

May 7, 1940.

C. E. LEWIS

2,200,215

REFRIGERATING APPARATUS

Filed Feb. 10, 1938

3 Sheets-Sheet 1

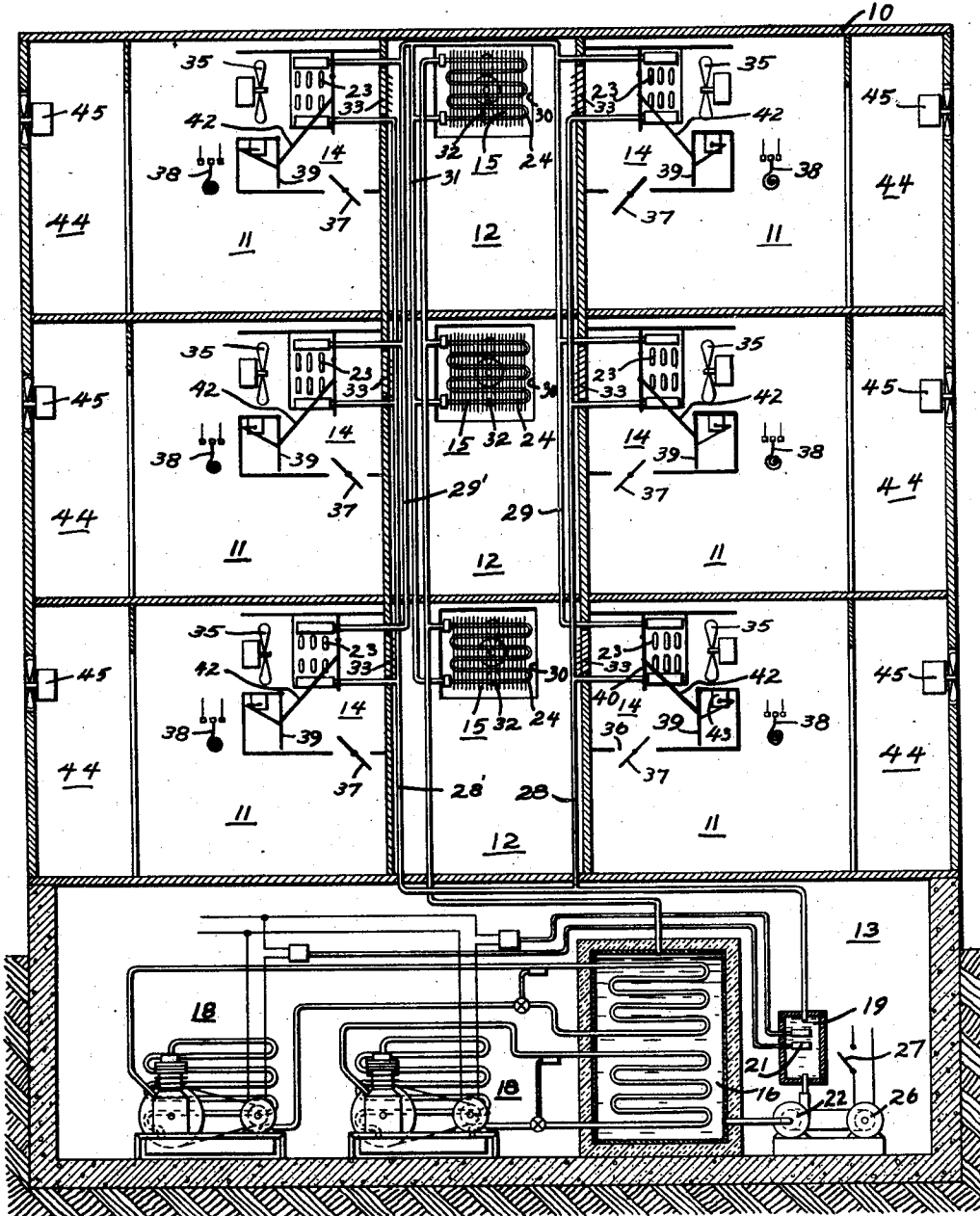


Fig. 1

INVENTOR.
C. E. Lewis
BY Spencer, Hardman & Fehr
ATTORNEYS.

May 7, 1940.

