

Dec. 14, 1943.

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2,336,671

REFRIGERATING APPARATUS

Original Filed Nov. 29, 1933

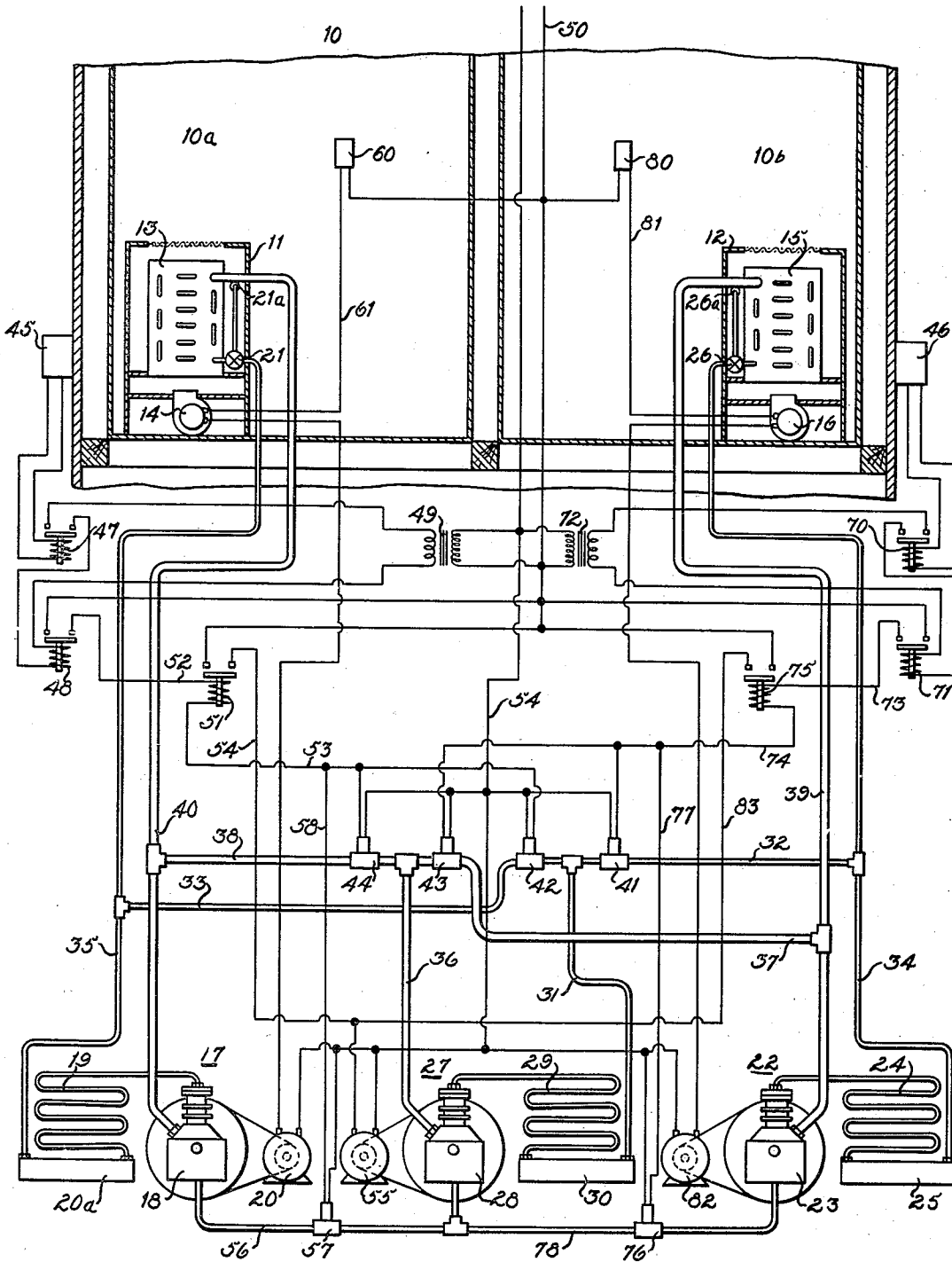


Fig. 1

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UNITED STATES PATENT OFFICE

2,336,671

REFRIGERATING APPARATUS

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Original application November 29, 1933, Serial No.
700,171. Divided and this application July 9,
1941, Serial No. 401,677

3 Claims. (Cl. 62—115)

This invention relates to refrigerating apparatus, and is directed to the conditioning of air in a building or the like in which the conditioning load varies in several parts of the building at certain periods of time. Thus in a building where the sun shines on opposite sides thereof, the conditioning load is greater on one side at one time of the day and is greater on the other side of the building at another time of the day. It is among the objects of this invention to provide an air conditioning apparatus which may shift its conditioning capacity to meet these changing conditions.

