Nov. 11, 1952 W. M. SIMPSON 2,617,632

AIR CONDITIONING SYSTEM

Original Filed April 9, 1946 2 SHEETS—SHEET 1

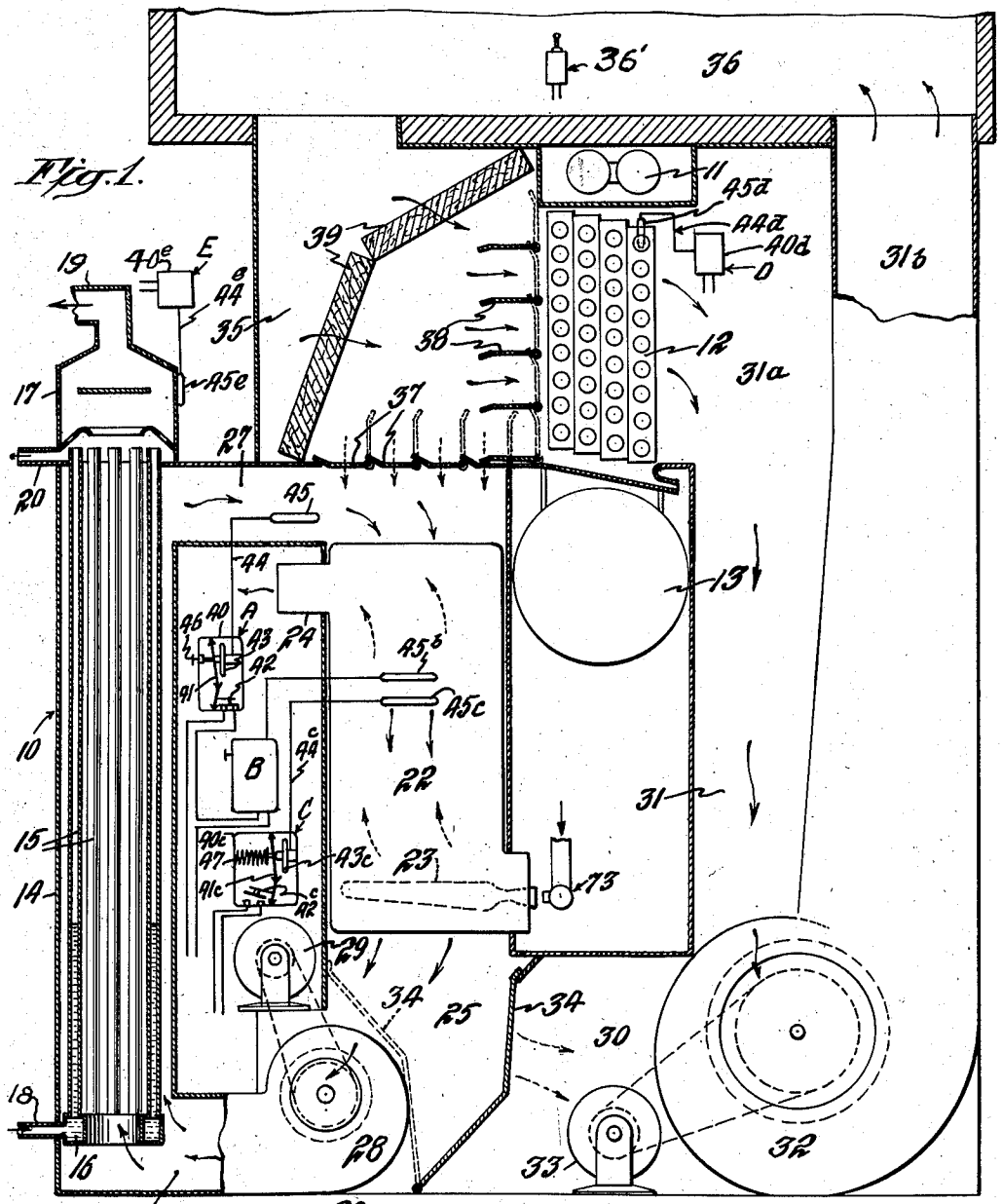


Fig. 1.

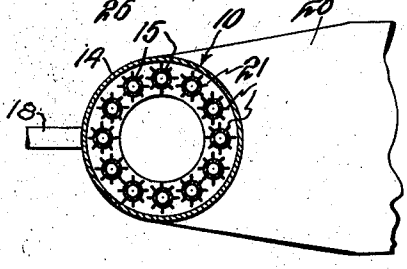


Fig. 2.

