

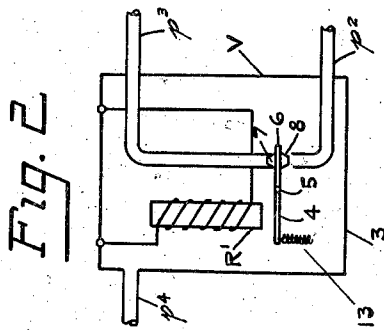
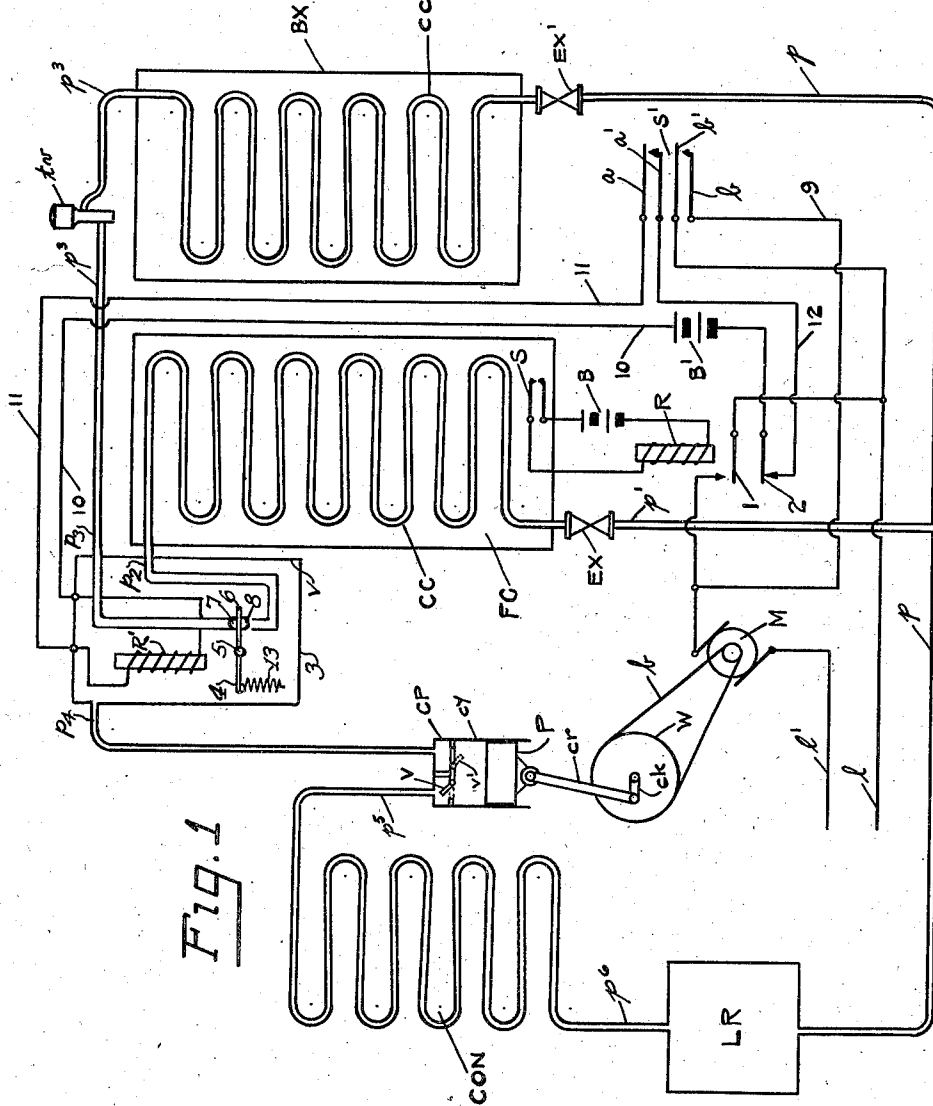
June 21, 1938.

L. D. KELLOGG

2,121,083

REFRIGERATING SYSTEM

Filed Oct. 15, 1931



Inventor:
LeRoy D. Kellogg
By C. P. Sober
Attorney

UNITED STATES PATENT OFFICE

2,121,083

REFRIGERATING SYSTEM

Leroy D. Kellogg, Deerfield, Ill., assignor to Kellogg Switchboard and Supply Company, Chicago, Ill., a corporation of Illinois

Application October 15, 1931, Serial No. 568,914

11 Claims. (Cl. 62-4)

My invention relates to refrigerating systems and more particularly to that type of mechanical refrigerating system used in the home for preserving food supplies and the like.

