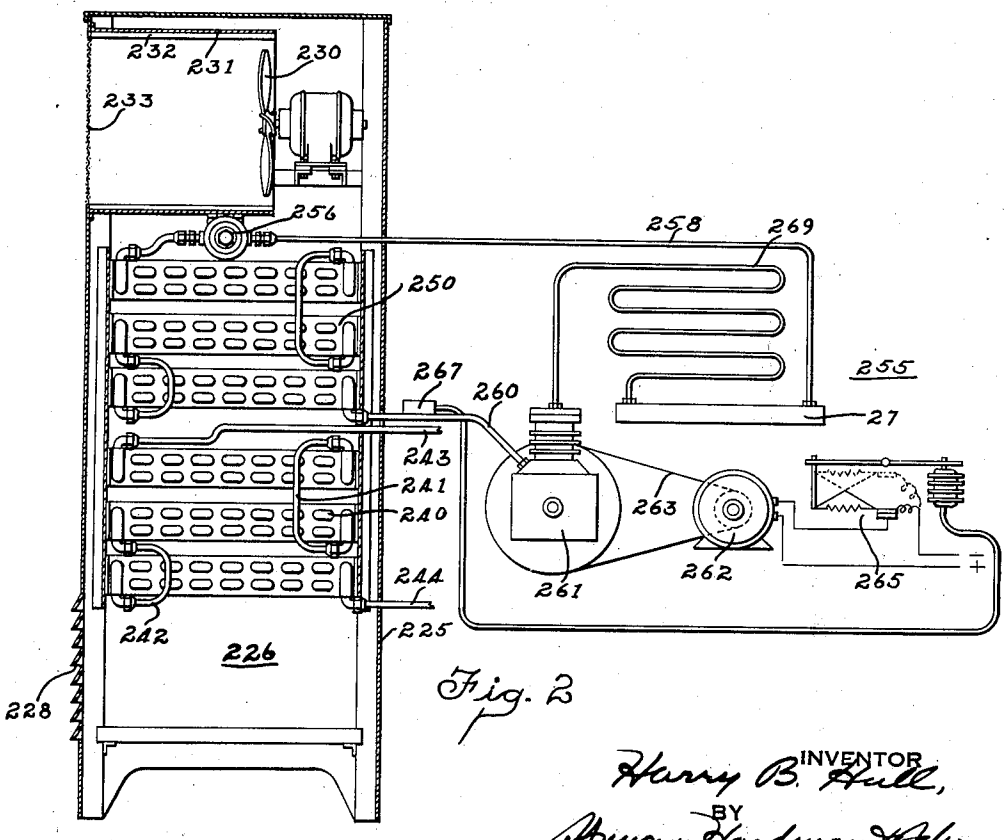


Fig. 2

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REFRIGERATING APPARATUS

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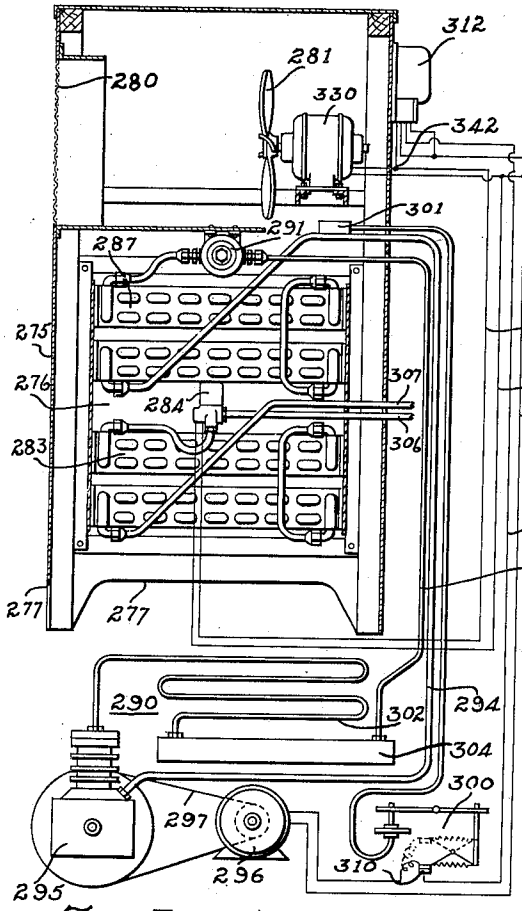