C. E. LEWIS

2,200,215

REFRIGERATING APPARATUS

Filed Feb. 10, 1938

3 Sheets-Sheet 2

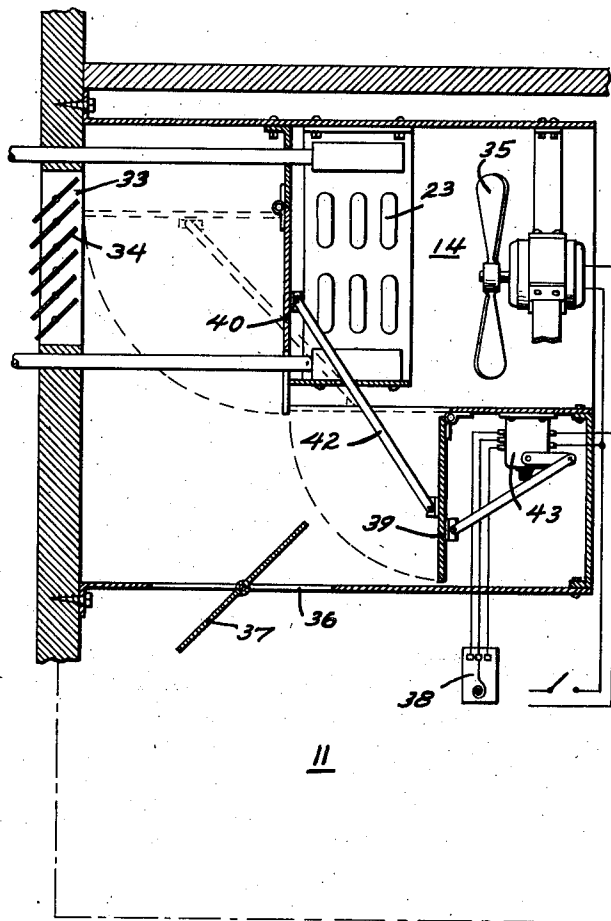
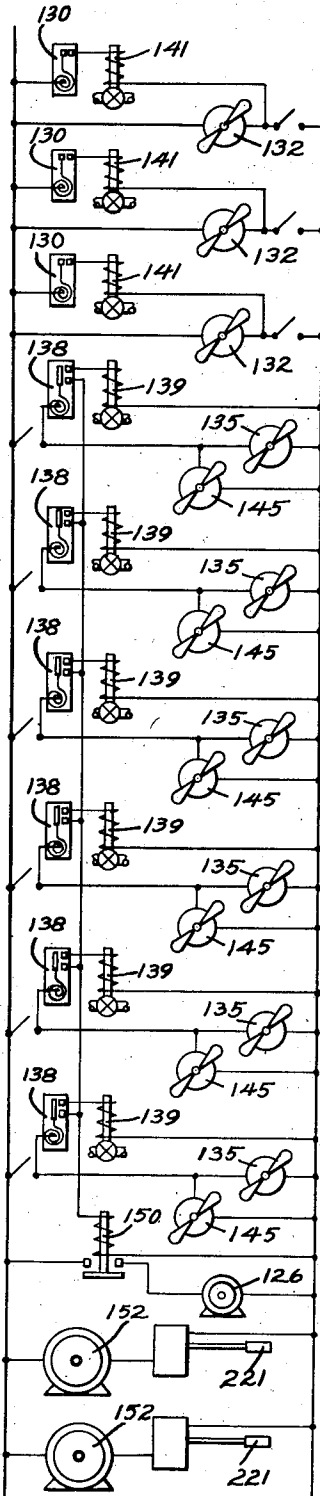


Fig. 2

Fig. 4

INVENTOR.
Carroll E. Lewis
BY Spencer, Hardman & Fehr
ATTORNEYS.

May 7, 1940.