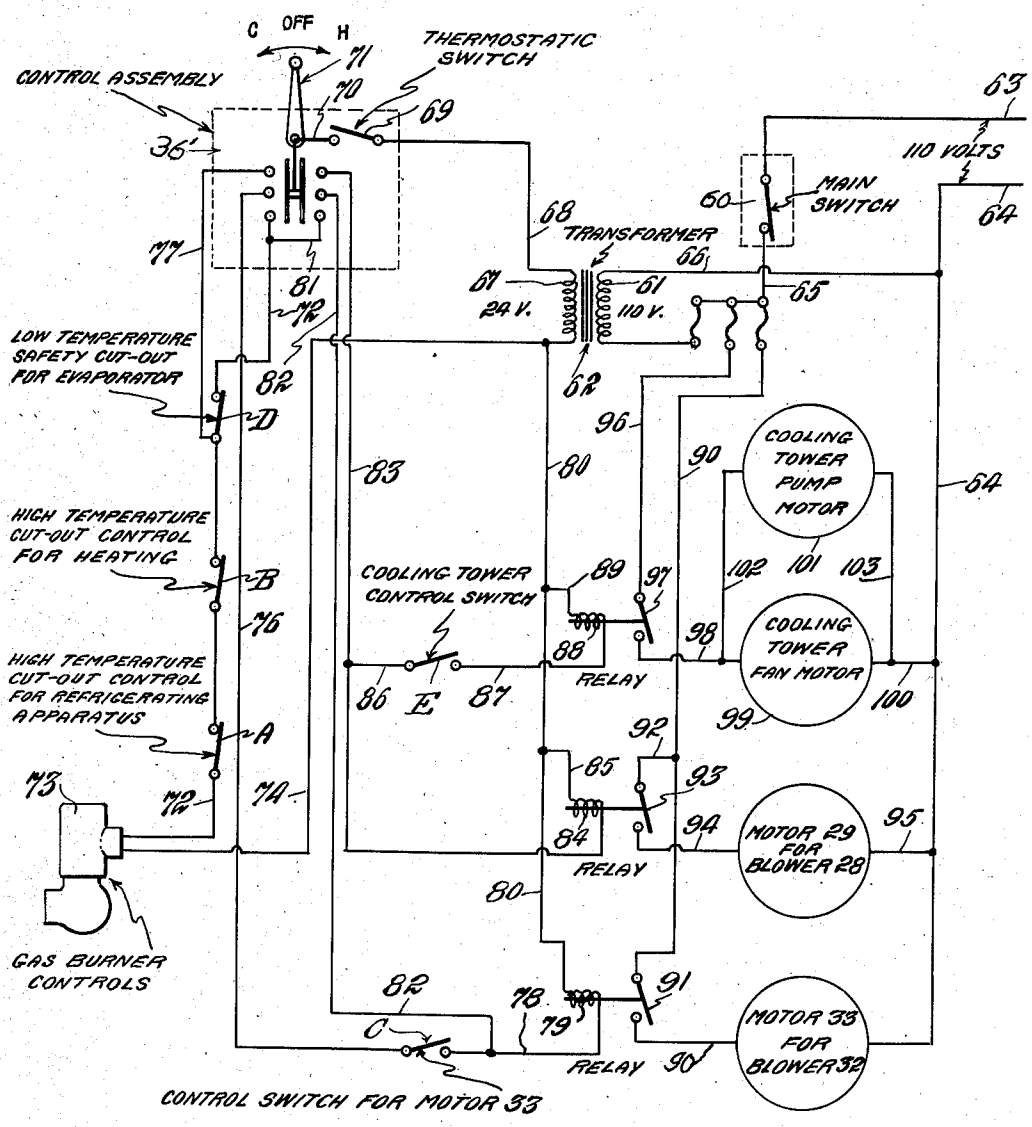
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Fig. 3.



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2,617,632

AIR CONDITIONING SYSTEM

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Continuation of abandoned application Serial No. 660,747, April 9, 1946. This application March 16, 1949, Serial No. 81,665

8 Claims. (Cl. 257—3)

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This invention relates to air conditioning and more particularly to a method of and a system for heating and cooling an enclosure.

This application is a continuation of and relates back for common subject matter to my copending application Serial No. 660,747, filed April 9, 1946 now abandoned.

It is an object of this invention to provide an improved method of heating and cooling an enclosure.

More specifically it is the object of this invention to provide an air heater and utilize this heater for both heating and cooling.

This is accomplished by supplying heated air to an enclosure when heating thereof is desired, and when it is desired to cool the enclosure, supplying this heated air to a heat operated refrigerating apparatus arranged to cool the enclosure.

