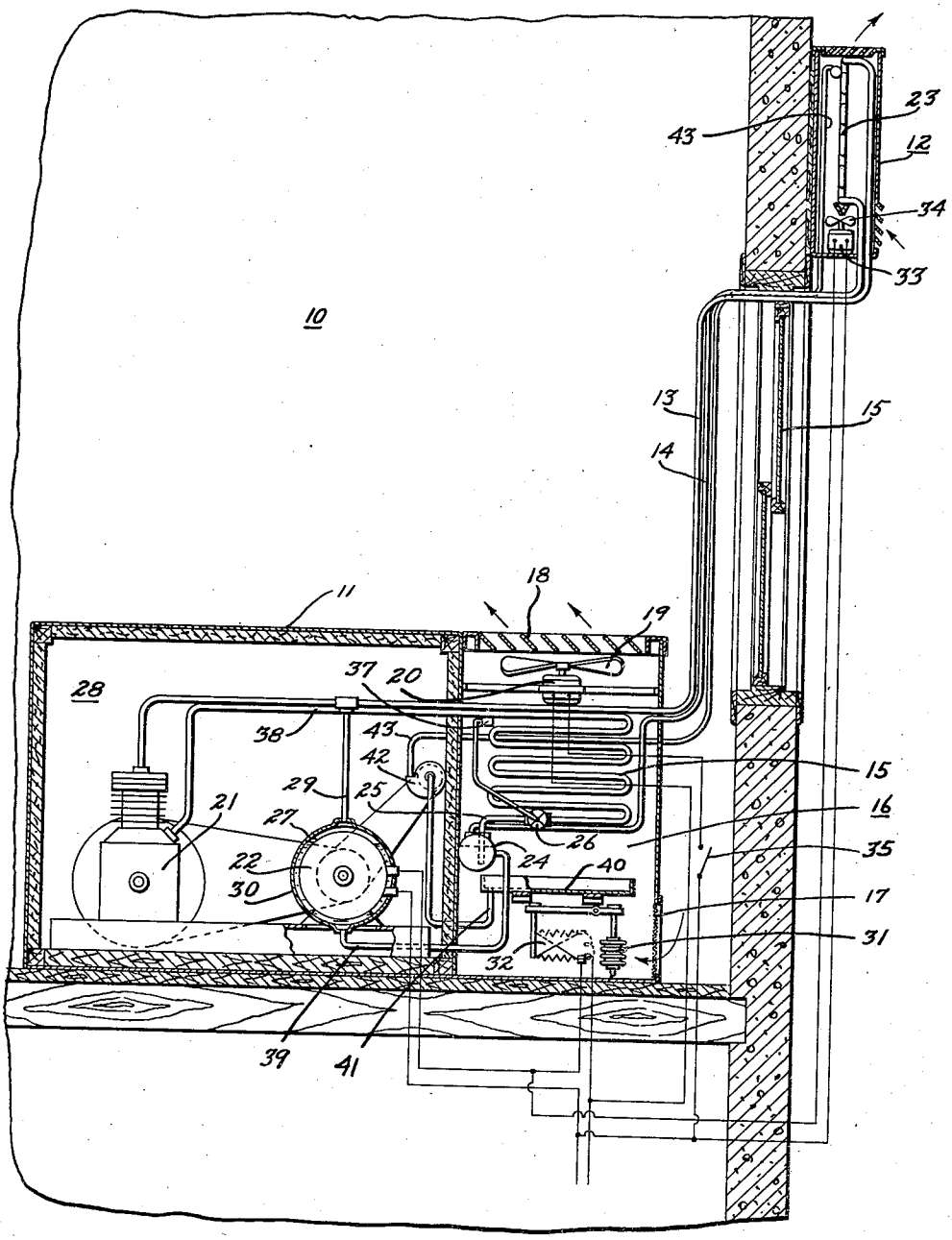
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REFRIGERATING APPARATUS

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REFRIGERATING APPARATUS

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This invention relates to refrigeration and more particularly to the conditioning of air in rooms or the like.

An object of this invention is to provide an apparatus and method for conditioning air in a room or the like in which the heat extracted from the room and a heat generated in a conditioning of the air may be dissipated from the room without the necessity of providing the usual water connections in the flooring or walls of the room.

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 figure illustrates partly in cross-section and partly diagrammatically the form of my invention now preferred.

In practicing my invention, air is conditioned or cooled and is discharged into a room or other enclosure 10. Preferably the apparatus for accomplishing this takes the form of a more or less unitary cabinet 11 which is connected to a heat dissipating means 12 located outside of the room. Preferably the heat dissipating means 12 is connected with the cabinet 11 through the medium of pipes 13 and 14 passing through the window 15 of the room.

