

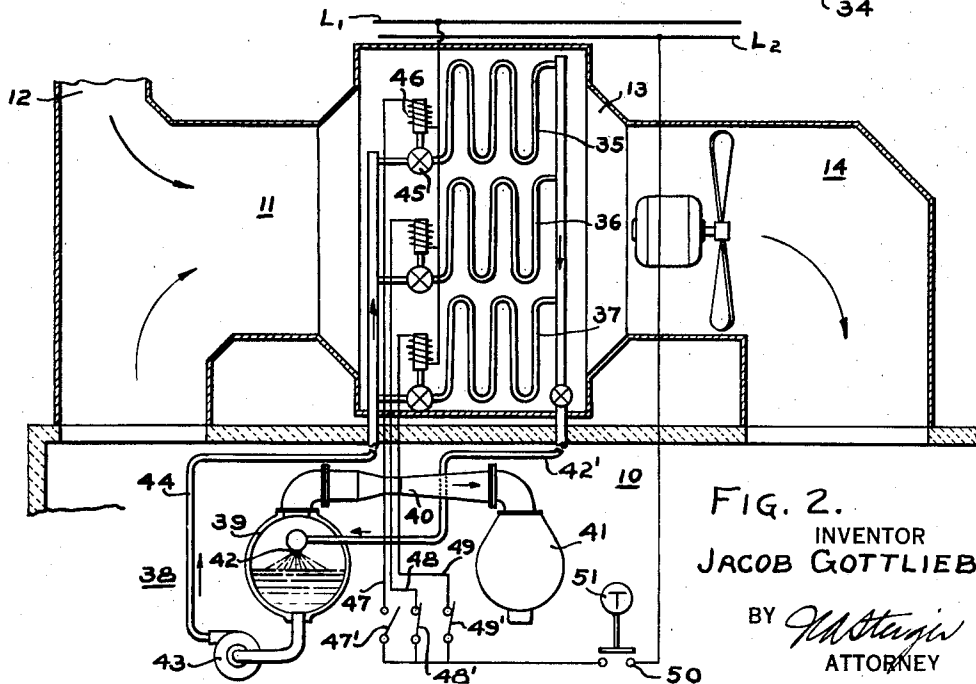
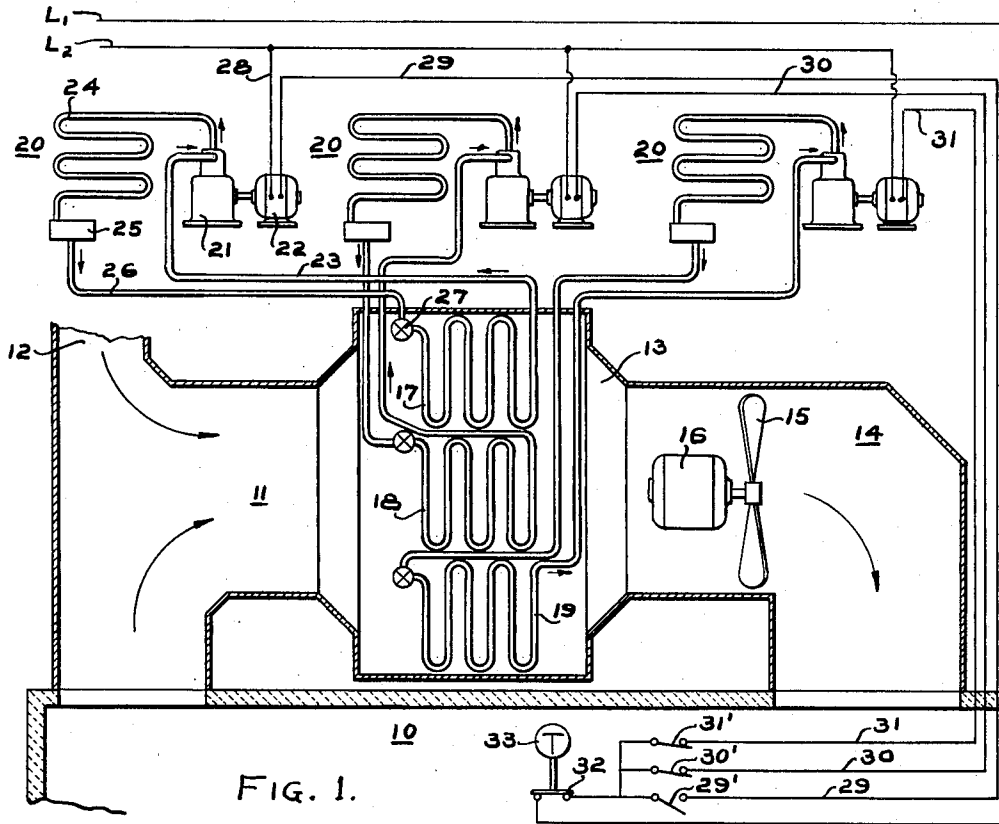
April 25, 1939.

J. GOTTLIEB

2,155,484

AIR CONDITIONING APPARATUS

Filed Jan. 12, 1935



INVENTOR
JACOB GOTTLIEB.