C. E. LEWIS

2,200,215

REFRIGERATING APPARATUS

Filed Feb. 10, 1938

3 Sheets-Sheet 3

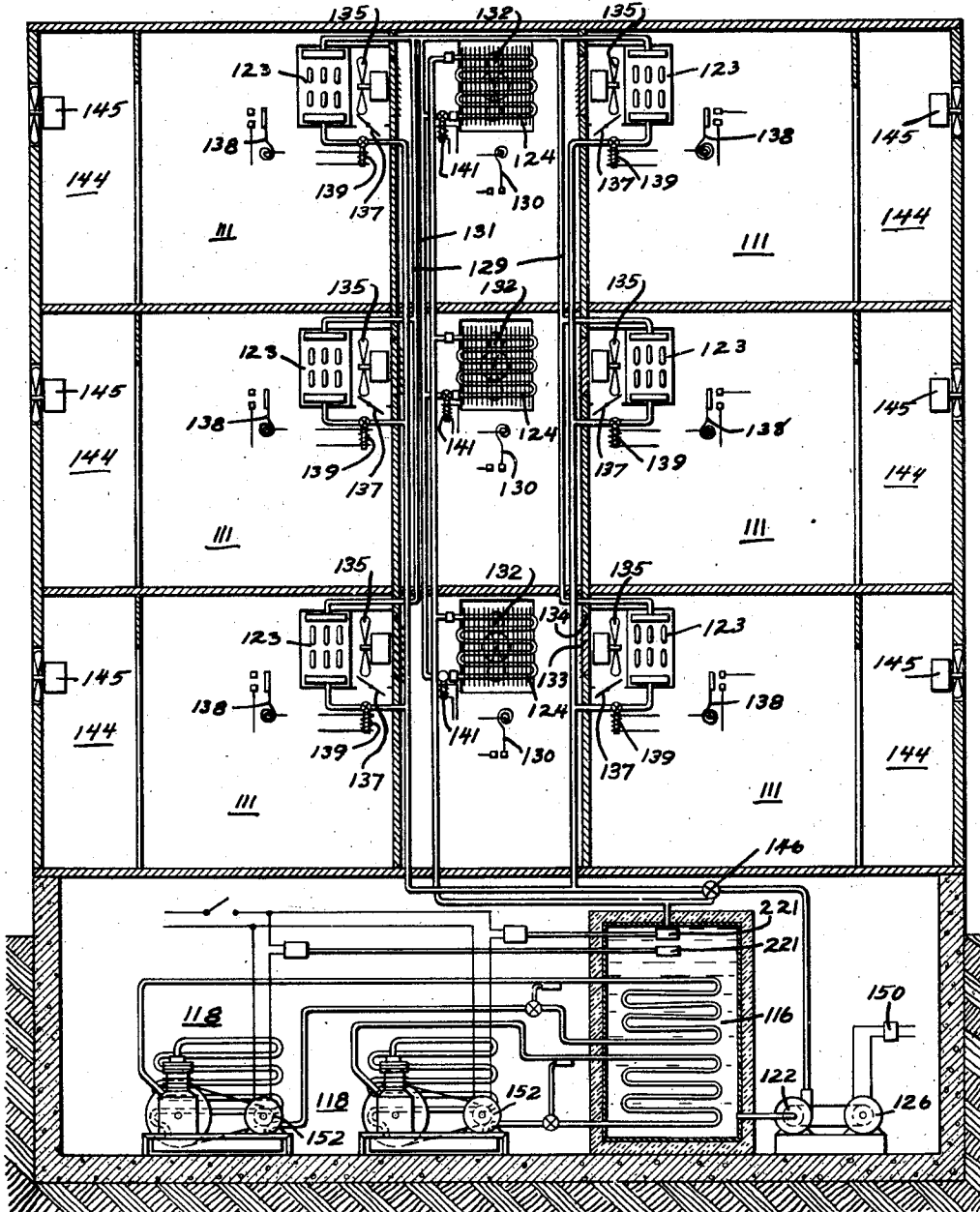


Fig. 3

INVENTOR.
Carroll E. Lewis
BY *Spencer, Hardman & Fehr*
ATTORNEYS.

UNITED STATES PATENT OFFICE

2,200,215

REFRIGERATING APPARATUS

Carroll E. Lewis, Dayton, Ohio, assignor to General Motors Corporation, Dayton, Ohio, a corporation of Delaware

Application February 10, 1938, Serial No. 189,832

6 Claims. (Cl. 62-134)

This invention relates to refrigerating apparatus and more particularly to the method and apparatus for cooling a plurality of individual rooms, such as in a hotel.

5 An object of the invention is to provide a system wherein cooled water may be circulated to the individual rooms and wherein waste water from the rooms may be used to cool the corridors.

10 Another object of this invention is to provide a ductless air conditioning system for use in hotels, office buildings and the like.

A further object of this invention is to provide novel control means for the conditioning apparatus.

15 Still another object of this invention is to utilize excess cooling capacity for precooling the fresh air prior to circulating the fresh air over the individual room cooler.