The air to be conditioned is brought into thermal contact with an evaporator 15, which is maintained at the desired temperature. Means are provided for accomplishing this thermal contact. This means may take the form of an air cooling section 16 in the cabinet and having an inlet 17 and an outlet 18 for the air being conditioned. A fan 19 driven by a motor 20 is placed in a position to force air through the section 16 in thermal contact with the evaporator 15. The air entering the inlet 17 may be air from the compartment 10 as shown, or, if desired, may be air from the outside, or both from the compartment and the outside.

A refrigerant liquefying unit is connected in refrigerant flow relationship with the evaporator 15. Preferably this liquefying unit may include a compressor 21 driven by an electric motor 22. The compressor 21 discharges compressed refrigerant through the line 13 to the condenser or condensing zone 23 located outside of the room in the heat dissipating means 12. The refrigerant condensed in the condenser 23 flows through the line 14 to the liquid refrigerant receiver 24 placed at substantially the same level as the motor 22. Conveniently it may be placed in the section 16. The liquid refrigerant receiver 24 is connected by the pipe 25 with the expansion valve 26 which discharges expanded refrigerant into the evaporator 15. The receiver 24 is also connected with a refrigerant chamber 27 which is placed in thermal contact with the insulated compartment 28. Refrigerant from the receiver 24 may flow by gravity and establish a body of liquid refrigerant in the chamber 27, which body is at relatively high pressure and substantially at the same pressure as the refrigerant in the condenser 23. The body of liquid refrigerant in chamber 27 absorbs heat generated in the section 28, and is evaporated thereby. The evaporated refrigerant is discharged through the pipe 29 and through the line 13 into the condenser and thus the body of refrigerant in the chamber 27 is placed in refrigerant flow relationship with the condenser 23. Refrigerant evaporated from chamber 27 flows through the pipes 29 and 13 to the condenser 23, thence back through the pipe 14 and receiver 24 to the chamber 27. The refrigerant thus changes phases in the chamber 27 and condenser 23 and thus transfers heat from the section 28 to the heat dissipating device 12.

The chamber 27 may be located where convenient in the section 28, and I now prefer to place it in thermal contact with the motor 22 by surrounding motor 22 with a shell 30 and thus forming the chamber 27 around the motor. It is to be understood, however, that the chamber 27 may be otherwise located.

Automatic controls may be provided. Thus a thermostatic bulb 31 is made responsive to conditions in the room 10 by being placed in the path of the air entering through the inlet 17. This bulb 31 operates a snap switch 32 which controls the flow of current to the motor 22, thus controlling the operation of the refrigerant liquefying unit by starting and stopping the motor 22. The switch 32 also controls the flow of current to the motor 33 which drives the fan 34 and which blows air over the condenser 23. The switch 32 thus starts and stops the motors 22 and 33 simultaneously. If desired a hand switch 35 is provided for controlling the flow of current to the motor 20 of fan 19 so that the fan 19 may be operated even when the refrigerating system is not in operation.

Moisture condensed on evaporator 15 falls into the drip pan 40 and drains through the pipe 41 to the pump 42 driven by the motor 22. The pump 42 discharges this moisture through the pipe 43, passing through the window 15 to the

top of condenser 23 where it is evaporated and is discharged into the atmosphere.

In the operation of the device the compressor 21 discharges compressed refrigerant to the condenser 23 from whence the liquefied refrigerant flows to the receiver 24. Here part of the liquid refrigerant flows through the pipe 25 to the expansion valve 26. The valve 26 may be of the automatic type which maintains a substantially constant pressure within the evaporator 15 and may be additionally controlled by a thermostatic bulb 37 when the liquid refrigerant tends to overflow into the pipe 38 which leads to the compressor 21. Air circulated by the fan 19 is cooled by the evaporator 15 and is discharged into the room 10 and maintains the same at the desired temperature in accordance with the setting of the thermostat 31. Heat generated by the refrigerant translating device which includes the compressor 21 and the motor 22 is transferred by the evaporation of refrigerant in the chamber 27, from whence the evaporated refrigerant flows to the condenser 23 and returns through the pipe 14, receiver 24 and pipe 39 to the chamber 27. Any moisture condensed from the air is gathered in the drip pan 40 which is provided with a suitable drain 41.

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. Air conditioning apparatus for an enclosure forming a room of a building comprising a refrigerant evaporator, means for thermally contacting air to be conditioned for said room with said evaporator, a refrigerant liquefying unit connected in refrigerant flow relationship with said evaporator, said liquefying unit including a refrigerant translating device located in said room and a refrigerant condenser located outside said building and condensing refrigerant from said translating device, means for dissipating heat from said translating device including means for bringing a portion of the refrigerant, while under high pressure, into heat exchange relation with said translating device whereby a portion is evaporated and discharged into said condenser, and means for controlling said liquefying unit in response to changes in the psychrometric condition of air within said room.