This is a division of my copending application, Serial No. 700,171, filed November 29, 1933, now Patent No. 2,274,774.

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

In the drawing:

The single figure is a diagrammatic representation of one embodiment of my invention.

To illustrate my invention, a building, generally designated as 10, may have means 11 and/or 12 for modifying the condition of the air at various parts or rooms 10a and 10b in the building. While I prefer to use my invention with a plurality of modifiers, certain aspects of my invention may be applied where only one modifier is used. Thus where only one such modifier is used, conditions may arise wherein the modifier need not operate during a certain portion of the day, but should operate during other parts of the day. It is within the purview of my invention that automatic means responsive to the sun's rays may be provided thus automatically to control the single modifier. Where two or more air modifiers are used, it is within the purview of this invention to provide means for automatically changing the operation of the modifiers to meet changes in the conditioning load on the apparatus throughout the building.

To accomplish the foregoing, the modifier 11 may be in the form of an evaporator 13 through which air is blown by the electrically driven blower 14. The second air modifier 12 may be in the form of a second evaporator 15 through which air is blown by the electrically driven blower 16. The evaporator 13 is connected to a first refrigerant liquefying unit 17, preferably in the form of a compressor 18, condenser 19 and receiver 20a in closed refrigerant flow connection with the evaporator 13, the compressor 18 being driven by an electric motor 20. The evaporator 13 may be provided with any suitable means of properly maintaining the refrigerant therein, and to this end an automatic expansion valve 21 is provided, having a thermostatic bulb

21a in contact with the outlet of the evaporator 13. This type of valve is constructed to maintain the evaporator 13 substantially in a liquid refrigerant flooded condition.

The second evaporator 15 is connected to a second refrigerant liquefying unit 22, similar to the first refrigerant liquefying unit 17, and which preferably comprises a compressor 23, condenser 24, refrigerant receiver 25 in closed refrigerant flow circuit with the evaporator 15, a suitable refrigerant flow valve, in the form of an automatic expansion valve 26 having thermostatic bulb 26a, being provided, the action of valve 26 being similar to the action of valve 21.

In the modification shown in the figure, a booster is provided to enhance the conditioning power of either or both the modifiers 11 and 12. In this particular embodiment, the booster is in the form of a booster refrigerant liquefying unit 27, preferably comprising a compressor 28, condenser 29 and receiver 30, constructed and arranged so that it may be connected in refrigerant flow relationship with either or both the evaporators 13 and 15.

In order to permit the booster 27 to be connected with either or both of the modifiers, the receiver 30 is connected with a liquid refrigerant pipe 31, having branches 32 and 33 which are connected respectively with the liquid refrigerant pipes 34 and 35 which connect respectively the receiver 25 with the evaporator 15 and the receiver 20 with the evaporator 13. Likewise the evaporated refrigerant line 36, which leads to the compressor 28 is connected by branches 37 and 38 respectively with the evaporated refrigerant lines 39 and 40 which connect respectively evaporator 15 with the compressor 23, and evaporator 13 with compressor 18.

Suitable valves, preferably in the form of solenoid valves 41, 42, 43 and 44 are provided for connecting the booster 27 with either of the modifiers 11 and 12. If the connection is to be automatic, automatic means, responsive to the shifting conditions of the building, are provided for properly actuating these valves. To this end, a first sun ray-sensitive instrument 45 is provided for the modifier 11 and evaporator 13 and a second sun ray-sensitive instrument 46 is provided for the modifier 12 and evaporator 15. These ray-sensitive instruments are constructed and arranged to change the operation of at least one of the modifiers in response to the action of the sun's rays on the instrument. This is accomplished by causing these instruments to connect the booster refrigerant liquefying unit 27 with either or both the evaporators 13 and 15 thus to embrace the conditioning power of these evaporators by enhancing the refrigerant liquefying capacities connected with the evaporators. The connection of the booster 27 by means of

