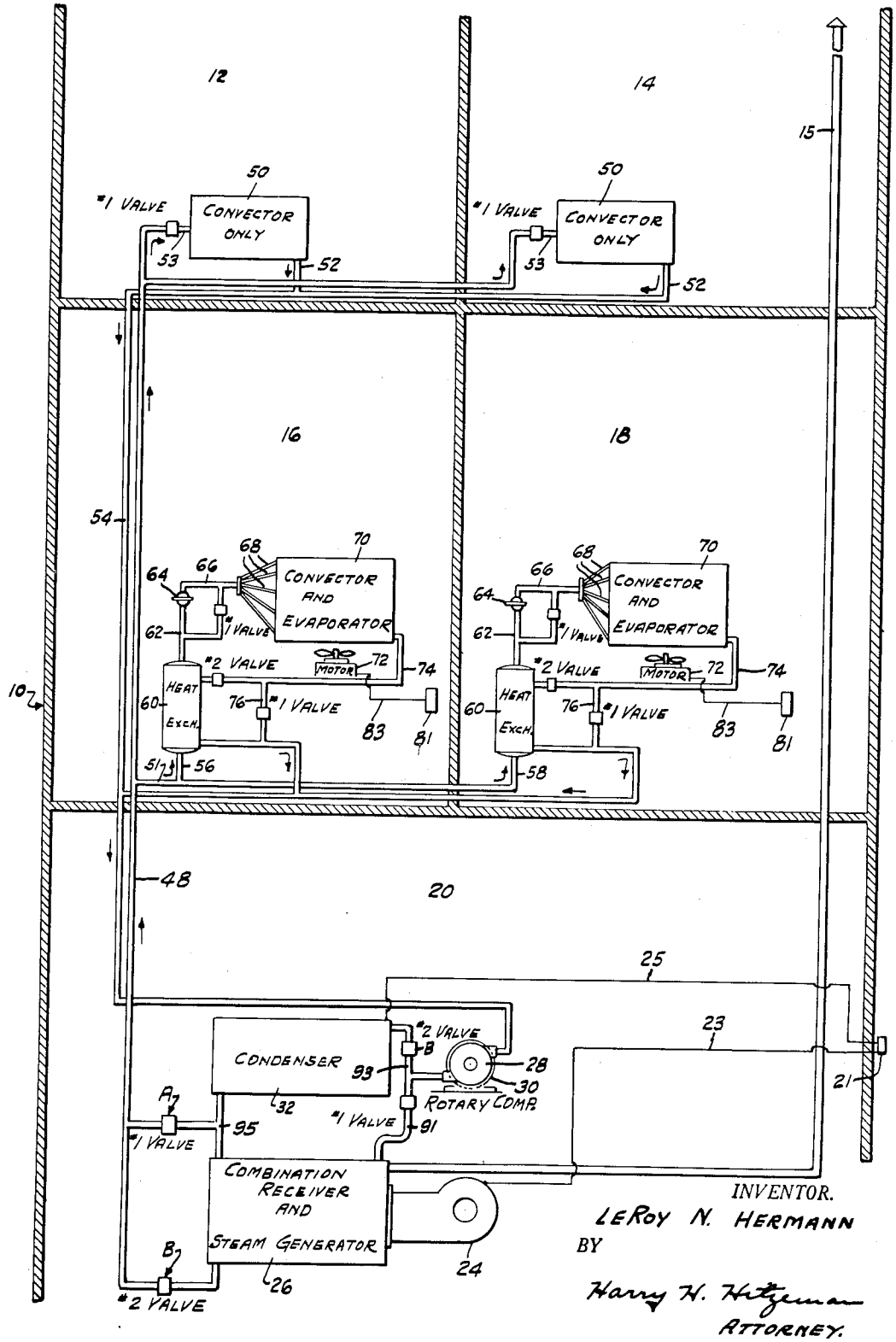
July 31, 1956 LE ROY N. HERMANN 2,756,970

AIR CONDITIONING SYSTEM

Filed Nov. 16, 1954




INVENTOR.
LEROY N. HERMANN
BY
Harry N. Hitzeman
ATTORNEY.