Fig. 3

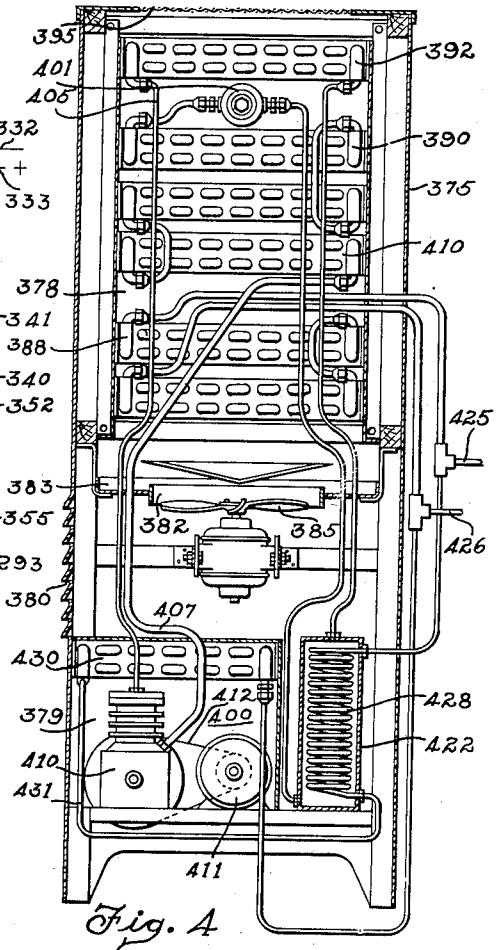


Fig. 4

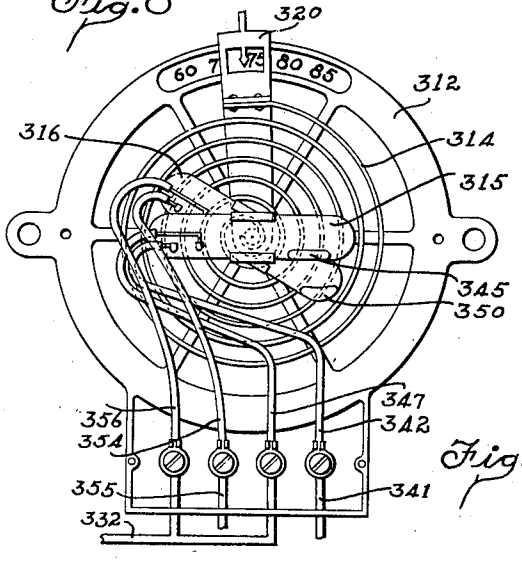


Fig. 5

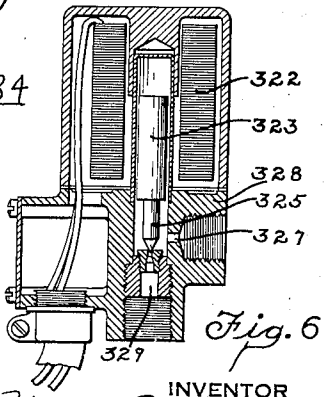


Fig. 6

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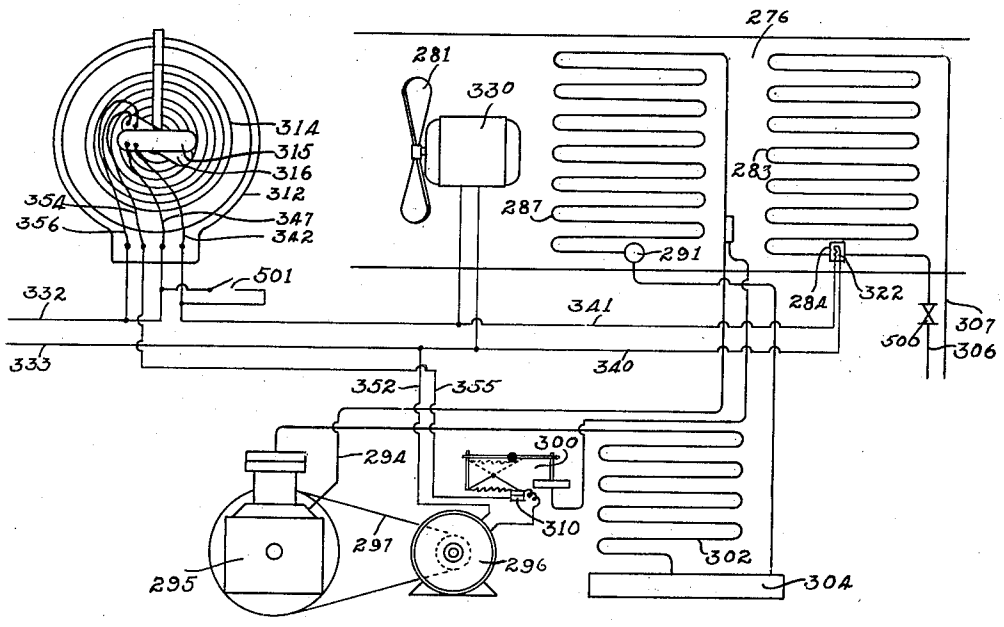