By way of example, there may be provided a plurality of closed circuits for the circulation of air, two of which circuits are separate or independent during cooling cycles of operation and a third of which circuits includes parts of each of the first two circuits during heating cycles of operation. During cooling cycles of operation a first of said circuits includes a closed duct system containing a heater, such as a hot air furnace and a refrigerant generator; the arrangement being such that air heated by the furnace is continuously circulated in a closed path between the furnace and the refrigerant generator. A second of said circuits includes a duct system leading from and to the enclosure that is to be conditioned and which duct system contains a cooling element; the arrangement being such that air from the enclosure is circulated over the cooling element and back to the enclosure. The third or combined circuit includes that part of the first circuit which contains the hot air furnace and that part of the second circuit which leads from and to the enclosure; the arrangement being such that during heating cycles of operation air from the enclosure is circulated over the furnace and back to the enclosure. The system is provided with suitable dampers for directing the flow of air through the different circuits and with suitable controls for governing the operation of the system.

The invention, together with the objects and advantages thereof, will be more fully understood from the following description taken in conjunction with the accompanying drawings forming a part of this specification, and of which:

Fig. 1 is a view more or less diagrammatically

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illustrating an air conditioning system embodying the invention;

Fig. 2 is an enlarged horizontal sectional view through the refrigerant generator; and

Fig. 3 is a view diagrammatically illustrating the auxiliary equipment for the system and the several electric circuits for operating and controlling the system.

Referring to Fig. 1 of the drawing, the present invention is embodied in an air conditioning system wherein the air is cooled by a two pressure absorption refrigerating apparatus like that disclosed in the United States patent to A. R. Thomas and P. P. Anderson, Jr., No. 2,282,503, granted May 12, 1942, and wherein a common source of heat, such as a gas heated hot air furnace is used to heat the air being conditioned during heating cycles of operation and to heat the generator of the refrigerating apparatus during cooling cycles of operation. A refrigerating apparatus of the above type operates at low pressure and includes a generator 10, a condenser 11, an evaporator 12 and an absorber 13 all of which are interconnected in a well known manner by suitable conduits, not shown, to form complete refrigerant and absorption solution circuits. Only so much of the refrigerating apparatus as is necessary for a complete understanding of this invention has been shown in the drawing. However, the disclosure of the aforementioned Thomas and Anderson patent may be considered as being incorporated in this application, and, if desired, reference may be made thereto for a detailed description of this refrigerating apparatus.

In accordance with this invention, the generator 10 is located in a cylindrical housing or duct 14 and includes a plurality of vertical riser tubes 15 having the lower ends thereof communicating with an annular header 16 and the upper ends thereof extending into and above the bottom of a vapor separating vessel 17. A refrigerant-absorbent solution, such as a water solution of lithium bromide, is supplied to the header 16 by a conduit 18 which conduit is connected by a suitable conduit, not shown, to the lower portion of the absorber 13. When the generator is heated water vapor is expelled from the solution and the absorption liquid is raised in the tubes 15 by gas or vapor lift action. Water vapor flows upward through the tubes 15 to the separating vessel 17, through outlet 19 and into the condenser 11 in which it is liquefied. The condensate formed in the condenser is conveyed to the evaporator 12 wherein the refrigerant evapo-

rates absorbing heat from air which passes over the evaporator, to be described in more detail hereinafter. The absorption liquid from which the refrigerant vapor has been expelled flows from the bottom of the separating vessel 17 through conduit 20 which conduit is connected in a suitable manner, not shown, to the upper portion of the absorber 13. The evaporator 12 is also connected to the absorber in a suitable manner not shown.

The riser tubes 15, as shown in Fig. 2, are provided throughout their length with heat exchange fins 21. For the sake of clearness the fins have been omitted from the riser tubes in Fig. 1. The generator is heated by a gas fired hot air furnace designated generally by reference character 22. This furnace may be of any suitable type but it is preferred that the furnace be made up of a plurality of sections arranged so that the products of combustion from the gas burners 23, only one of which is shown, pass upward through the inside of the sections and air to be heated passes downward over the outside of the sections. The supply of fuel gas to the burners 23 may be controlled in any suitable manner as by a solenoid operated valve 73. Suitable baffles or heat transfer fins, not shown, may be applied to the outer surface of the furnace sections so as to increase the heat transfer surface thereof. Products of combustion from the furnace are conveyed from the outlet 24 to a suitable flue, not shown.

As shown in Fig. 1, the hot air furnace is located in a housing or duct 25, which housing is connected to the generator housing 14 by a lower duct 26 and an upper duct 27. A blower 28 operated by an electric motor 29 is located in the lower portion of housing 25. When energized, blower 28 circulates air through a closed circuit comprising housing 25, lower duct 26, generator housing 14 and upper duct 27 back to housing 25. Housing 25 is also connected at its lower end by a duct 30 to a duct 31, which last-named duct includes two vertical passageways 31*a* and 31*b*. A blower 32 operated by an electric motor 33 is located in the lower portion of duct 31. Flow of air through the ducts 26 and 30 is controlled by a damper 34. Housing 25 is connected at its upper end by a duct 35 with the room or other enclosure 36 that is to be conditioned. Duct 35 is in open communication with the upper or inlet portion of passageway 31*a*, in which inlet the evaporator 12 is located. A pair of dampers 37 and 38 controls the flow of air from the duct 35 to the furnace housing 25 and to the air passageway 31*a*, respectively. Dampers 34, 37 and 38 are interconnected in such manner, not shown, that when damper 37 is closed, damper 38 is open and damper 34 is in the full line position shown in Fig. 1. When the position of dampers 37 and 38 is reversed, damper 34 is moved to the broken line position shown in Fig. 1. A pair of air filters 39 is arranged in the path of flow of air in duct 35.