20 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:

25 Fig. 1 is a diagrammatic sectional elevational view showing a building equipped with a conditioning system employing features of my invention;

30 Fig. 2 is a fragmentary sectional view showing more in detail the construction of the conditioning apparatus placed in the individual rooms;

Fig. 3 is a diagrammatic sectional elevational view showing a building equipped with a modified form of air conditioning apparatus; and

35 Fig. 4 shows the circuit diagram used in the air conditioning system shown in Fig. 3.

In the first embodiment of my invention, the building 10 which has a plurality of rooms 11, corridors 12 and a basement 13 is provided with an air conditioning system employing a plurality of individual air conditioning units placed in the rooms and corridors and generally designated by the reference characters 14 and 15. These units are supplied with cold water, or any other suitable cooling medium from the supply tank 16 which for purposes of illustration has been shown as located in the basement. Each room is provided with one or more of the conditioning units 14 and each corridor is provided with one or more of the units 15. The water in the storage tank 16 is cooled by means of one or more refrigerating units 18 which are controlled automatically in response to the temperature of water in the receptacle 19 placed in the water line leading to the individual conditioning units.

Each refrigerating unit 18 is provided with a thermostat 21 in the receptacle 19, and this thermostat starts and stops the refrigerating unit 18 in the conventional manner. The thermostats 21 may be set to operate at the same temperature or at different temperatures.

A pump 22 is provided for continuously circulating the water first through the cooling coils 23 in parallel and then through the coils 24 in parallel. The pump 22 is driven by means of a motor 26 which may be started or stopped by the manually controlled switch 27. During operation of the system, however, the motor 26 which drives the pump 22 will be in operation at all times, and the amount of water circulated will be constant since no means are provided in this modification for varying the amount of cooling water flowing through the individual cooling coils. With this arrangement the water lines have a constant restriction irrespective of the number of individual cooling units in operation. Water is supplied to the cooling coils 23 through the riser pipes 28 and 28' which supply water to all of the coils 23 in parallel. The water leaving the coils 23 leaves via one or the other of the pipes 29 and 29' which lead to the upper part of the building, from whence it flows through the pipe 31 to the respective corridor cooling coils 24. Inasmuch as the coils 24 are all connected in parallel, water of substantially the same temperature is supplied to each of these coils. The coils 24 are placed in the fresh air inlets 30 through which fresh air is introduced into the corridors by means of fans 32 which are in operation at all times.

Each individual room cooling unit is placed adjacent an opening 33 leading from a corridor 12 into a room 11. As best shown in Fig. 2, a damper arrangement 34 is provided in each of the openings 33. The dampers 34 are preferably left uncontrolled, but may be either manually or automatically controlled in response to either dry bulb temperature, wet bulb temperature, or a combination of both. A fan 35 is used for circulating air through the conditioning unit 14. The air flowing through the unit 14 may be corridor air coming through the passage 33, or it may be recirculated room air coming through the passage 36, or it may be a mixture of both. The passage 36 is provided with a damper 37 which is preferably left open at all times but which may be either manually controlled or automatically controlled by a dry bulb thermostat, a wet bulb thermostat, or by a combination of both.

In order to control the amount of cooling tak-

ing place in each individual room, a thermostat 38 is provided in each room for controlling the positioning of dampers 39 and 40. These dampers are connected by link 42 so as to operate simultaneously. A conventional type of damper operating motor 43 is provided which moves the dampers into the full-line position when the temperature within the room is below a predetermined point and moves the dampers to the dotted-line position whenever the temperature is high enough to require added cooling. In the dotted-line position of the dampers 39 and 40, all of the air is caused to circulate over the cooling coil 23; whereas, in the full-line position, all of the air is by-passed around the cooling coil with the result that very little, if any, cooling takes place.

The fan 35 is intended to be operated at all times so as to maintain a constant air velocity within the room irrespective of the temperature conditions within the room. However, this fan 35 may, likewise, be controlled either by means of a dry bulb thermostat, wet bulb thermostat or a combination of both.

In hotel installations and similar installations where an extra room 44 such as a toilet cloak room, or the like is provided in connection with the room to be conditioned, an exhaust fan 45 is provided which exhausts air from the extra room 44 to the outdoor atmosphere. The fan 45 could be used to discharge the air directly from the main room, if desired. With the arrangement of pipes, as shown in Fig. 1, preference is given to the cooling of the individual rooms, and only waste water is used in cooling the corridors.