Fig. 7

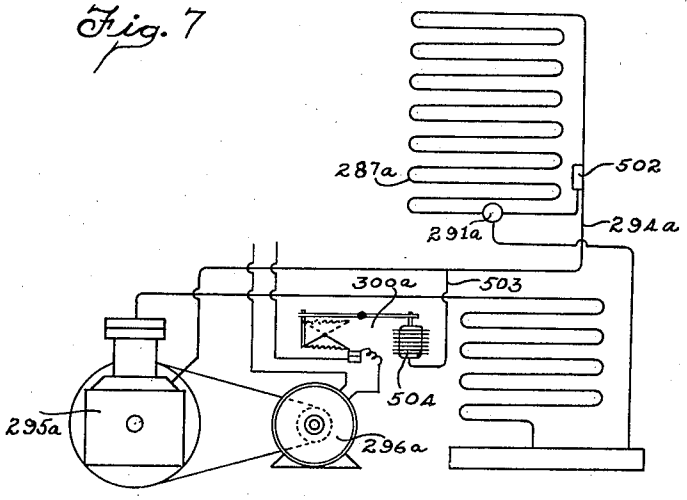


Fig. 8

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Patented Mar. 14, 1939 2,150,224

UNITED STATES PATENT OFFICE

2,150,224

REFRIGERATING APPARATUS

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Application July 31, 1933, Serial No. 682,977

20 Claims. (Cl. 62—6)

This application is a continuation in part of my copending application Serial No. 465,019, filed June 30, 1930, for Refrigerating apparatus.

This invention relates to refrigerating apparatus and more particularly to apparatus for cooling air, as, for instance, in rooms or the like.

One of the objects of the present invention is to provide an improved apparatus for cooling and circulating air in rooms or the like.

Another object of this invention is to provide an improved apparatus which automatically circulates the air in the room, reduces the humidity and maintains said air at a predetermined temperature.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings, wherein a preferred form of the present invention is clearly shown.

In the drawings:

Fig. 1 is a vertical cross sectional view, semi-diagrammatic in character, of a room cooler or air conditioner embodying my invention;

Fig. 2 is a view somewhat similar to Fig. 1; but disclosing a different arrangement of air conditioning coils and casing;

Fig. 3 is a view similar to Fig. 2, but showing automatic controls applied thereo;

Fig. 4 is a view of a unitary portable air conditioner embodying features disclosed both in Figs. 1 and 2 as well as further features;

Fig. 5 is a view in elevation of an apparatus for controlling the operation of the air conditioners herein disclosed in accordance with the temperature of the air;

Fig. 6 is a cross sectional view of the water valve shown in Fig. 3;

Fig. 7 is a diagrammatic representation of the application of the device shown in Fig. 5 to the various air conditioners; and

Fig. 8 is a diagrammatic representation of a modified portion of Fig. 7.

In the particular embodiment shown in Fig. 1 air is circulated through a cabinet 160 by means of an electrically operated fan or means 162 which draws the air through louvers 164, through an air treating zone 166 and discharges the treated air through a screened opening 168 provided in the top of the cabinet 160. A plurality of cooling coils 170 connected in series by means of pipes are adapted to cool the air to a temperature below its dew point so that when the air is rewarmed it will be at the desired relative humidity, which rewarming may be accomplished by a plurality of coils 175 disposed above the coils 170 thus preventing cold saturated air from striking occupants of the room. Refrigerant is circulated in a closed path through the coils 170 by means of a refrigerant circulating element 180 under the control of an expansion valve 181. The element 180 delivers the liquid refrigerant through pipe 185 and withdraws the gaseous refrigerant through pipe 187. The element 180 comprises a compressor 190 operatively connected with a motor 191 by belt 192. The motor 191 is controlled by a switch 193 actuated by a thermostat 194 in response to the temperature of pipe 187. The compressor 190 compresses the gaseous refrigerant and delivers it to a water cooled condenser 195 through pipe 196. The gaseous refrigerant is liquefied in the condenser 195 and from which it is delivered through pipe 185 to the coils 170. The heating coils 175 are heated by water passing through coil 200 used for liquefying the refrigerant in the condenser 195. The coil 200 used for liquefying the refrigerant is provided with an inlet 201. The water then passes through pipe 203, heating coils 175 to an outlet pipe 210. The water inlet 201 may be connected to any suitable water pressure system while the outlet pipe 210 may be connected to the waste system. In the apparatus shown in Fig. 1, the electrically operated fan 162 draws the air through the louvers 164 and some air through cutaway portions of the cabinet 160 as shown at 211. The air is then forced through an opening 215 provided in a drip or moisture pan 216 whence the air is forced along the loops of coils 170 and coils 175 and is then discharged through the screened opening 168. A bonnet or hood 219 is provided to prevent moisture from the coils from dripping through the opening 215. A thermostatic switch of the type shown in Fig. 5 may be employed for controlling the operation of the electrically operated fan 162 and the flow of current to the contacts of the switch 193 as diagrammatically shown in Fig. 7. Thus it will be noted that refrigerant is circulated through the air treated zone for cooling the air to a temperature below its dew point and that the air is later rewarmed so that the discharged air will have the desired relative humidity and that in rewarming said air a part of the heat of liquefaction of said refrigerant is utilized for heating the air.