United States Patent Office 2,756,970 Patented July 31, 1956



2,756,970

# AIR CONDITIONING SYSTEM

Le Roy N. Hermann, Chicago, Ill.

Application November 16, 1954, Serial No. 469,236

5 Claims. (Cl. 257—3)

My invention relates to an air conditioning system for buildings of the type which may be used for cooling the building in the summer and for heating the building in the winter.

My invention further contemplates the use of a refrigerating apparatus and refrigerant which may be utilized for both the heating and the cooling of the building.

The principal object of the present invention is to provide an air conditioning system for houses or other types of building units which may be completely automatic in operation, depending entirely upon the outside temperature for actuation for heating or cooling.

A further object of the invention is to provide an improved air conditioning system which may be installed without insulated pipe or conduit and by which zone by zone heating and cooling control may be obtained.

A further object of the invention is to provide an air conditioning system which may be composed of a plurality of convector and combined convector and evaporator units for separate rooms or zones, all in a continuous circulation arrangement, and one which has all the advantages of a vacuum steam system.

A further object of the invention is to provide an air conditioning system of the type described which may be installed as a single unit, but which, when required, may be added to to provide heating or cooling in additional convectors or combined convector and evaporator units.

For a more comprehensive understanding of the features and advantages of my improved system, reference is had to the following description and accompanying drawing wherein a preferred form of the invention is shown.

The single drawing is a diagrammatic view illustrating a system embodying my invention, as installed in an ordinary dwelling house.

In the embodiment of the invention which I have chosen to illustrate and describe the same, I have shown a building **10** which may have a basement **20** therein, and a pair of floors above the same generally dividing the house into the rooms **12**, **14**, **16** and **18**, each room having its own air conditioning or heat exchange unit therein. While in the drawings I have shown two convectors only for direct heating when desired and two combined convectors and evaporators in other rooms, it will of course be understood that the number may be varied and the arrangement need not be either in the proportion shown nor necessarily with convectors and evaporators of the same size. The important feature resides in the fact that in a single installation I have provided a combined heating and/or cooling unit with a plurality of separate closures to be individually air conditioned.

The system which I provide may include an outdoor thermostat **21** which may have an electric circuit **23** extending to an oil burner or other heating unit **24** to control the operation of the same in accordance with the outdoor temperature, and a second electric circuit **25** which will operate to shut off the motor of the blower



of condenser **32** whenever it is desired to use the heating apparatus.

The central installation, preferably in the basement as shown, may also include a rotary compressor **28** suitably driven by an electric motor **30** and a condenser **32**. A vent **15** may extend from the combined receiver and steam generator **26** to an outside location. The rotary compressor **28** is of the type well known in the art which will handle a liquid, a combination of liquid and gas, or gas only. This compressor may be of the type shown in the patent to W. Von Pittler, No. 974,913, issued November 8, 1910, and by the use of which the return line **54**, later to be described, is connected to the inlet for the suction pipe **9**, Fig. 2 of said patent, and the delivery is at the showing for delivery pipe **11** of said patent, to conduit **91** or **93**, depending upon whether heating or cooling is desired.

The system generally may comprise a fluid conduit **48** which extends from the steam generator **26** through a pressure responsive valve B. Valves such as B are shown throughout the circuit where required, and marked #2 valve. These valves, which are all similar, are adapted to operate to permit the passage of gas or fluid at a comparatively low pressure, and adapted to shut off when the pressure reaches a maximum, such for example as 25 pounds.

A plurality of similar valves A, marked #1 valve, are also used throughout the circuit, these valves also being pressure operated and adapted to open to permit the passage of fluid at higher than a minimum pressure, such for example as at 75 pounds or over.

The conduit **48**, as shown, may extend from the bottom of steam generator **26** through valve B through individual leads or conduits **51** and **53** communicating with convectors **50** and combined convectors and evaporators **70** in a manner which will be more fully explained hereinafter.