Such a system usually comprises a cooling coil, a compressor and a condenser. The liquid refrigerant passes into the cooling coil where it vaporizes thereby lowering the temperature of the compartment in which the cooling coil is located. The compressor removes the vapor from the cooling coil and passes it to the condenser under pressure where it is converted back into a liquid. The compressor is driven by a motor or engine of any suitable type which starts and stops under the control of means, such as a thermostat, responsive to the temperature or condition of the compartment being cooled. Under ordinary circumstances in the average home the compressor will be operating only about one-third of the time. It is an object of my invention to provide a second cooling coil which may be utilized to cool another compartment such as a room in the home and to use the same compressor to operate in conjunction with the second cooling coil when it is not in use with the cooling coil of the food refrigerator.

Another object of my invention is the provision of means for automatically controlling the operation of my improved system of refrigeration.

Referring to the accompanying drawing, in which like reference characters in the different views represent like parts,

Fig. 1 is a schematic drawing of the refrigerating system of my invention; and

Fig. 2 is a detail view of the valve used in the system.

In Fig. 1 a liquid receiver LR is provided which contains a suitable amount of any desirable liquid refrigerant such as sulphur dioxide, ammonia or any other similar substance. A food compartment FC in which food may be placed is provided with a cooling coil CC which occupies a portion of the space therein. Usually it is desired that the temperature of such a compartment be maintained between a high point of about 20° F. and a low point of about 5° F., that is, the temperature is allowed to vary between these two points. To obtain this desired result a switch S having a pair of contacts which may be thermostatically controlled is also located in the compartment FC. These contacts S control an energizing circuit for an electromagnetic device or relay R, the contact 1 of which controls one circuit for an electric motor M, the purpose of which will be described presently, and the contact 2 of which controls the ener-

gizing circuit of an electromagnetic device herein shown as an electromagnet R'. The device R' is associated with a valve V, a detailed view of which is shown in Fig. 2, and controls the operation thereof as will be explained later.

The motor M drives a wheel W by suitable means such as a belt b. Wheel W is fixed to the crank shaft CK of the compressor CP which comprises a cylinder cy, a piston P, and a connecting rod cr which joins the piston to the crank shaft CK. Valves v and v' are provided at the top of the cylinder cy and are adapted to assume the alternate positions shown in dotted lines.

Pipes p and p' are provided to conduct a liquid refrigerant such as ammonia to the cooling coil CC. A pressure reducing valve EX, commonly known as an expansion valve, is interposed between the pipe p' and coil CC. The other end of the coil CC is connected by a pipe p² to the valve V. Pipe p also supplies a second cooling coil CC' similar to coil CC, with the selected liquid refrigerant through an expansion valve EX'. The other end of the coil CC' is connected to the valve V by a pipe p³ equipped with a two pressure valve, tv which is of a type well known in the art and maintains the proper pressure relation between the coil CC' and the compressor CP.

The valve V comprises a casing 3 (see Fig. 2) within which is located the electromagnetic device R' having an armature 4 pivoted at point 5. The end 6 of the armature 4 is provided with the movable valve members 7 and 8 formed of any suitable material and secured to the armature in any desired manner. The member 7 is adapted to fit into the end of pipe p³ to normally close that pipe. This normal position of the member 7 may be maintained by having the armature 4 weighted or under spring tension or in any other way. When an energizing circuit is closed for the device R' the armature 4 is attracted thereby and as it is pivoted at 5 will remove the member 7 from the end of pipe p³ and will cause the member 8 to enter the end of pipe p². The valve V as shown in Fig. 2 is merely a diagrammatic illustration of any of the well known two-way valves which are old in the art. It is to be understood that I do not wish to be limited to the device shown but that I aim to use any of the two-way valves which are capable of being electrically operated to produce the desired result.

A pipe p⁴ extends from the valve V to the intake side of the compressor CP and a pipe p⁵ extends from the output side of the compressor CP to a condenser CON where the gaseous refrigerant is

changed into a liquid and passes to the liquid receiver LR through the pipe p^6 . The condenser CON may be of the air cooled or water cooled type or any other desired form.

5 The cooling coil CC' may be located in a box Bx of an air conditioning device which is connected with a room in the house which it is desired to cool. If desired, means such as an electric fan, not shown, may be provided to force the
10 cooled air in the box Bx into the room to be cooled. A double switch S' is located in the room to be cooled and may be controlled manually or by means of a thermostat located in the room. When the switch S' is actuated the contacts a
15 and a' engage each other to close an energizing circuit for the electromagnetic device R' located in the valve V and the contacts b and b' close to establish a circuit to operate the motor M. Batteries B and B' are provided to furnish current
20 to energize the electromagnets R and R'. The leads l and l' are connected to any suitable source of current such as the house lighting system and furnish operating current for the motor M.