During the cooling cycles of operation the condenser 11 and the absorber 13 constitute heat rejecting elements of the refrigerating apparatus and are cooled by suitable cooling medium such as, for example, water which is cooled and circulated in a closed circuit through a spray cooling tower, not shown. The cooling water is first conducted to the absorber whereby heat, resulting from absorption of refrigerant vapor by the liquid absorbent medium, is given up to the cooling water. The cooling water is then conducted from the absorber to the condenser in which heat of condensation, resulting from condensation of refrigerant vapor in the condenser, is given up to the cooling water. The water flows from the condenser to the spray cooling tower wherein it is sprayed into an upwardly flowing stream of air which is forced through the cooling tower by a suitable electrically driven fan. The water, which is cooled by partial evaporation into the upwardly flowing air stream, collects in the bottom of the tower and is conducted from there to the absorber by a suitable electrically driven pump. Only the electric motors for driving the cooling tower fan and pump are schematically shown at 99 and 101, respectively, in Fig. 3. However, for a complete showing and description of a cooling tower along with the accessories and controls therefor that is suitable for use with the refrigerating apparatus described in this application reference may be had, if desired, to the United States patent to Sven W. E. Andersson No. 2,381,427, granted August 7, 1945. This Andersson patent is to be considered as incorporated in this application.

In the operation of the air conditioning system so far described, when it is desired to cool the air in the enclosure 36, dampers 34, 37 and 38 are each moved to their full line positions shown in Fig. 1. Assuming that the gas burners 23 and blowers 28 and 32 are energized, blower 28 draws air downward through the housing 25 and over the outer surface of the furnace 22 whereby the air is heated. The heated air is then forced through lower duct 26, upward through the housing 14 and over the riser tubes 15 wherein the air gives up its heat to the refrigerant-absorbent solution contained in the tubes. The air then passes through the upper duct 27 and back to the housing 25 completing this closed air circuit. Circulation of air through this circuit continues so long as the enclosure 36 requires cooling; the control of which will be described presently. The heating of the riser tubes 15, as described above, causes water vapor to be expelled from the refrigerant-absorbent solution contained therein which vapor passes to the condenser wherein it is liquefied and the condensate flows from there into the evaporator 12. The blower 32 being energized, air is drawn from the enclosure 36, through duct 35, through filters 39, over the coils of the evaporator, downward through air passageway 31*a*, through blower 32, upward through passageway 31*b* and back to the enclosure. The air in passing over the coils of the evaporator gives up its heat to the refrigerant contained therein causing the refrigerant to vaporize. The vaporized refrigerant passes from the evaporator to the absorber wherein the vapor is absorbed into the absorption solution contained therein, and the enriched solution is conveyed from the absorber back to the riser tubes of the generator. The circulation of air is continued through this last described circuit so long as the air in the enclosure 36 calls for cooling.

Assuming now that it is desired to heat the air in enclosure 36, dampers 34, 37, 38 are shifted from their full line positions to their broken line positions shown in Fig. 1. Gas burners 23 and blower 32 are energized but blower 28 stands dormant. With this arrangement, blower 32 draws air from enclosure 36, through duct 35, through filters 39, into housing 25, downward over the surface of hot air furnace 22, through duct 30, blower 32 and upward through passageway 31*b* back to enclosure 36. Circulation of air through this last-named circuit is continued so long as the air in enclosure 36 requires heat. The controls

for this phase of operation will be described presently.

It is to be noted that the air conditioning system includes three closed air circuits, two of which are separate or independent when the system is operating on cooling cycles and the third of which comprises parts of each of the first two circuits when the system is operating on heating cycles. That is, during cooling cycles the circuit for heating the generator of the refrigerating apparatus includes housing 25, blower 28, duct 26, housing 14, and duct 27. The circuit for circulating air from and to the enclosure during cooling cycles of operation includes the enclosure, duct 35, passageway 31a, blower 32 and passageway 31b. During heating cycles of operation the combined air circuit includes enclosure 36, duct 35, housing 25, duct 30, blower 32 and passageway 31b.