A return line **54** is connected through leads **52** with the convectors **50** and with leads **74** to the combined convector and evaporator **70**, the return being to the compressor **28**. From the compressor **28**, and depending on whether heating or cooling is desired, fluid will pass either through a valve A in conduit **91** to combined receiver and steam generator **26**, and if cooling is required, through valve B up through conduit **93**. If heating is required, the fluid to be heated will leave receiver and generator **26** through line **95** and valve A to enter conduit **48**. The type of fluid preferred will be discussed hereinafter, the same being used for either heating or cooling.

When fluid for cooling is directed to the combined convector and evaporator **70**, it passes up through conduits **48** and **56** through a heat exchange unit **60**, conduit **62** and expansion valve **64** and conduit **66** to a manifold distributor which has a plurality of tubes **68** communicating with various levels of the unit **70**. From the unit **70** the expanded gas flows through conduit **74** through valve #2 into heat exchanger **60** and returns through conduit **61** to the return line **54**. A motor **72** is associated with the convector and evaporator unit **70**, the control for the motor being the usual room thermostat **81** which has an electric conduit **83** connected to the motor **72**.

When heating is desired in the combined convector and evaporator **70**, fluid will also pass from the main line **48** through conduit **56** and heat exchange unit **60** to a bypass in the line **62** through a valve #1 to the manifold for the unit **70**. The return of the fluid will be through the conduit **74** and conduit **76** through a valve #1 to the return pipe **54**.

A typical operation, both heating and cooling, will now be described. For cooling, the outside thermostat **21**, op-

erating at above 80° F., shuts off burner 24 and opens the solenoid on condenser 32, or opens shutters on condenser 32, causing assumed liquid temperature of 200° F., and pressure of 80 p. s. i. to drop throughout the entire system.

Gas leaves the rotary compressor 28 through conduit 93 to type #2 valve B through condenser 32 through conduit 95 (type #1 valve A being closed to passage of gas or liquid) to receiver 26, and from bottom outlet to receiver through type #2 valve B and up through conduits 48 and 51 through conduit 56. The liquid then goes through the heat exchanger 60 out through conduit 62, through expansion valve 64 (by-pass valve #1 is closed to passage of fluid at the lower pressures used in cooling) through conduit 66 to distributors 68 into evaporator 70; expansion and absorption having taken place, the liquid has now become gas and the gas flows in conduit low side line 74 through valve #2 (valve #1 blocking gas flow at this time) through heat exchanger 60 out return line 61, into return conduit 54, back to compressor 28 to repeat the cycle. It will be noted that any flow leading to conduit 53 and into convector 50 back through conduit 52 to return conduit 54 is blocked by valve #1 so no flow is possible.

For heating, assuming that the system has been on the cooling cycle described above and the outside temperature drops to 65° F. causing the thermostat 21 to start the burner 24 and shutoff condenser 32, the heat rise caused by operating burner 24 in the combination receiver and steam generator will raise the pressure in the entire system to over 80 p. s. i., causing all #1 valves to move from a closed position to an open position, and all #2 valves to move from an open position to a closed position.

Liquid from the rotary compressor 28 flows through valve #1 in conduit 91 into the combined receiver and steam generator 26 where it is heated and flows from generator 26 through conduit 95 and through type #1 valve A to conduit 48 and conduits 51 and 56 to the heat exchanger 60; then from the heat exchanger 60 through conduit 62 through by-pass valve #1 into conductor 66 and through distributor 68 into convector 70, and after losing some of the liquid heat, passes out through conduit 74 through conduit 76 and valve #1 out to return conduit 54, returning to compressor 28 to repeat the cycle. It should be noted that valve #2 in conduit line 74 blocks liquid flow through the heat exchanger 60, so that the heat exchanger 60 acts only as a conduit during the heating cycle.

In the heating phase of this system, part of the liquid flows through conduit 48, through valve #1, through conduit 53, into convector 50 and returns through conduit 52 to conduit 54, flowing to compressor 28 to repeat the heating cycle. The convectors 50 have damper controls, and are used in kitchens and baths, and cannot be used for cooling; each room is its own separate zone and separately controlled.