Referring to Fig. 2 there is shown another form of room cooling or air conditioning apparatus comprising in general a cabinet 225 forming an air treating zone 226. The cabinet 225 is provided with louvers 228 through which air enters the air

treating zone 226. The air is circulated through the treating zone by means of an electrically driven fan or means 230 and is later discharged through duct 231 provided with sound insulating material 232, which duct leads to a screened opening 233 through which the air is discharged into the room being cooled. In the present instance I have provided a water flow apparatus comprising a plurality of longitudinally disposed coils 240 connected in series by means of pipes 241 and 242. The water flow apparatus is arranged for precooling the air entering the air treating zone 226. The water flow apparatus is provided with an inlet pipe 243 and outlet pipe 244. The air circulating through the treating zone is precooled by the water flow apparatus and is later cooled to the desired temperature by means of a refrigerant circulating apparatus comprising a plurality of longitudinally disposed cooling coils 250 located above the water flow apparatus in the air treating zone 226. Refrigerant is circulated through the coils 250 by means of a refrigerant circulating element 255 under the control of an expansion valve 256. The element 255 delivers refrigerant through a pipe 258 and withdraws the gaseous refrigerant through a pipe 260. The element 255 comprises a compressor 261 operatively connected with a motor 262 by means of belt 263. The motor 262 is controlled by a switch 265 actuated by a thermostat 267 in response to the temperature of pipe 260. The compressor 261 compresses the gaseous refrigerant and delivers it to an air cooled condenser 269 wherein it is liquefied and from which it is delivered to a receiver 27 to which the pipe 258 is connected. If desired, automatic means for controlling the operation of the electrically operated fan 230 and for controlling the flow of current to contacts of switch 265 of the type shown diagrammatically in Fig. 5 may be employed for controlling the operation of the apparatus shown in Fig. 2 in a manner somewhat similar to that indicated in Fig. 7.

In Fig. 3 there is shown a modified form of room cooling apparatus, adapted to be placed in a room or enclosure, comprising a cabinet or cooler chamber 275 forming an air treating zone 276. The cabinet is cut away as at 277 which permits air to enter the air treating zone at the lowermost portion thereof whence the air is later discharged through a screened opening 280. The air is circulated through the treating zone by means of an electrically driven fan or means 281. In the particular apparatus I provide a water flow apparatus comprising a plurality of cooling coils 283 extending across the cooler chamber controlled by an electrically operated valve 284 through which a cooling medium flows, such as water. I also provide a refrigerant circulating apparatus including a plurality of coils 287 located above the water flow apparatus through which a cooling medium flows, such as a volatile refrigerant. Refrigerant is delivered to the coils 287 by means of a refrigerant circulating element 290 under the control of an expansion valve 291. The element 290 delivers the liquid refrigerant through a pipe 293 and withdraws gaseous refrigerant through a pipe 294. The element 290 comprises a compressor 295 operatively connected with a motor 296 by belt 297. The motor 296 is controlled by a switch 300 actuated by a thermostat 301 in response to the temperature of pipe 294. The compressor 295 compresses the gaseous refrigerant and delivers it to an air cooled condenser 302 wherein it is liquefied and from which it is delivered to a receiver 304 which is connected to the pipe 293. The water flow coils 283 are provided with an inlet connection 306 and outlet connection 307.