In Fig. 1 of the drawing there are schematically shown five thermostatic controls, A, B, C, D and E, which aid in the control of my improved air conditioning system. These controls may be operated in any suitable manner. However, for purposes of illustration each of these controls is shown as operated by a fluid thermostat. Controls A, B, and D, in the event of abnormal conditions of operation of the air conditioning system, each operates a different safety cut-out switch to cut off the electric power which operates the solenoid valve 73 of the gas burner. Controls A, B and D are each of the snap-acting type which automatically snaps its respective switch open, but which switch must be manually closed. Controls A, B and D are each substantially identical, except for the charge of the fluid thermostat, which charge must be adjusted to cut off at temperature suited to the function for which each of the switches is intended. Controls C and E are also of a snap-acting type but these two controls are thermostatically operated to both open and close the switches which they operate. Control C operates a switch which in turn controls the energization of blower motor 33. Control E operates a switch which controls the energization of the pump and fan of the cooling tower.

In the event that the heat supplied to the generator 10 by the hot air furnace is not consumed by the generator, control A operates to cut off the electric power to solenoid valve 73. This control includes a casing 40 in which is located a snap-acting toggle 41 which in turn is connected to a switch 42. The toggle is suitably connected to a fluid thermostat which includes an expansible-contractable diaphragm 43, a capillary tube 44, and a thermal bulb 45. A manually actuated push button 46 is operatively connected to the toggle. As shown in Fig. 1, bulb 45 is located in the air duct 27 in the path of flow of air flowing from the generator housing 14 to the heater housing 25. The arrangement is such that if the air passing through the duct 27 reaches a predetermined high temperature the fluid in the bulb 45 is heated to such an extent that the diaphragm 43 is expanded and through toggle 41 snaps switch 42 to open position thereby cutting off the electric power to solenoid valve 73. As stated above, this switch remains in open position until it is manually closed.

Control B, as stated above, is identical with control A, except that the thermal bulb of the fluid thermostat of this control is charged differently from that of the thermal bulb of control A. Control B operates to cut off the electric power to the solenoid valve of the gas burner in the event that either of the blowers 28 or 32 fails to operate as intended. That is, during cooling cycle of operation the blower 28 is intended to force air from the heater housing 25, through the duct 26, upward over the riser tubes in the generator housing 14 and back through duct 27 to the heater housing. Should blower 28 fail to operate the air in the heater housing will reach an abnormally high temperature and the fluid in the thermal bulb 45b, which bulb is located in the path of flow of air between the sections of the heater, would reach a sufficiently high temperature to cause the switch, not shown, of this control to snap to open position in the same manner as described above regarding switch 42 of control A. The switch of control B, as with that of control A, must be manually reset in order to close the electric circuit to the solenoid valve. During heating cycles of operation the blower 32 is intended to force air through the air circuit which includes heater housing 25, conduit 30, blower 32, passageway 31b, enclosure 36, duct 35 and back to the heater housing. If for any reason blower 32 fails to operate as intended the fluid in bulb 45b will, as before, become heated to such a temperature that the switch of control B will be snapped to open position.

During heating cycles of operation of the system, control C operates to delay the energization of blower 32 until the temperature of the air in the heater housing has reached a predetermined high. Control C includes a casing 40c, a snap-acting toggle 41c to which is connected a switch 42c, an expansible-contractable diaphragm 43c, a capillary tube 44c and a thermal bulb 45c. The toggle is moved to the left, as viewed in Fig. 1, by the expansion of diaphragm 43c to close switch 42c and to the right by the contraction of the diaphragm to open the switch. The switch is biased toward open position by a spring 47. Thermal bulb 45c is located in the path of flow of air in heater housing 25 in much the same manner as bulb 45b of control B. In the operation of control C when it is desired to heat the enclosure 36, the enclosure thermostat 36', to be described presently, closes a switch 69 (Fig. 3) which energizes the solenoid valve 73 to supply gas to the burner 23. When the air in the heater housing reaches a predetermined temperature, diaphragm 43c expands and snaps switch 42c to closed position thereby closing the circuit to the electric motor 33 of blower 32. This circuit remains closed so long as the enclosure 36 requires heat. When the enclosure reaches the desired temperature the enclosure thermostat opens switch 69, deenergizing the solenoid of the gas valve with the result that the supply of gas to the burner is reduced and the temperature in housing 25 falls causing diaphragm 43c to snap switch 42c to its open position.

It is to be noted that the charge in each of the thermal bulbs 45, 45b and 45c is either directly or indirectly influenced by the temperature of the air in the heater housing 25, and since under normal operating conditions the temperature in this housing will be higher during cooling cycles of operation than during heating cycles of operation, these different bulbs must be charged to suit the different functions of the switches with which they are associated.