BY *W. H. H. H.*
ATTORNEY

UNITED STATES PATENT OFFICE

2,155,484

AIR CONDITIONING APPARATUS

Jacob Gottlieb, New York, N. Y., assignor to Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., a corporation of Pennsylvania

Application January 12, 1935, Serial No. 1,475

4 Claims. (Cl. 62—6)

My invention relates to air conditioning apparatus, more particularly to mechanism for controlling the operation of air cooling and dehumidifying apparatus, and it has for an object to provide improved apparatus.

A further object is to provide a simple and satisfactory control mechanism of the character set forth.

A further object is to provide automatic operation of air cooling and dehumidifying apparatus without producing excessive cooling on a day which is only moderately hot.

In accordance with my invention, I provide a plurality of air cooling elements arranged in parallel with respect to flow of air being cooled. I provide mechanism whereby each air cooling element may be individually rendered operable or inoperable at will, and mechanism for automatically controlling the operation of those elements which are rendered operable. The air cooling elements may be of any type known in the art; for example, they may be evaporators having refrigerating units for supplying liquid refrigerant thereto.

The above and other objects are effected by my invention as will be apparent from the following description and claims taken in connection with the accompanying drawing, forming a part of this application, in which:

Fig. 1 is a diagrammatic view of one embodiment of my invention, in which a compression refrigerating system is provided for each air cooling element; and

Fig. 2 is a diagrammatic view of a second embodiment, in which a vapor jet cooling unit supplies cold liquid to the several air cooling elements.

Referring to the drawing in detail, I show, in Fig. 1, an enclosure 10 which is to be supplied with cooled and dehumidified air. A duct 11 is provided for conveying return air from the enclosure and fresh air from a fresh air inlet 12 to a chamber 13, in which it is cooled and dehumidified, and a supply duct 14 delivers the conditioned air to the enclosure 10, said circulation being effected by a fan 15 driven by a motor 16. A plurality of air cooling and dehumidifying elements, 17, 18, and 19, preferably in the form of coils, are provided in the chamber 13, and are arranged in a row extending across the stream of air flowing therethrough, so that said elements are arranged in parallel with respect to air flow.

The air cooling elements may be of any suitable form known in the art. They may be supplied with any suitable cooling fluid, such as a cold

liquid which absorbs merely sensible heat or a refrigerant liquid which is vaporized therein, and having a temperature suitable for air cooling for comfort, such as about 40° F. In either case, the cooling elements may be supplied with cooling fluid either from a common source or from separate sources.

As illustrated in Fig. 1, each cooling element constitutes the evaporator of refrigerating apparatus and is supplied with its own refrigerating system or unit 20. Each refrigerating unit 20 includes a compressor 21 driven by a motor 22 and having its inlet connected by a conduit 23 to the outlet of the cooling element. The outlet of the compressor is connected to a condenser 24 which, in turn, is connected through a liquid receiver 25 to a supply conduit 26. The latter is connected through an expansion valve 27 to the inlet of the air cooling element or coil. The expansion valve 27 may be of any suitable form known in the art, or any equivalent device for reducing the pressure of the refrigerant may be used.

Electric current for driving the motors 22 and effecting operation of the air cooling apparatus is supplied through line conductors L₁ and L₂. One terminal of each motor is connected to the line conductor L₂ through a conductor 28. The other terminals of the several motors associated with the cooling elements 17, 18, and 19 are connected to circuits 29, 30, and 31, respectively. Manually operated switches 29', 30', and 31' are connected in the circuits 29, 30, and 31, respectively, whereby any of the circuits may be opened at will. From the manually operated switches, the several circuits are connected in common through a thermostat switch 32 operated by a thermostat 33 in response to an operating condition of the apparatus, for example, the temperature of the air within the enclosure 10. The thermostat 33 may be located either within the enclosure 10 or in the duct 11 at a point ahead of the fresh air inlet. From the thermostat switch 32 the common circuit extends through a conductor 34 to the line conductor L₁.

Operation

The fan 15 is operated to provide circulation of return air from the enclosure and fresh air to the air cooling elements, and for supplying the same through the duct 14 to the enclosure 10. The operation of the fan 15 may be controlled in any suitable manner, but preferably, it is operated for the full period that air cooling operation is desired, that is, it is operated continuously while the

air cooling elements are operated intermittently. The number of air cooling elements that may be operated is determined by closing the manually operated switches for those cooling elements which it is desired to operate and opening the manually operated switches of the cooling elements which are not to be operated. The number of cooling elements to be operated may be determined in accordance with the general conditions of the day. On a very hot and humid day, all of these switches will be closed, while on a day which is only moderately hot, only one or two of the switches will be closed and the others left open. In other words, as many cooling elements are rendered operable as will supply the required cooling load. The air cooling elements which are rendered operable by closing their manually operated switches are then controlled automatically by the switch 32, which is actuated by room temperature taken either in the return duct 11 or the enclosure 10. As the temperature in the enclosure 10 rises above a predetermined degree, the thermostat 33 operates the switch 32 to close those circuits whose manually operated switches are closed, thereby effecting cooling of the operable air cooling elements. Cooled air is supplied to the enclosure until the temperature therein drops below said predetermined value, whereupon the thermostat 33 opens the switch 32, and cooling action is discontinued. As indicated above, circulation of air without cooling preferably continues to provide the desired ventilation.