In a modification shown in Fig. 3, the water in the cold water storage tank 116 is cooled by one or more refrigerating units 118 which are started and stopped in response to temperature of the water at 221. The arrangement may be such that, normally, only one refrigerating unit 118 is in operation, and the second unit comes into operation only when the cooling water exceeds a predetermined high temperature. In the arrangement shown in Fig. 3 the temperature of the individual rooms 111 is controlled by means of a thermostat 138 which, in place of operating by-pass dampers, operates a solenoid valve 139 which controls the flow of cooling water into the cooling coils 123. A pressure responsive relief valve 146 is provided between the cold water supply line and the return line so as to compensate for changes in the number of solenoid valves which are open. In this installation, as in the installation shown in Fig. 1, the cooling water first flows through the room cooling coils 123 in parallel and is then conveyed by means of pipes 128 to the return line 131 which supplies cooling water to the corridor cooling coils 124 which are likewise arranged in parallel. In order to regulate the temperature in the corridors, thermostats 130 are provided which control solenoid valves 141 placed in the individual lines leading to the cooling coils 124.

In this modification, as in the modification shown in Fig. 1, the fresh air is first introduced into the corridors by means of fans 132 and passes over the cooling coils 124, and air from the corridors is supplied to the individual rooms through passages 133 by means of fans 135. The amount of corridor air supplied to each room may be fixed or it may be varied by means of the dampers 134 and 137. Air may be exhausted from the room by means of fans 145

placed in an opening in an outside wall of either the room 111 or some other room such as room 144 adjoining room 111.

As shown in Fig. 4 the water circulating pump motor 126 is energized by the relay switch 150 whenever one of the control thermostats closes the circuit to one of the solenoid valves. The circuits for energizing the motors 152 which operate the compressors are energized by thermostats 221 which are responsive to the temperature of water returning from the cooling coils.

While I have disclosed an air conditioning system in which the air is cooled by means of cold water or the like flowing through coils in the path of air being circulated, certain features of the invention could equally well be used in a system in which volatile refrigerant evaporators could be used in lieu of the water cooled coils. In installations where refrigerant evaporators are substituted for the water coils the refrigerant could be supplied to all of the individual evaporators from a single refrigerant liquefying unit located in the basement, for example; or a number of independent refrigerating systems could be used. The fresh air would be introduced into the corridors in a manner disclosed hereinabove, and air from the corridors would be supplied to the individual rooms the same as in the installations described hereinabove.

While the form of embodiment of the 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 conditioning air for a room and a corridor adjacent said room which comprises circulating a cooling medium in thermal exchange with air in said room, thereafter circulating said cooling medium in thermal exchange with air for said corridor, and thereafter introducing air from said corridor into said room.

2. Air conditioning apparatus comprising a cold water sump, an evaporator in thermal exchange relationship with said sump, refrigerant liquefying means for supplying refrigerant to said evaporator, a plurality of cooling coils, means for circulating water from said cold water sump to said cooling coils, means whereby said water flows through one group of said coils in parallel, and means whereby at least a portion of the water returning from said one group flows through another coil prior to its return to said sump.

3. Air conditioning apparatus for a plurality of rooms comprising means for circulating fresh air into a first of said rooms, first means for cooling said fresh air, a second cooling means in a second room, means for circulating air from said second room over said second cooling means, and means for circulating a cooling fluid first through said second cooling means and thereafter through said first cooling means.

4. The method of conditioning a plurality of rooms which comprises circulating a cooling medium through a first cooling zone in a first room and thereafter through a second cooling zone in a second room, introducing fresh air into said second room, circulating said fresh air through said second cooling zone and thereafter introducing said cooled fresh air into said first room.

5. The method of conditioning air for a build-

ing having a plurality of rooms leading from a corridor which comprises circulating a cooling medium through a cooling coil for one of said rooms and thereafter through a cooling coil for said corridor, introducing fresh air into the corridor over the cooling coil for the corridor and introducing corridor air into said room, and further cooling the corridor air when conditions in the room require.

10 6. In combination with a building having a corridor and a plurality of rooms, a first cooling

coll, means for circulating outside air over said coil and into the corridor, an opening between said corridor and one of said rooms, an air conditioner in said room adjacent said opening, a second cooling coil in said conditioner, means for circulating a cooling medium through said coils in series, means for circulating air from said corridor through said conditioner, and means for by-passing a portion of said air around one of said cooling coils.

CARROLL E. LEWIS.

10