Because liquids carry more heat than gas, and high pressure compels gas to remain mostly liquid or very dense gas, the fluid flow during the heating cycle will be either liquid or combined liquid and gas at a stage very near a liquid state.

This system presents a unique advantage of combining units which can be adapted to heat only, or to provide both heating and cooling in differing zones with no change of the system, nor any manual correction or manipulation, the system being entirely automatic and adapted to be controlled for heating by the outside thermostat 21, and to be controlled for cooling by the room thermostats 81, providing zone by zone and room by room control.

A system of this kind prevents and precludes a grievous fault with full air distribution systems in that each room and zone is treated individually and no mixtures of noxious odors or gases may be traveled by virtue of a common circuit.

Relative pressures used in tests of this system were for heating gases and liquids at 100 lbs. of pressure and 220 degrees of temperature, and when reverting to the cooling cycle, vacuums of 18 lbs. were used on the low side and a pressure of 10 lbs. per square inch on the high side.

A preferred type of fluid for systems of this description might be Freon No. 11. Other gases may be used having similar characteristics by varying the pressure factors in the control valves A and B and other components of the system.

While I have illustrated and described a specific embodiment of the invention in a general schematic system, it will of course be understood that changes and modifications may be made in the details shown, and I do not wish to be limited in any particular; rather what I desire to secure and protect by Letters Patent of the United States is:

1. Air conditioning apparatus of a house having a plurality of separate closures therein adapted to be heated or cooled, said apparatus including a combination receiver and steam generator, a condenser, a rotary compressor, a conduit from said rotary compressor to both said combination receiver and steam generator and to said condenser, a low pressure-responsive valve between said rotary compressor and said condenser, said valve adapted to shut off when pressure of fluid therethrough reaches a predetermined maximum, a high pressure-responsive valve in said conduit between said rotary compressor and said combination receiver and steam generator, said valve operated to permit flow of fluid therethrough at higher than a predetermined minimum pressure, a supply conduit extending from said combined receiver and steam generator, a combined convector and evaporator, said supply conduit communicating therewith, a low pressure-responsive valve in said conduit adjacent said combined receiver and steam generator, a conduit connecting said condenser and combination receiver and steam generator, a by-pass from said conduit to said supply conduit, a high pressure valve in said by-pass, said supply conduit having an expansion valve therein ahead of said convector and evaporator, a by-pass line around said expansion valve, a high pressure valve in said by-pass line and a return conduit from said convector and evaporator to said rotary compressor.

2. Air conditioning apparatus for a house having a plurality of separate closures therein adapted to be heated or cooled, said apparatus including a combination receiver and steam generator, a condenser, a rotary compressor, a conduit from said rotary compressor to both said combination receiver and steam generator and to said condenser, a low pressure-responsive valve between said rotary compressor and said condenser, said valve adapted to shut off when pressure of fluid therethrough reaches a predetermined maximum, a high pressure responsive valve in said conduit between said rotary compressor and said combination receiver and steam generator, said valve operated to permit flow of fluid therethrough at higher than a predetermined minimum pressure, a supply conduit extending from said combined receiver and steam generator, a combined convector and evaporator, said supply conduit communicating therewith, a low pressure-responsive valve in said conduit adjacent said combined receiver and steam generator, a conduit connecting said condenser and combination receiver and steam generator, a by-pass from said conduit to said supply conduit, a high pressure valve in said by-pass, said supply conduit having an expansion valve therein ahead of said convector and evaporator, a by-pass line around said expansion valve, a high pressure valve in said by-pass line and a return conduit from said convector and evaporator to said rotary compressor, a heat exchanger unit associated with said supply conduit adjacent the combined convector and evaporator, a by-pass from said return conduit extending therethrough and connected to said return conduit beyond said high pressure valve, said by-pass having a low pressure valve therein permitting fluid passage therethrough only during a cooling phase.