In the event that evaporater 12 reaches a predetermined low temperature during cooling cycles of operation, control D operates to cut off the supply of gas to burner 23. Control D is similar to control A in that it is a snap-acting control which automatically opens a switch in the elec-

tric circuit which energizes solenoid valve 73 and which control must be manually reset in order to close the switch. Control D includes a casing 40*d* in which is contained a diaphragm, a toggle and switch arrangement, not shown, but which are similar to those of control A, except that the contraction of the diaphragm of this control snaps the switch to open position. The diaphragm of control D is connected by a capillary tube 44*d* to a thermal bulb 45*d*, which bulb is located, as shown in Fig. 1, on the evaporator 12.

Control E is a delayed action and on and off control which operates a switch to close an electric circuit which, in turn, energizes a cooling tower pump and fan in accordance with the temperature of the generator of the refrigerating apparatus. That is, when generator 10 is heated and refrigerant vapor passes from the generator to the condenser, the cooling tower pump and fan should be energized. Conversely, when the generator is not being heated or when refrigerant vapor is not being expelled from the solution in the generator there is no need for operating the cooling tower pump or fan. Control E is similar to control C in that they are both on and off controls. Control E includes a casing 40*e* which contains a toggle switch and an expansible-contractable diaphragm, not shown, but which are similar to the toggle switch and diaphragm of control C. The diaphragm of control E is connected by a capillary tube 44*e* to a thermal bulb 45*e*. As shown in Fig. 1, bulb 45*e* is in thermal contact with separating vessel 17 of the generator 10.

Referring now to Fig. 3 of the drawing, when it is desired to operate the air conditioning system described above, a main switch 60 is manually closed so that the primary winding 61 of a transformer 62 is connected to a suitable alternating current source of electrical energy. The complete circuit for energizing the transformer 62 includes conductors 63 and 64 which are connected to the source of electrical energy and in which is provided the main switch 60, and conductors 65 and 66 which are connected to opposite terminals of the primary winding 61. The transformer 62 is a step-down transformer with one terminal of the low voltage winding 67 connected by a conductor 68 to thermostatic switch 69. This thermostatic switch, which is contained in a room thermostat diagrammatically illustrated at 36', Figs. 1 and 3, may be of any suitable type. However, it is preferred to use a thermostatic switch which opens and closes the low voltage circuit in accordance with the temperature of the enclosure that is being conditioned during both heating and cooling cycles of operation. A suitable thermostatic switch which operates on both the heating and cooling cycles is shown and described in the above Andersson Patent No. 2,381,427, and, if desired, reference may be had to this patent for a detailed description of this switch. Thermostatic switch 69 is connected by a conductor 70 to a manual switch 71. Switch 71 is of the triple-pole, double-throw type, as illustrated in Fig. 3.

During the heating cycles of operation, that is, when switch 71 has been moved to the left from the neutral position shown in Fig. 3, the switch lever having been moved to the right to the position marked H, a conductor 72, which contains the switches of safety cut-out controls D, B and A, connects the left side of switch 71 to one side of the solenoid operated valve 73 for controlling the supply of gas to the burner 23. The opposite side of the solenoid is connected to the low voltage winding of the transformer by a conductor 74. With switch 71 in the above position, a conductor 76 connects this switch to one side of the switch of safety cut-out C, and a by-pass conductor 77 connects switch 71 to conductor 72. The opposite side of safety cut-out switch C is connected by a conductor 78 to one terminal of a relay 79, the opposite terminal of which relay is connected to the low voltage winding of the transformer by a conductor 80.

To initiate a cooling cycle of operation, switch 71 is moved to the right from the neutral position shown in Fig. 3, the switch lever being moved to the C position. With switch 71 in this last-named position a conductor 81 connects this switch with conductor 72; a conductor 82 connects switch 71 with conductor 78; and a conductor 83 connects switch 71 to one terminal of a relay 84, the opposite terminal of which relay is connected by a conductor 85 to conductor 80. As shown in Fig. 3, cooling tower control switch E is connected on one side by a conductor 86 to conductor 83 and on its opposite side by a conductor 87 to one side of a relay 88, the opposite side of which relay is connected by a conductor 89 to conductor 80.

Referring again to Fig. 3, a conductor 90 containing a switch 91 operated by relay 79 connects one side of blower motor 33 to high voltage conductor 65, the opposite side of which motor is connected directly to conductor 64 of the high voltage circuit. Conductor 90 is connected by a conductor 92, a switch 93 operated by relay 84 and a conductor 94 to one side of the blower motor 29, the opposite side of which motor is connected to conductor 64 by a conductor 95. A conductor 96, a switch 97 operated by relay 88 and a conductor 98 connect one side of cooling tower fan motor 99 to high voltage conductor 65, and the opposite side of the fan motor is connected by a conductor 100 to conductor 64 of the high voltage circuit. As shown, a cooling tower pump motor 101 is connected in parallel with fan motor 99 by conductors 102 and 103.