In order to provide means for controlling the operation of the electrically driven fan 281 and the electrically operated valve 284 and for controlling the flow of current to contacts 310 of switch 300 a thermostatic switch 312 has been provided. As shown in Fig. 5 the thermostatic switch 312 is provided with a bimetallic thermostatic coiled blade 314 and a plurality of mercury containing tubes or bulbs 315 and 316. The switch 312 is adapted to control the valve 284 and the fan 281 at a predetermined room temperature which may be determined by the position of the adjustable handle or indicator 320 of switch 312. As shown in Fig. 6 the electrically operated valve includes a magnet winding 322 and a movable core 323 which carries the valve proper 325. The valve 284 is provided with an inlet passage 327 in a casing 328 and an outlet passage 329. When the magnet winding 322 becomes energized, the core 323 will be moved upwardly to move the valve proper 325 from the seat to thus allow unrestricted communication between the inlet passage 327 and the outlet passage 329 to thus permit the circulation of water through the coils 283. The switch 312 is adapted to place the magnet winding 322 of valve 284 and the motor 330 which operates the fan 281 in circuit with the power mains 332 and 333 when the temperature of the room attains a predetermined value, for instance, the temperature as indicated by the indicator 320. Thus when the temperature of the room reaches the point indicated by the indicator 320, the switch 312 will allow the current to be supplied to the magnet winding 322 of valve 284 and to the motor 330 to cause water to circulate in coils 283 and to cause air to circulate through the air treating zone 276 by the operation of fan 281. The circuit through the magnet winding 322 of valve 284 and through the motor 330 is as follows: Power main 333, wire 340, magnet winding 322, wire 341, motor 330, wire 342, contacts of mercury containing tube 315 which contacts are completed by the engagement of the mercury drop 345 therewith, and wire 347 which is connected to power main 332. If the temperature of the room continues to increase, for instance, to an increase of five degrees over the desired temperature as indicated by indicator 320, the bimetallic thermostatic blade 314 will cause the rotation of the mercury containing tube 316 to thus cause the mercury drop 350 to engage the contacts of the mercury containing tube 316 to complete a circuit through the contacts 310 of switch 300 to thus allow current to flow from the power mains to the motor 296 to thereby actuate the compressor 295. The circuit through the motor 296 is power main 333, wire 352, motor 296, contacts 310 of switch 300, wire 355, wire 354, contacts of mercury containing tube 316 and wire 356 which is connected with power main 332. From the foregoing it will be noted that when the temperature of the room attains a predetermined amount above the setting of the indicator 320 of switch 312, the electrically operated fan 281 and the electrically operated valve 284 will be actuated to thus cause the flow of water in the coils 283 and the circulation of air through the air treating zone 276. However, should the water flow apparatus and the fan 281 be unable to maintain the desired temperature in the room to be cooled the refrigerating element 290 would be rendered operative to supply refrigerant to the coils 287 to thus reduce the temperature in the room to the temperature indicated by the indicator 320 of switch 312.

When the temperature of the room is reduced to a temperature below that indicated by the means 320, the thermostat 314 will cause the rotation of mercury containing tube 316 to separate the mercury drop 350 from the contacts of the tube 316 to thus interrupt the flow of current to the motor 296 to thereby render the refrigerant circulating element inoperative. In the event the temperature of the room should fall below the desired temperature, as indicated by means 320 of switch 312, by the operation of the water flow apparatus and fan alone, the thermostat 314 will actuate the mercury containing tube 315 to thus separate the mercury drop 345 from the contacts of mercury tube 315 to thus interrupt the circuit to the motor 330 and to the magnet winding 322 of valve 284 to thus close the valve to thus prevent the circulation of water in the coils 283 and render the fan 281 inoperative. By this construction the cooling medium supplied to the banks of coils 283 and 287, extending across the cooler chamber 275, is independently and automatically varied so that the cooling effect of each bank on the air is varied in accordance with refrigeration demands.

If desired, the water inlet pipe 306 may be provided with a manually operable valve 500 as shown in Figure 7, so that the fan 281 may be caused to operate to create an air current in the room without any cooling whatsoever merely by closing the manually operable valve 500 and by operating the manual switch 501 placed across the leads to the automatic control 312. Under such conditions, the pointer 320 should be adjusted to a temperature higher than any temperature likely to be reached by the air in the room. When under such setting and condition, the motor 330 will operate continuously and water will be prevented from flowing through the coil 283 by the valve 500, and no refrigerant will flow through the coil 287, because the control 312 is adjusted above the normal range of the air in the room.

Referring to Fig. 4 there is shown a modified form of room cooling apparatus which comprises a cabinet 375 forming an air treating zone or upper air cooling and dehumidifying section 378 and is provided with a machinery compartment or lower refrigerant circulating section 379. The cabinet is provided with louvers 380 through which the air enters the air treating zone 378. The air is forced through an opening 382 in a moisture pan 383 by means of an electrically operated fan 385. The air is then forced through a water cooling apparatus comprising coils 388 which pre-cool the air. The air, when artificial cooling is desired, is then cooled to a temperature below its dew point by refrigerant cooling coils 390 so that when the air is rewarmed it will have the desired relative humidity, which rewarming may be accomplished by utilizing part of the heat of liquefaction which is liberated from the coil 392 to prevent cold saturated air from striking occupants of the room. When the air is treated to the desired temperature said air is discharged through a screened opening 395 provided in the top of the cabinet 375. Refrigerant is circulated through coils 390 by means of a refrigerant circulating element 400 under the control of an expansion valve 401. The element 400 delivers the liquid refrigerant through pipe 405 and withdraws the gaseous refrigerant through a pipe 407. The element 400 comprises a compressor 410 operatively connected with the motor 411 by belt 412. Compressor 410 compresses the gaseous refrigerant and delivers it to the air cooled condenser or coil 392 where it is partially liquefied and from whence it is delivered to pipe 420 to a water cooled condenser 422 which is connected to the expansion valve 401 by pipe 423. The cooling coils 388 of the water flow apparatus and the coil 428 of the condenser 422 are provided with a common inlet 425 and common outlet connection 426. Thus water will enter inlet 425 and circulate through the coils 388, condenser coil 428 which is connected to a water coil 430 by pipe 431 which water coil 430 is adapted to remove the heat from the machinery compartment 379.