3. Air conditioning apparatus for a house having a plurality of separate closures therein adapted to be heated or cooled, said apparatus including a combination receiver and steam generator, a condenser, a rotary compressor, a conduit from said rotary compressor to both said combination receiver and steam generator and to said condenser, a low pressure-responsive valve between said rotary compressor and said condenser, said valve adapted to shut off when pressure of fluid therethrough reaches a predetermined maximum, a high pressure-responsive valve in said conduit between said rotary compressor and said combination receiver and steam generator, said valve operated to permit flow of fluid therethrough at higher than a predetermined minimum pressure, a supply conduit extending from said combined receiver and steam generator, a combined convector and evaporator, said supply conduit communicating therewith, a low pressure-responsive valve in said conduit adjacent said combined receiver and steam generator, a conduit connecting said condenser and combination receiver and steam generator, a by-pass from said conduit to said supply conduit, a high pressure valve in said by-pass, said supply conduit having an expansion valve therein ahead of said convector and evaporator, a by-pass line around said expansion valve, a high pressure valve in said by-pass line and a return conduit from said convector and evaporator to said rotary compressor, a heat exchanger unit in said return conduit and a high pressure valve and a low pressure valve associated therewith to permit return through the heat exchanger during a cooling phase and to by-pass the heat exchanger during a heating phase.

4. Air conditioning apparatus for a house having a plurality of separate closures therein adapted to be heated or cooled, said apparatus including a combination receiver and steam generator, a condenser, a rotary compressor, a conduit from said rotary compressor to both said combination receiver and steam generator and to said condenser, a low pressure-responsive valve between said rotary compressor and said condenser, said valve adapted to shut off when pressure of fluid therethrough reaches a predetermined maximum, a high pressure-responsive valve in said conduit between said rotary compressor and said combination receiver and steam generator, said valve operated to permit flow of fluid therethrough at higher than a predetermined minimum pressure, a supply conduit extending from said combined receiver and steam generator, a combined convector and evaporator, said supply conduit communicating therewith, a blower associated with said combined convector and evaporator, a low pressure-responsive valve in said



conduit adjacent said combined receiver and steam generator, a conduit connecting said condenser and combination receiver and steam generator, a by-pass from said conduit to said supply conduit, a high pressure valve in said by-pass, said supply conduit having an expansion valve therein ahead of said convector and evaporator, a by-pass line around said expansion valve, a high pressure valve in said by-pass line and a return conduit from said convector and evaporator to said rotary compressor, a heat exchanger unit in said return conduit and a high pressure valve and a low pressure valve associated therewith to permit return through the heat exchanger during a cooling phase and to by-pass the heat exchanger during a heating phase.

5. Air conditioning apparatus for a house having a plurality of separate closures therein adapted to be heated or cooled, said apparatus including a combination receiver and steam generator, a condenser, a rotary compressor, a conduit from said rotary compressor to both said combination receiver and steam generator and to said condenser, a low pressure-responsive valve between said rotary compressor and said condenser, said valve adapted to shut off when pressure of fluid therethrough reaches a predetermined maximum, a high pressure-responsive valve in said conduit between said rotary compressor and said combinaton receiver and steam generator, said valve operated to permit flow of fluid therethrough at higher than a predetermined minimum pressure, a supply conduit extending from said combined receiver and steam generator, a combined convector and evaporator, said supply conduit communicating therewith, a heat exchanger associated with said supply conduit and positioned adjacent said combined convector and evaporator, a low pressure-responsive valve in said conduit adjacent said combined receiver and steam generator, a conduit connecting said condenser and combination receiver and steam generator, a by-pass from said conduit to said supply conduit, a high pressure valve in said by-pass, said supply conduit having an expansion valve therein ahead of said convector and evaporator, a by-pass line around said expansion valve, a low pressure valve in said by-pass line and a return conduit from said convector and evaporator to said rotary compressor, said heat exchanger connected by a by-pass line in said return conduit only during a cooling phase.

**References Cited** in the file of this patent

UNITED STATES PATENTS

| | | |
|---|---|---|
| 2,260,887 | Dasher | Oct. 28, 1941 |
| 2,645,101 | La Porte | July 14, 1953 |