Assuming now that the enclosure 36 is calling for heat, thermostatic switch 69 is closed by the room thermostat and manual switch 71 has been shifted to the H position thereby energizing the solenoid valve 73 to supply gas to the burner 23. When the hot air furnace is brought up to a predetermined temperature, control switch C closes and energizes relay 79 which in turn closes switch 91 and energizes blower 33. When the enclosure reaches the desired temperature, thermostatic switch 69 opens the low voltage circuit deenergizing the solenoid valve and the relay 79.

Assume now that the enclosure is calling for cooling, that switch 71 has been shifted to the C position and that thermostatic switch 69 has been closed by the room thermostat, solenoid valve 73 is energized causing gas to be supplied to the burner. Also relays 79 and 84 are energized whereby switches 91 and 93 are closed and blower motors 33 and 29 are energized. Blower 28 circulates hot air from the furnace over the refrigerant generator causing refrigerant vapor to be expelled from the solution contained therein. When refrigerant vapor reaches the separating vessel 17 control E operates to close the cooling tower control switch whereby the relay 88 is energized. The energization of relay 88 closes switch 97 whereby the fan and pump motors of the cooling tower are energized. So long as the

enclosure calls for cooling, the different electric circuits last described remain closed, except as pointed out above, should the evaporation reach an abnormally low temperature safety cut-out D operates to deenergize the solenoid valve. Also safety cut-out A will operate to deenergize the solenoid valve in the event that the air passing through duct **27** reaches an abnormally high temperature. With normal operation of the system, when the enclosure is cooled to the desired temperature, the room thermostat opens switch **69** in the low voltage circuit which deenergizes the solenoid valve, the blower motors and the cooling tower fan and pump motors.

Although a single embodiment of the invention has been shown and described, the invention may obviously take other forms and may be variously applied. The invention is therefore limited only within the scope of the following claims.

I claim:

1. An air conditioning system comprising a first closed air circuit including a source of heat, a refrigerant generator and air ducts connecting said elements to form the closed circuit, a second closed air circuit including an enclosure to be conditioned, a refrigerant evaporator and air ducts interconnecting said elements to form the second closed circuit, a third closed air circuit including that part of the first circuit that contains the source of heat and that part of the second circuit that contains the enclosure and the air ducts communicating with the enclosure, and dampers for controlling the flow of air through the different circuits, the construction and arrangement being such that during cooling cycles of operation air flows through the first two circuits independently as set out above, and during heating cycles of operation the dampers are shifted so that air from the enclosure flows through the third circuit over the source of heat and back to the enclosure.

2. An air conditioning system comprising a hot air furnace, an absorption refrigerating apparatus including a generator, a condenser, an evaporator and an absorber, an air duct system connecting said hot air furnace to said generator to form a first closed circuit for circulation of air from the hot air furnace to the generator and back to the hot air furnace, a blower in said first circuit, a second closed circuit including an enclosure to be conditioned, an air duct system containing the evaporator and arranged to circulate air from the enclosure over the evaporator and back to the enclosure, a blower for forcing air through the second circuit, a third closed air circuit including that part of the first circuit that contains the hot air furnace and that part of the second circuit that contains the enclosure, the second blower and the air ducts communicating with the enclosure, and dampers arranged in each of said circuits, the construction and arrangement being such that when it is desired to cool the enclosure air is circulated through the first circuit to operate the refrigerating apparatus and air is circulated through the second circuit to be cooled by the evaporator, and when it is desired to heat the enclosure the dampers are shifted so that air is drawn from the enclosure, passed through the third circuit over the hot air furnace and returned to the enclosure.

3. An air conditioning system comprising a hot air furnace, a heat operated refrigerating apparatus including a generator, a condenser, an evaporator and an absorber, a first closed air circuit including an air duct system, the furnace, the generator and a blower, a second closed air circuit including an enclosure to be conditioned, an air duct system leading from and to the enclosure, the evaporator and a second blower, a third closed air circuit including the enclosure, the hot air furnace, the second blower and parts of the air duct system of the second closed circuit which lead from and to the enclosure, a plurality of dampers for controlling the circulation of air through the different air circuits, said dampers and said air circuits being so constructed and arranged that when it is desired to cool the enclosure the dampers are moved to certain positions whereby the first and second air circuits are separate and independent, air is circulated through the first circuit to operate the refrigerating system and air is circulated through the second circuit to cool the enclosure, and when it is desired to heat the enclosure the dampers are moved to other positions whereby parts of the first and second circuits are combined to form the third circuit and air is circulated through this third circuit to heat the enclosure.