The operation of the system of my invention
25 is as follows. Assume that the temperature in the food compartment FC has risen sufficiently to cause the thermostat (not shown) to close the contacts of switch S. Current will immediately flow from the positive side of the battery B
30 through the closed switch S, the coil of relay R to the negative pole of battery B. This flow of current will energize the relay R which will attract its armatures 1 and 2. The attraction of
35 armature 2 prevents the energization of the relay R'. The attraction of contact 1 closes an operating circuit for the electric motor M which circuit can be traced from one side of the supply
40 line, over conductor 1, alternate contact 1 of relay R, through the motor M to the other side of the line via conductor l' .

The motor M operates and rotates the wheel W which causes a reciprocating movement of the piston P within the cylinder cy as is well understood by those skilled in the art. The liquid refrigerant, which is under considerable pressure,
45 flows from LR through the pipes p and p' to the expansion valve Ex where it is passed into the coil CC under a greatly reduced pressure. The temperature of the air in the food compartment
50 is sufficiently high to cause the liquid refrigerant to boil or change into a gas. The heat used to cause this change is taken from the air and the temperature in the food compartment is accordingly reduced.

55 As the armature 4 of the valve V is in its normal position the member 8 is raised and the end of pipe p^2 is open. As the piston P moves downwardly the valves v and v' assume their alternate positions indicated by the dotted lines and the gas
60 in the cooling coil CC is drawn through pipe p^2 , valve V, pipe p^4 and valve v' into the cylinder cy. As the piston P moves upwardly the valve v' closes and the gas within the cylinder cy is placed under pressure which opens the valve v thus
65 allowing the gas within the cylinder cy to flow through the open valve v and pipe p^2 to the condenser where it is changed into a liquid and returned to the liquid receiver LR. This process is continued until the temperature within the
70 food compartment FC is reduced to the point at which the thermostat (not shown) separates the contacts of switch S thereby opening the energizing circuit of relay R which restores its contacts 1 and 2 to normal. The restoration of
75 contact 1 breaks the circuit for the electric motor

M which ceases operating and stops the compressor CP. All the apparatus is normal at this time.

Assume next that the switch S' is operated either manually or under the control of a thermostat device. The closure of the contacts b
5 and b' establishes an operating circuit for the electric motor M which may be traced over conductor 1, contacts b' and b , conductor 9, motor M and conductor l' . The motor M operates and
10 drives the compressor CP as before explained. The contacts a and a' move to their alternate positions and close an energizing circuit for the relay R' which may be traced from the battery B',
15 conductor 10, relay R', conductor 11, contacts a and a' , conductor 12, normal contact 2 to the battery B'. The relay R' is energized over this circuit and attracts its armature 4 which removes
20 the member 7 from the end of pipe p^3 and places the member 8 in the end of pipe p^2 to close the same. Under these circumstances the gas in the unit CC' will be drawn into the cylinder cy
25 through pipe p^3 and valve tv , valve V, pipe p^4 and valve v' . On the upward stroke of the piston P the gas is passed into the condenser CON under considerable pressure where it is changed
30 back into liquid form and passes into the liquid receiver LR as before explained.

Should the switch S' be operated while the unit CC is in operation nothing will happen until
35 the switch S, which controls the operation of the unit CC, opens its contacts. As long as relay R is energized the contact 2 is in its alternate position and the energizing circuit for relay R' is open. As soon as switch S opens its contacts the
40 relay R deenergizes and restores contact 2 to its normal position thereby closing one break in the energizing circuit for electromagnet R' previously traced.

If the unit CC' is being operated and the switch
45 S is closed the relay R will energize over a circuit previously traced and will open normal contact 2 which opens the circuit for electromagnet R' which deenergizes. Upon the deenergization
50 of device R' the armature 4 opens the pipe p^2 and closes the pipe p^3 which causes the compressor CP to withdraw gas from the cooling coil CC instead of from coil CC'. It will thus be seen that the cooling coil or unit CC' is subordinate, at all
55 times, to the unit CC.

While I have illustrated and described one embodiment of my invention it is to be understood that I do not wish to be limited thereto as alterations and modifications may readily suggest
60 themselves to those skilled in the art, but aim to cover all cases which come within the spirit and scope of the appended claims.

Having described my invention, what I claim as new and desire to secure by United States Letters Patent is:

1. A refrigerating system of the character described including a compressor, a condenser, a liquid container connected in series, a motor for driving said compressor, a plurality of cooling units, each having its high pressure end connected
65 to said liquid container, an electromagnetically operated valve, a connection between said compressor and said valve and connections between said valve and the low pressure end of each of said cooling units, means for controlling
70 the operation of one of said cooling units, other means for controlling the operation of a second cooling unit, both said means independently controlling the operation of said motor.