2. Air conditioning apparatus for an enclosure forming a room of a building comprising a refrigerant evaporator, means for thermally contacting air to be conditioned for said room with said evaporator, a refrigerant liquefying unit connected in refrigerant flow relationship with said evaporator, said liquefying unit including a refrigerant translating device located in said building and a refrigerant condenser located outside said building and condensing refrigerant from said translating device, and means for dissipating heat from said translating device including means for bringing a portion of the refrigerant, while under high pressure, into heat exchange relation with said translating device whereby a portion is evaporated and discharged into said condenser.

3. Air conditioning apparatus for an enclosure forming a room of a building comprising a refrigerant evaporator, means for thermally contacting air to be conditioned for said room with said evaporator, a refrigerant liquefying unit connected in refrigerant flow relationship with said evaporator, said liquefying unit including a motor member and a refrigerant compressor member located in said room and a refrigerant condenser located outside said room and receiving refrigerant from said compressor, and means for dissipating heat from one of said members including means for bringing a portion of the refrigerant, while under high pressure, into heat exchange relation with one of said members whereby said portion is evaporated and discharged into said condenser.

4. Air conditioning apparatus for an enclosure forming a room of a building comprising a refrigerant evaporator, means for thermally contacting air to be conditioned for said room with said evaporator, a refrigerant liquefying unit connected in refrigerant flow relationship with said evaporator, said liquefying unit including a motor and compressor located in and thermally insulated from said room and a condenser outside said building receiving refrigerant from said compressor, and means for dissipating heat from said motor including means for bringing a portion of the refrigerant, while under high pressure, into heat exchange relation with said motor whereby said portion is evaporated and discharged into said condenser.

5. Air conditioning apparatus for an enclosure forming a room of a building comprising a refrigerant evaporator, means for thermally contacting air to be conditioned for said room with said evaporator, a refrigerant liquefying unit connected in refrigerant flow relationship with said evaporator, said liquefying unit including a refrigerant translating device located in said room and a refrigerant condenser located outside said room and condensing refrigerant from said translating device, means for dissipating heat from said translating device including means for bringing a portion of the refrigerant, while under high pressure, into heat exchange relation with said translating device whereby a portion is evaporated and discharged into said condenser, a motor-driven fan for said condenser, and means responsive to conditions in said room controlling the operation of said liquefying unit and motor-driven fan.

6. Air conditioning apparatus for an enclosure forming a room of a building comprising a refrigerant evaporator, means for thermally contacting air to be conditioned for said room with said evaporator, a refrigerant liquefying unit connected in refrigerant flow relationship with said evaporator, said liquefying unit including a refrigerant translating device located in said room and a refrigerant condenser located outside said building and condensing refrigerant from said translating device, means for dissipating heat from said translating device including means for bringing a portion of the refrigerant, while under high pressure, into heat exchange relation with said translating device whereby a portion is evaporated and discharged into said condenser, and means responsive to conditions in said room controlling the operation of said liquefying unit.

7. The method of conditioning air for an enclosure forming a room of a building which comprises thermally contacting air to be conditioned for the room with an expanding and evaporating refrigerant, recompressing the expanded and evaporated refrigerant in an insulated zone in the room, forwarding the recompressed refrigerant to a condensing zone outside the room for condensation, returning a portion of the condensed refrigerant for reexpansion and reevaporation in thermal contact with air to be condi-

tioned for the room, forwarding another portion of the condensed refrigerant in liquid form and without substantial reduction in pressure for evaporation within and consequent cooling of the insulated zone, and returning the evaporated refrigerant from the last named portion to the condensing zone.

8. Air conditioning apparatus for an enclosure forming a room of a building comprising a refrigerant evaporator, means for thermally contacting air to be conditioned for said room with said evaporator, a refrigerant liquefying unit connected in refrigerant flow relationship with said evaporator, said liquefying unit including a refrigerant translating device located in said room and a refrigerant condenser located outside said room and condensing refrigerant from said translating device, means for dissipating heat from said translating device including means for bringing a portion of the refrigerant, while under high pressure, into heat exchange relation with said translating device whereby a portion is evaporated and discharged into said condenser, a fan for forcing air over said condenser, and means for controlling the operation of said refrigerant liquefying unit in accordance with refrigeration conditions.