4. An air conditioning system comprising a gas fired hot air furnace, means responsive to the temperature of an enclosure being conditioned for controlling the supply of gas to the hot air furnace, a heat operated refrigerating apparatus including a generator, a condenser, an evaporator and an absorber, a first closed air circuit including a duct system containing the hot air furnace, the generator and a blower, a second closed air circuit including the enclosure, a duct system leading from and to the enclosure which duct system contains the evaporator and a second blower, dampers in each of the circuits, a third circuit including that part of the first circuit that contains the hot air furnace and that part of the second circuit that leads from and to the enclosure and which contains the second blower, the construction and arrangements of said air circuits and said dampers being such that when it is desired to cool the enclosure the dampers are positioned in such manner that the first two circuits are separate and independent, air is circulated through the first circuit to operate the refrigerating apparatus and air is simultaneously circulated through the second circuit to cool the enclosure, and when it is desired to heat the enclosure the dampers are positioned in such manner that the third circuit is formed and air is circulated through this circuit to heat the enclosure.

5. An air conditioning system comprising a gas fired hot air furnace, means for supplying gas to said furnace, means responsive to the temperature of an enclosure being conditioned for controlling the supply of gas to the furnace, a heat operated refrigerating apparatus including a generator, a condenser, an evaporator and an absorber, a first closed air circuit including an air duct system, the furnace, the generator and a blower, means responsive to an abnormal high temperature of air in said circuit for cutting off the supply of gas to the furnace, a second closed air circuit including the enclosure, an air duct system leading from and to the enclosure, the evaporator and a second blower, a third closed air circuit including the enclosure, the hot air furnace, the second blower and parts of the air duct system of the second closed circuit which lead from and to the enclosure, a plurality of dampers for controlling the circulation of air through the different air circuits, said dampers and said air circuits being so constructed and

arranged that when it is desired to cool the enclosure the dampers are moved to certain positions whereby the first and second air circuits are separate and independent, air is circulated through the first circuit to operate the refrigerating system and air is circulated through the second circuit to cool the enclosure, and when it is desired to heat the enclosure the dampers are moved to other positions whereby parts of the first and second circuits are combined to form the third circuit and air is circulated through this third circuit to heat the enclosure.

6. An air conditioning system having heating and cooling cycles of operation and comprising a gas fired hot air furnace, means for supplying gas to said furnace, means responsive to the temperature of an enclosure being conditioned for controlling the supply of gas to the furnace, a heat operated refrigerating apparatus including a generator, a condenser, an evaporator and an absorber, a first closed air circuit including an air duct system, the furnace, the generator and a blower, means responsive to an abnormal high temperature of air in said circuit for cutting off the supply of gas to the furnace, a second closed air circuit including the enclosure, an air duct system leading from and to the enclosure, the evaporator and a second blower, means responsive to an abnormal low temperature of the evaporator for cutting off the supply of gas to the furnace, a cooling system for cooling the absorber and condenser of the refrigerating apparatus, means responsive to the temperature of the generator for controlling the operation of said cooling system, a third closed air circuit including the enclosure, the hot air furnace, the second blower and parts of the air duct system of the second closed circuit which lead from and to the enclosure, means responsive to the temperature of the hot air furnace for cutting off the supply of gas to the furnace and for controlling the operation of the second blower during heating cycles of operation, a plurality of dampers for controlling the circulation of air through the different air circuits, said dampers and said air circuits being so constructed and arranged that when it is desired to cool the enclosure the dampers are moved to certain positions whereby the first and second air circuits are separate and independent, air is circulated through the first circuit to operate the refrigerating system and air is circulated through the second circuit to cool the enclosure, and when it is desired to heat the enclosure the dampers are moved to other positions whereby parts of the first and second circuits are combined to form the third circuit and air is circulated through this third circuit to heat the enclosure.

7. An air conditioning system comprising a first closed air circuit including a source of heat, a refrigerant generator and air ducts connecting said elements to form the closed circuit, a second closed air circuit including that part of the first circuit that contains the source of heat, an enclosure to be conditioned and air ducts leading from and to the enclosure and cooperating therewith to form the second circuit, and mechanism for shifting the flow from one to the other of said circuits.

8. A system for conditioning air including an enclosure to be conditioned, air ducts forming at least two closed circuits for flow of air therethrough, a heater in said air ducts, a refrigerant generator in said air ducts, said air ducts being connected to the enclosure for flow of air from and to the enclosure, and control mechanism in the air ducts operable in one position to cause air to flow in one closed circuit between the heater and the enclosure and in a second position to cause air to flow in a second closed circuit between the heater and the refrigerant generator.

WALTER M. SIMPSON.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,981,952	Foss	Nov. 27, 1934
2,216,075	Henderson	Sept. 24, 1940
2,381,427	Andersson	Aug. 7, 1945