Fig. 7 is a diagrammatic representation to indicate how the controls shown in Figs. 5 and 6 are applied specifically to the apparatus shown in Fig. 3; but it is to be understood that the same controls can be applied to all of the modifications shown in Figs. 1, 2, 3 and 4 inclusive. Similar reference characters have been used in Figs. 7 and 3, so that the various parts in the two figures can be readily identified without further description.

In Fig. 8, a modification of a portion of Fig. 7 is shown in which the motor 296*a*, driving the compressor 295*a*, may be controlled in response to refrigerant pressure in the evaporator 287*a*. This is accomplished by causing the valve 291*a* to be thermostatically operated by the thermostatic bulb 502 at the outlet of the evaporator 287*a* in a manner to prevent liquid refrigerant in any appreciable quantity from flowing past the thermostatic bulb 502. The switch 300*a* is operated in response to pressure in the refrigerant suction line 294*a* by connecting the pipe 503 with the suction line 294*a* and the bellows 504 of the switch 300*a*. This modification or arrangement will be readily understood by those skilled in the art, and the remainder of the structure illustrated in Fig. 7 is understood to be incorporated or combined with the structure shown in Fig. 8, the only change thus accomplished being that the compressor motor in Fig. 8 is controlled in accordance with refrigerant pressure in the evaporator, whereas in Fig. 7 the compressor motor is controlled in accordance with the temperature at the outlet end of the evaporator.

In all of the modifications, the controls are preferably set so that the evaporators do not attain a temperature below the freezing point of water, thus preventing the accumulation of frost on the evaporators.

While the form of embodiment of the present invention as herein disclosed, constitutes a preferred form, it is to be understood that other forms might be adopted all coming within the scope of the claims which follow.

What is claimed is as follows:

1. The method of refrigeration which comprises circulating refrigerant in a closed path, condensing said refrigerant in one zone of said path and evaporating said refrigerant in a second zone, circulating air to and from a main body along said second zone to thereby cool the air, circulating water in a closed path through said second zone for removing heat from the air passing through said second zone, and automatically controlling the circulation of the refrigerant, the air and the water in accordance with the temperature of the air.

2. The method of refrigeration which comprises circulating refrigerant in a closed path, condensing said refrigerant in one zone of said path and evaporating said refrigerant in a second zone, circulating air to and from a main body along said second zone to thereby cool the air, circulating water in a closed path through said second zone for removing heat from the air

passing through said second zone, and automatically controlling the circulation of refrigerant in response to predetermined environment temperature, and automatically controlling the circulation of the air and the water at a different predetermined environment temperature.

3. An apparatus for conditioning air including means forming an air treating zone, a refrigerant circulating apparatus having an evaporator in said zone, electrically operated means for forcing air through said zone, a switch adapted to actuate a set of contacts for controlling the operation of said circulating apparatus, means responsive to the pressure in said evaporator for controlling said switch, and means responsive to the temperature of the air for controlling said electrically operated means and for controlling the flow of current to said switch.

4. An apparatus for conditioning air including means forming an air treating zone, a refrigerant circulating apparatus having an evaporator in said zone, a water flow apparatus having connections for removing heat from the air passing through said zone, valve means for controlling said water flow apparatus, means for circulating air through said zone, and means responsive to the temperature of the air for simultaneously controlling said air forcing means and said valve means.

5. An apparatus for conditioning air including means forming an air treating zone, a refrigerant circulating apparatus having an evaporator in said zone, a water flow apparatus having connections for removing heat from the air passing through said zone, valve means for controlling said water flow apparatus, means for circulating air through said zone, means responsive to the environment temperature for simultaneously controlling said air forcing means and said valve means, said temperature responsive means also controlling said refrigerant circulating apparatus.

6. An apparatus for conditioning air including means forming an air treating zone, a refrigerant circulating apparatus having an evaporator in said zone, a water flow apparatus having connections for removing heat from the air passing through said zone, valve means for controlling said water flow apparatus, means for circulating air through said zone, means including a mercury containing bulb for controlling said air forcing means and said valve means, a second mercury containing bulb for controlling said refrigerant circulating apparatus and a single temperature responsive device for controlling said bulbs.

7. A unitary portable apparatus for conditioning air comprising a cabinet forming an air treating zone, a liquid refrigerant evaporator in said zone, a water flow coil in said zone below said evaporator, said water flow coil having connections for removing heat from the air passing through said zone, means for forcing air through said zone, and means located over said evaporator for partially condensing the refrigerant by air cooled in said zone.