In Fig. 2, I show a second embodiment of my invention in which an enclosure 10 is similarly connected through a return duct 11 and a supply duct 14 to an air cooling chamber 13. Air cooling elements 35, 36, and 37 are arranged in the chamber 13 in a row transversely of the air stream, as in the first embodiment. In this embodiment, however, the air cooling elements are supplied with a cold liquid which absorbs heat only as sensible heat, and they are preferably supplied from a common source of cold liquid.

The cold liquid may be supplied by a conventional vapor jet vacuum cooling unit indicated generally by the reference numeral 38. This unit includes a cold tank or flash chamber 39 in which a high vacuum is produced by an ejector 40 which withdraws vapor from the tank 39. The ejector 40 is motivated in any suitable manner, as by steam, and discharges into a condenser 41. The liquid returned from the air cooling elements through a return conduit 42' is discharged into the interior of the tank 39 through spray nozzles 42, whereby it is subjected to the vacuum in the tank and cooled by partial evaporation of liquid, as is well understood in the art. The cooled liquid is then circulated by a pump 43 through a conduit 44 to the several air cooling elements.

Each air cooling element is provided with a valve 45 for controlling the flow of cooling liquid therethrough. These valves are preferably operated by solenoids 46 connected in circuits 47, 48, and 49, respectively, in which there are provided manually operated switches 47', 48', and 49' as in the first embodiment. The several circuits are connected in series with a thermostat switch 50 actuated by a thermostat 51 responsive to the temperature of the air in the enclosure 38. From the switch 50 the common circuit is connected to a line conductor L₂, while the opposite terminals of the solenoids 46 are connected to the line conductor L₁.

The operation of this embodiment is the same as that of Fig. 1, the only difference being that

the several air cooling elements are controlled by the valves 45 controlling the flow of cooling liquid therethrough, instead of controlling several refrigerating units. The vapor jet cooling unit 38 operates in the usual manner well known in the art, being controlled to provide a constant temperature of the cold liquid supplied to the air cooling elements.

From the above description, it will be seen that I have provided a control mechanism for air cooling apparatus whereby the degree of cooling can be readily adjusted to the general load characteristics of the day, and whereby the operation of the cooling apparatus is controlled automatically so as to maintain the desired temperature or other condition. By reducing the number of cooling units in operation on a day which is only moderately hot, the delivery of excessively cold or an excessive quantity of cold air is avoided.

While I have shown my invention in two forms, it will be obvious to those skilled in the art that it is not so limited but is susceptible of various other changes and modifications without departing from the spirit thereof and I desire, therefore, that only such limitations shall be placed thereupon as are imposed by the prior art or as are specifically set forth in the appended claims.

What I claim is:

1. In apparatus for cooling air for an enclosure, the combination of a plurality of evaporators, a refrigerating unit for each evaporator for supplying refrigerant thereto, means for conveying air over said evaporators in parallel and delivering the same to said enclosure, said means including a fan common to the several evaporators, manually actuated means for individually rendering each refrigerating unit and its evaporator operable or inoperable at will, and means responsive to a condition of the air in the enclosure for starting and stopping operation of all the operable refrigerating units and evaporators simultaneously.

2. In apparatus for cooling air for an enclosure, the combination of a plurality of evaporators, a refrigerating unit for each evaporator for supplying refrigerant thereto, means for conveying air over said evaporators in parallel and delivering the same to said enclosure, said means including a fan common to the several evaporators, means for individually rendering each refrigerating unit and its evaporator operable or inoperable, and means for starting and stopping operation of all the operable refrigerating units and evaporators simultaneously in response to the temperature of the air in the enclosure.

3. In apparatus for cooling air for an enclosure, the combination of a plurality of evaporators, a refrigerating unit for each evaporator for supplying refrigerant thereto, means for conveying air over said evaporators in parallel and delivering the same to the enclosure, said means including a fan common to the several evaporators, an electrical circuit for controlling operation of each refrigerating unit and its evaporator, a switch in each circuit for rendering the same operable or inoperable, and means operable automatically in response to the temperature of the air in the enclosure for opening and closing the operable circuits simultaneously.

4. In apparatus for cooling air for an enclosure, the combination of a plurality of cooling elements, a housing and duct structure common to said cooling elements for housing the cooling elements and for conveying air from the cooling elements to the enclosure, said cooling elements

being arranged in parallel with respect to flow of air thereover, a fan common to the several cooling elements for effecting flow of air thereover and through the housing and duct structure to the enclosure, an electrical circuit for controlling each cooling element, a manually actuated switch in

each of a plurality of said circuits for rendering the same operable or inoperable, and means operable automatically in response to the temperature of the air in the enclosure for opening and closing the operable circuits simultaneously.

JACOB GOTTLIEB.