2. A refrigerating system, a first cooling unit, a 75

second cooling unit, a compartment adapted to be cooled by said first cooling unit, a second compartment adapted to be cooled by said second cooling unit, a compressor, a valve normally connecting the low pressure side of said compressor to one of said cooling units, a connection between said valve and said other cooling unit, an electromagnet for operating said valve to connect said other cooling unit to said compressor, an energizing circuit for said electromagnet, a pair of thermostatically controlled contacts controlling said circuit, one of said contacts being associated with each of said compartments, said energizing circuit being completed when the contact associated with one of said compartments is open and the contact associated with the other said compartment is closed by a rise of temperature beyond a predetermined degree in said other compartment.

3. A refrigerating system of the character described including a cooling unit, means for controlling the operation of said cooling unit, a second cooling unit and means for controlling the operation of said second unit, a compressor, a two-way valve connected to the two controlling means and normally connecting said compressor on the low pressure side thereof to the first mentioned cooling unit, a connection between said valve and said second cooling unit, the second mentioned controlling means being arranged to operatively connect said second cooling unit to, and disconnect said first cooling unit from, said compressor, the first mentioned controlling means having precedence over the second mentioned controlling means and having control of said second means, said second means being operable only when said first means are not operating.

4. A refrigerating system of the character described including a cooling unit, a second cooling unit, a compressor, an electromagnetically controlled valve normally connecting the low pressure side of said compressor to said first cooling unit, a connection between said valve and said second cooling unit, and means for operating said valve to operatively connect said second cooling unit to said compressor.

5. A refrigerating system of the character described including a cooling unit, a second cooling unit, a compressor, an electromagnetically controlled valve normally connecting the low pressure side of said compressor to said first cooling unit, a connection between said valve and said second cooling unit, and means for operating said valve to operatively connect said second cooling unit to said compressor and disconnect said first cooling unit from said compressor.

6. A refrigerating system of the character described including a cooling unit, means for controlling the operation of said cooling unit, a second cooling unit, a compressor, a valve normally connecting the low pressure side of said compressor to said first cooling unit, a connection between said valve and said second cooling unit, and means for operating said valve to disconnect said first cooling unit from and to connect said second cooling unit to said compressor, said first means having precedence over and control of

said second means, said second means being subject to the operation of said first means.

7. A refrigerating system of the character described including a cooling unit, means for controlling the operation of said cooling unit, a second cooling unit, a compressor, a valve normally connecting the low pressure side of said compressor to said first cooling unit, a connection between said valve and said second cooling unit, and means for operating said valve to disconnect said first cooling unit from and to connect said second cooling unit to said compressor, said first means having precedence over and control of said second means, and said second means being operable only when said first means are not operating.

8. A refrigerating system of the character described including a cooling unit, means for controlling the operation of said cooling unit, a second cooling unit, a compressor, a valve normally connecting the low pressure side of said compressor to said first cooling unit, a connection between said valve and said second cooling unit, and means for operating said valve to connect said second cooling unit to said compressor and disconnect said first unit, said first means being operable at any time, said second means being subject to the operation of said first means.

9. A refrigerating system of the character described including a cooling unit, a second cooling unit, a compressor, driving means for said compressor, a valve normally connecting said first cooling unit to the low pressure side of said compressor, a connection between said valve and said second cooling unit, electromagnetic means for operating said valve to connect said second cooling unit to said compressor, a circuit for said electromagnetic means, an electrical relay operative to control said driving means and interrupt said operating circuit to cause said electromagnetic means to restore said valve to normal.

10. In a cooling system, two chambers to be cooled, cooling apparatus common to said chambers comprising a compressor, a condenser and a liquid container connected in series, a motor for driving said compressor, a valve normally connecting the low pressure side of said compressor to one of said chambers, electromagnetic means for operating said valve to connect said compressor to said second chamber, a thermostatic switch and a relay controlled by said switch associated with said first chamber for restoring said valve to normal thereby giving precedence to said one of said chambers whereby it can use said common cooling apparatus until said chamber is cooled.

11. A refrigerating system, a first cooling unit, a second cooling unit, a compressor, a valve normally connecting the low pressure side of said compressor to said first cooling unit, a connection between said valve and said second cooling unit, an electromagnet for operating said valve to connect said second cooling unit to said compressor, a circuit for said electromagnet and a pair of thermostatically controlled contacts in said circuit, one of said contacts being associated with each of said cooling units.

LEROY D. KELLOGG.