8. A unitary portable apparatus for conditioning air comprising a cabinet forming an air treating zone, a refrigerant circulating apparatus said apparatus having an evaporator in said zone, a water flow apparatus having connections for removing heat from the air passing through said zone, said water flow apparatus being located in said zone below said evaporator, means for forcing air through said zone, said refrigerant circulating apparatus having means in said zone above said evaporator for partially condensing the refrigerant by air cooled in said zone, and a water cooled condenser in said zone.

9. An apparatus for conditioning air comprising a unitary casing, a fan and an evaporator in said casing, an air inlet and an air outlet arranged to permit air to be conditioned to flow through said inlet, outlet, fan and evaporator, a refrigerant liquefying unit connected in refrigerant flow relationship with said evaporator at least a portion of which refrigerant liquefying unit is enclosed in a machinery compartment having an air space, and a water coil in the air space of said machinery compartment separate from said liquefying unit.

10. An apparatus for conditioning air comprising a unitary casing, a fan and an evaporator in said casing, an air inlet and an air outlet arranged to permit air to be conditioned to flow through said inlet, outlet, fan and evaporator, a refrigerant liquefying unit connected in refrigerant flow relationship with said evaporator and including a motor, compressor and condenser, said motor and condenser being placed in a machinery compartment having an air space, and a water coil in the air space of said machinery compartment separate from said liquefying unit.

11. An apparatus for conditioning air comprising a unitary casing, a fan and an evaporator in said casing, an air inlet and an air outlet arranged to permit air to be conditioned to flow through said inlet, outlet, fan and evaporator, a refrigerant liquefying unit connected in refrigerant flow relationship with said evaporator and including a motor, compressor and condenser, said motor and condenser being placed in a machinery compartment having an air space, a water coil in the air space of said machinery compartment separate from said liquefying unit, and water flow connections causing the flow of cooling water through said condenser and water coil.

12. In an air conditioning apparatus, in combination with an enclosure in which conditioned air is used, a cooler chamber, a fan for passing air to be supplied to the enclosure through said chamber, a plurality of cooled surfaces extending in the path of the air flowing through said chamber, means for supplying cooling medium inside said surfaces, means for automatically and independently varying the supply of cooling medium to said surfaces in accordance with different degrees of an air condition in said enclosure and means for heating the air in said enclosure after being cooled by said surfaces.

13. In an air conditioning apparatus, in combination with an enclosure in which conditioned air is used, a cooler chamber, means for passing air to be supplied to the enclosure in a single stream through said chamber, a plurality of cooled surfaces across the cross section of said cooler in the path of said air stream, means for supplying cooling medium inside said surfaces, means for modifying the supply of cooling medium to one of said surfaces in accordance with a psychrometric function of air and means for modifying the supply of cooling medium to another of said surfaces in accordance with a psychrometric function of air.

14. An air conditioning apparatus, in combination with an enclosure in which conditioned air is used, air-flow means for air to be conditioned for said enclosure, a water-flow coil in said means cooling air passing through said means, an evaporator in said means cooling air passing through

said means, a refrigerant condensing unit connected to said evaporator, and a common source of water supply connected to said water-flow coil and to said condensing unit.

15. An air conditioning apparatus, in combination with an enclosure in which conditioned air is used, air-flow means for air to be conditioned for said enclosure, a water-flow coil in said means cooling air passing through said means, an evaporator in said means cooling air passing through said means, and means controlling the flow of water through said water-flow coil in accordance with a temperature condition, and means controlling the flow of refrigerant in said evaporator in accordance with a temperature condition.

16. Apparatus of the character described, including: an air duct adapted to supply air to a room; means in said duct for cooling said air; demand means responsive to a psychrometric function of air in said room; means for forcing a current of air through said duct upon a demand from said demand means; and means for rendering said cooling means operative upon a more urgent demand from said demand means, whereby a current of cooled air is forced through said duct.

17. A unitary room cooler and dehumidifier to be used in a room or the like where refrigeration is desired to maintain the temperature and humidity of the air in said room or the like within the values bounding the human comfort range, comprising a cabinet with upright substantially vertical walls with an upper air cooling and dehumidifying section and a lower refrigerant circulating section; a refrigerant evaporator in said upper section; a refrigerant compressor, an electric compressor motor drivingly connected to said compressor and a refrigerant condenser in said lower section; said evaporator, compressor and condenser being connected in refrigerant flow relationship; air intake forming means in said cabinet located a substantial distance above the floor of said room to introduce air from said room into the lower part of said upper section; air discharge forming means in the upper part of said upper section; an air circulator and an electric air circulator motor drivingly connected to said air circulator causing the flow of air from said room into said air intake forming means, past said evaporator, and out of said air discharge forming means; control means including a switch for causing operation of said air circulator motor whenever said compressor motor operates, and a device responsive to a psychrometric function of air conditions in said room controlling the operation of said compressor; said air circulator, evaporator, compressor and condenser being correlated with each other to maintain said evaporator temperature above freezing and below the minimum dew point temperature prevailing at a time when artificial air cooling is desired, whereby the accumulation of frost on said evaporator is prevented and moisture may be condensed from the air passing over said evaporator.