9. Air conditioning apparatus for an enclosure forming a room of a building comprising a refrigerant evaporator, means for thermally contacting air to be conditioned for said room with said evaporator, a refrigerant liquefying unit connected in refrigerant flow relationship with said evaporator, said liquefying unit including a refrigerant translating device located in said room and a refrigerant condenser located outside said building and condensing refrigerant from said translating device, means for dissipating heat from said translating device including means for bringing a portion of the refrigerant, while under high pressure, into heat exchange relation with said translating device whereby a portion is evaporated and discharged into said condenser, a fan for forcing air over said condenser, and means for controlling the operation of said refrigerant liquefying unit and said fan in accordance with refrigeration conditions.

10. Air conditioning apparatus for an enclosure forming a room of a building comprising a refrigerant evaporator, means for thermally contacting air to be conditioned for said room with said evaporator, a refrigerant liquefying unit connected in refrigerant flow relationship with said evaporator, said liquefying unit including a refrigerant translating device located in said room and a refrigerant condenser located outside said room and condensing refrigerant from said translating device, means for dissipating heat from said translating device including means for bringing a portion of the refrigerant, while under high pressure, into heat exchange relation with said translating device whereby a portion is evaporated and discharged into said condenser, a fan for forcing air over said condenser, and means for controlling the operation of said fan in accordance with refrigeration conditions.

11. Air conditioning apparatus for an enclosure forming a room of a building comprising a refrigerant evaporator, means for thermally contacting air to be conditioned for said room with said evaporator, a refrigerant liquefying unit connected in refrigerant flow relationship with said evaporator, said liquefying unit including a refrigerant translating device located in said building and a refrigerant condenser located outside said building and condensing refrigerant from said translating device, means for dissipating heat from said translating device including means for bringing a portion of the refrigerant, while under high pressure, into heat exchange relation with said translating device whereby a portion is evaporated and discharged into said condenser, and means whereby the condensate formed on the evaporator is utilized in condensing refrigerant.

12. Air conditioning apparatus for an enclosure forming a room of a building comprising an evaporator and a refrigerant translating device mounted within said room, a condenser adapted to be placed outside of said room, refrigerant flow means between said refrigerant translating device and condenser, means for circulating cooling fluid over said condenser, means for cooling said translating device comprising an auxiliary evaporator adapted to receive a portion of the refrigerant, while under high pressure, and means whereby said auxiliary evaporator discharges into said condenser.

13. Refrigerating apparatus comprising a refrigerant translating device, a condenser and an evaporator in refrigerant flow relationship, and means for evaporating high pressure liquid refrigerant in thermal exchange with said translating device, and for condensing the vaporized refrigerant thus formed, said translating device being in an insulated enclosure and said condenser being outside said enclosure.

14. Refrigerating apparatus comprising a refrigerant translating device, a condenser and an evaporator in refrigerant flow relationship, and means for evaporating high pressure liquid refrigerant in thermal exchange with said translating device and for condensing the vapor thus formed in said condenser, said translating device being in an insulated enclosure and said condenser being outside said enclosure.

15. In a cooler for a room or the like, a cabinet within the room with an evaporator and a refrigerant translating device mounted thereon, a condenser adapted to be placed outside said room, refrigerant flow connections between said device, evaporator and condenser, said evaporator being in thermal contact with air for said room, means for insulating said translating device from said air, and means for evaporating high pressure liquid refrigerant in thermal exchange with said translating device and for condensing the vapor thus formed.

16. In a cooler for a room, a condenser, evaporator and refrigerant translating device in refrigerant flow relationship, an insulated compartment for said refrigerant translating device located within said room, means for evaporating high pressure liquid refrigerant in thermal exchange with said translating device and for condensing the vapor thus formed in said condenser, and means mounting said condenser outside said room.

17. In a cooler for a room or the like, a cabinet adapted to be placed in the room, an evaporator and a refrigerant translating device mounted thereon, a condenser, refrigerant flow connections between said device, evaporator and condenser, said evaporator being in thermal contact with air from said room, means for evaporating high pressure liquid refrigerant in thermal exchange with said translating device, and means for insulating said last named means and said translating device from the air in the room.

18. In a cooler for a room or the like, an evaporator and a refrigerant translating device

mounted therein, a condenser adapted to be mounted outside of said room, refrigerant flow means between said evaporator, translating device and condenser, means for circulating cooling medium over said condenser, and means for evaporating high pressure liquid refrigerant in thermal exchange with said translating device and for condensing the vapor thus formed outside said room.

19. In an air conditioning apparatus for a room or the like, an evaporator and a refrigerant translating device mounted therein, a condenser adapted to be placed outside of said room, refrigerant flow means between said evaporator, translating device and condenser, means for circulating cooling fluid over said condenser, means for cooling said translating device comprising an auxiliary evaporator, and means whereby said auxiliary evaporator discharges into said condenser.

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