the instruments 45 and 46 is accomplished by suitable electrical relays. Thus when sun's rays become sufficiently effective on the instrument 45, the relay 47 is energized. This causes the relay 48 to be energized through the action of the current flowing through the transformer 49, which in turn is energized by the line current from source 50. When the more powerful relay 48 is closed, current flows through the line 52 and 53 to the solenoid valves 44 and 42 and back to the main line 54, thus opening valves 44 and 42 and thus connecting the booster 27 in refrigerant flow relationship with the evaporator 13. It is also desirable simultaneously to cause the refrigerant liquefying unit 27 to start operating if the same is not already operating. This is accomplished by providing a relay 51 which is energized by the relay 48, which relay 51 causes current to flow through the line 54 to the motor 55 which drives the compressor 28, thus causing the unit 27 to start operating. Also, if the compressors in these units have bodies of lubricant which may enter into flow relationship with the refrigerant, it is desirable to provide a lubricant flow connection between the compressors which connection is opened when the booster is connected with either of the other refrigerant liquefying units. Thus a lubricant line 56 is provided with the solenoid valve 57 which is energized through the line 58 when the relay 48 is closed, and thus the oil in the crankcase of the compressors 18 and 28 attain a common level at the opening of the valve 57. If, therefore, there is any tendency for the oil flowing through the refrigerating system to accumulate in either of the compressors 18 or 28, the connection 56 overcomes this tendency and prevents the accumulation of oil in one compressor to the detriment of the other.

Preferably the air modifier 11 is automatically controlled in accordance with conditions in the enclosure 10a in which it is located. Thus the condition sensitive instrument 60, which may be a dry bulb thermostat, a wet bulb thermostat, a hygrometer or any other suitable automatic instrument, permits the flow of electric current through the line 61 when conditions require it, and this flow causes the blower 14 to operate and simultaneously causes the motor 20 to operate, thus controlling the operation of the unit 17.

When the conditioning load shifts to the other side of the building, the ray-sensitive instrument 46 is adapted to connect the booster 27 with the modifier 12 in substantially the same manner that the ray-sensitive instrument 45 connects the booster with the modifier 11. Thus when the sun's rays become effective on the instrument 46, the relay 70 is energized thus closing its switch and energizing the relay 71 through the action of transformer 72. When the switch of relay 71 is closed, current flows through the lines 73 and 74 to the solenoid valves 41 and 43, opening them and thus connecting the unit 27 with the evaporator 15. Simultaneously the valve 76 is energized through line 77. When the valve 76 is opened, the oil line 78 permits the oil level in the crankcases of compressors 28 and 23 to equalize.

Means are provided for causing the unit 27 to operate when it is connected with the modifier 12. This is accomplished because when the relay

75 is energized by the flow of current through the lines 73 and 74, the switch of the relay 75 is closed and permits current to flow through the line 83 to the motor 55 which drives the compressor 28.

The modifier 12 is operated in accordance with conditions in the enclosure in which the modifier is located. Thus the condition-sensitive instrument 80, similar to instrument 60, permits the flow of current through the line 81 when conditions require it, thus actuating the blower 16 and the motor 82 which drives the compressor 23.

From the foregoing it will be seen that the modifiers 11 and 12 maintain normal desired conditions in the rooms in which they are located. When the conditioning load shifts or increases abnormally in the building and the sun's rays become effective on either of the instruments 45 or 46, these instruments change the operation of the corresponding modifier by connecting the booster refrigerant liquefying unit 27 with the corresponding evaporator. This action naturally changes or modifies the action of the refrigerant liquefying unit which is permanently connected to the evaporator, by boosting its refrigerant liquefying power. If the sun's rays become effective on both of the instruments 45 and 46, then the booster 27 is connected to both modifiers 11 and 12 by the opening of all of the valves 41, 42, 43 and 44.

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. In an air conditioning apparatus, a first evaporator, a first refrigerant liquefying unit connected to said evaporator and including a first compressor having a lubricant sump, a second evaporator, a second refrigerant liquefying unit connected to said second evaporator and including a second compressor having a lubricant sump, a booster refrigerant liquefying unit including a third compressor having a lubricant sump, means for automatically connecting said booster with either of said evaporators in accordance with environmental conditions, and means for equalizing the lubricant level in said compressors.

2. In an air conditioning system, a first refrigerant liquefying unit including a compressor adapted to contain a supply of lubricant, a second refrigerant liquefying unit including a compressor adapted to contain a supply of lubricant, an evaporator connected to said liquefying units, and a conduit connecting the lubricant supply in the one compressor to the lubricant supply in the other compressor.

3. In an air conditioning system, a first refrigerant liquefying unit including a condenser and a compressor adapted to contain a supply of lubricant, a second refrigerant liquefying unit including a condenser and a compressor adapted to contain a supply of lubricant, evaporator means connected to said liquefying units, and a conduit connecting the lubricant supply in the one compressor to the lubricant supply in the other compressor.

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