18. A unitary room cooler and dehumidifier to be used in a room or the like where refrigeration is desired to maintain the temperature and humidity of the air in said room or the like within the values bounding the human comfort range, comprising a cabinet with upright substantially vertical walls with an upper air cooling and dehumidifying section and a lower refrigerant circulating section; a refrigerant evaporator in said upper section; a refrigerant compressor, an electric compressor motor drivingly connected to said compressor and a refrigerant condenser in said lower section; said evaporator, compressor and condenser being connected in refrigerant flow relationship; air intake forming means in said cabinet located a substantial distance above the floor of said room to introduce air from said room into the lower part of said upper section; air discharge forming means in the upper part of said upper section; an air circulator and an electric air circulator motor drivingly connected to said air circulator causing the flow of air from said room into said air intake forming means, past said evaporator, and out of said air discharge forming means; control means including a switch for causing operation of said air circulator motor whenever said compressor motor operates, and a device responsive to a psychrometric function of air conditions in said room controlling the operation of said compressor; said air circulator, evaporator, compressor and condenser being correlated with each other to maintain said evaporator temperature above freezing and below the minimum dew point temperature prevailing at a time when artificial air cooling is desired, whereby the accumulation of frost on said evaporator is prevented and moisture may be condensed from the air passing over said evaporator; and a water circulating, air cooling apparatus in said upper section located in the path of said flow of air to precool the air before it flows past said evaporator.

19. A unitary room cooler and dehumidifier to be used in a room or the like where refrigeration is desired to maintain the temperature and humidity of the air in said room or the like within the values bounding the human comfort range, comprising a cabinet with upright substantially vertical walls with an upper air cooling and dehumidifying section and a lower refrigerant circulating section; a refrigerant evaporator in said upper section; a refrigerant compressor, an electric compressor motor drivingly connected to said compressor and a refrigerant condenser in said lower section; said evaporator, compressor and condenser being connected in refrigerant flow relationship; air intake forming means in said cabinet located a substantial distance above the floor of said room to introduce air from said room into the lower part of said upper section; air discharge forming means in the upper part of said upper section; an air circulator and an electric air circulator motor drivingly connected to said air circulator causing the flow of air from said room into said air intake forming means, past said evaporator, and out of said air discharge forming means; control means including a switch for causing operation of said air circulator motor whenever said compressor motor operates, and a device responsive to a psychrometric function of air conditions in said room controlling the operation of said compressor; said air circulator, evaporator, compressor and condenser being correlated with each other to maintain said evaporator temperature above freezing and below the minimum dew point temperature prevailing at a time when artificial air cooling is desired, whereby the accumulation of frost on said evaporator is prevented and moisture may be condensed from the air passing over said evaporator; said condenser being water cooled; a water circulating air cooling apparatus in said upper section located in the path of said flow of air to precool the air before it flows past said

evaporator, and a source of supply of water for said water circulating, air cooling apparatus and said condenser.

20. A unitary room cooler and dehumidifier to be used in a room or the like where refrigeration is desired to maintain the temperature and humidity of the air in said room or the like within the values bounding the human comfort range, comprising a cabinet with upright substantially vertical walls with an upper air cooling and dehumidifying section and a lower refrigerant circulating section; a refrigerant evaporator in said upper section; a refrigerant compressor, an electric compressor motor drivingly connected to said compressor and a refrigerant condenser in said lower section; said evaporator, compressor and condenser being connected in refrigerant flow relationship; air intake forming means in said cabinet located a substantial distance above the floor of said room to introduce air from said room into the lower part of said upper section; air discharge forming means in the upper part of said upper section; an air circulator and an electric air circulator motor drivingly connected to said air circulator causing the flow of air from said room into said air intake forming means, past said evaporator, and out of said air discharge forming means; control means including a switch for causing operation of said air circulator motor whenever said compressor motor operates, and a device responsive to a psychrometric function of air conditions in said room controlling the operation of said compressor; said air circulator, evaporator, compressor and condenser being correlated with each other to maintain said evaporator temperature above freezing and below the minimum dew point temperature prevailing at a time when artificial air cooling is desired, whereby the accumulation of frost on said evaporator is prevented and moisture may be condensed from the air passing over said evaporator; and an air reheating coil in said upper section located in the path of said flow of air to reheat the air after it flows past said evaporator, said air reheating coil utilizing part of the heat of liquefaction of the refrigerant circulated by said compressor.

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