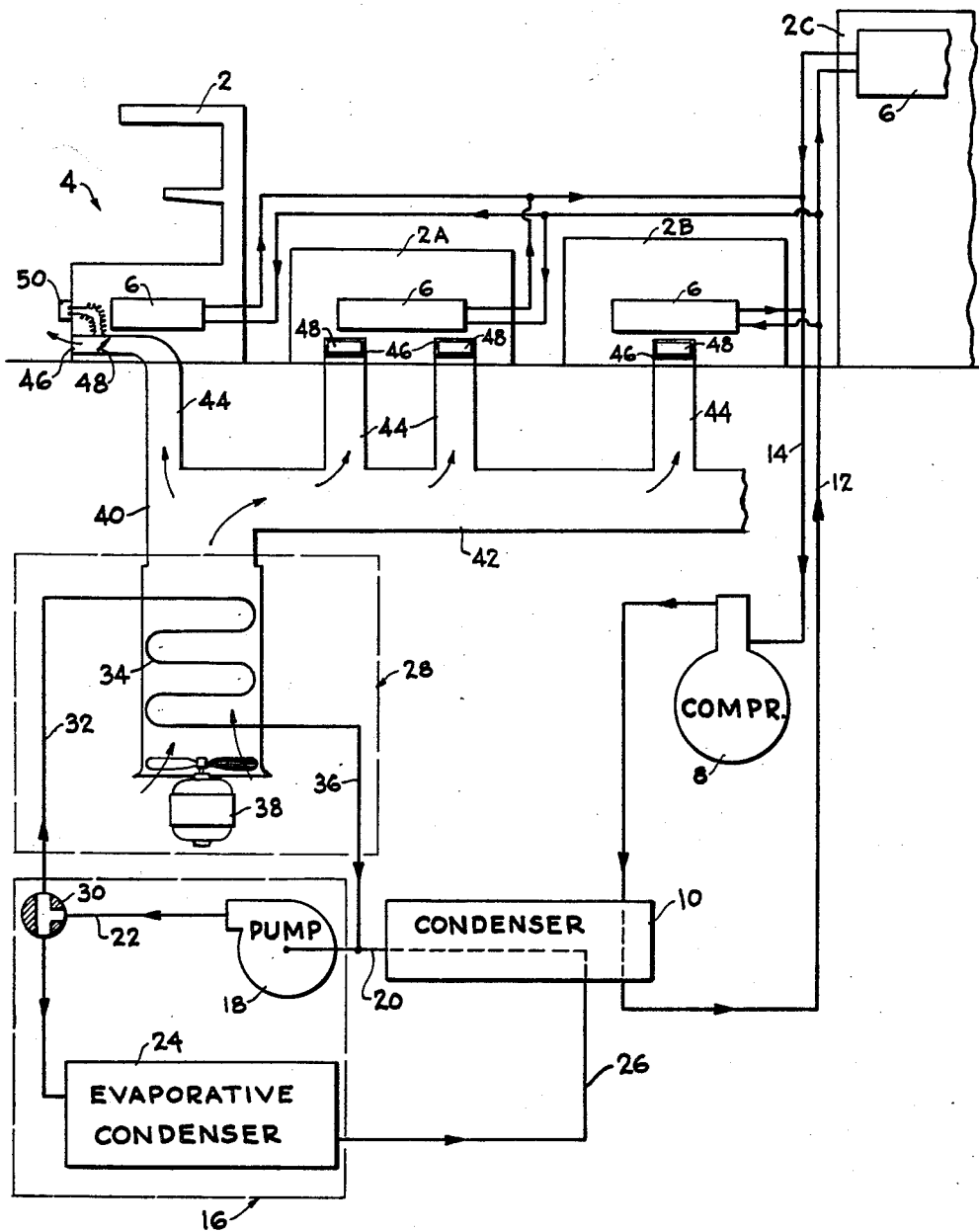


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SYSTEM FOR OPERATING REFRIGERATED EQUIPMENT
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This invention relates to heating and refrigerating apparatus and is particularly directed to novel means for refrigerating display cases or the like and employing the heat extracted therefrom to heat a selected area, such as the aisles adjacent said display case.

In modern store construction, it is common to install a plurality of refrigerated display cases for displaying vegetables, frozen foods, dairy products and the like, and to provide refrigerating means which are common to all of the refrigerated display cases. Such systems include refrigerant supply and return lines that pass to evaporators located in each display case to be refrigerated whereas the compressor and condenser are located in remote locations in a basement, machine room, or elsewhere. The condenser in particular may be mounted on the roof, in the basement, outside the rear of the store or at some other remote location while being connected to the display cases inside the store by suitable pipes, conduits or the like through which the refrigerant flows from the remote condenser to an evaporator in the display case. Heretofore, the heat removed from the display case has been discharged into or taken up by the air or water used to cool the condenser. Ordinarily, no use has been made of this heat despite the fact that, in stores where a plurality of refrigerated display cases are employed, the amount of heat thus removed from the display cases and discharged from the store or otherwise wasted has been quite substantial.

In accordance with the present invention, this heat is captured and may be employed to supplement or replace the heating system of the store thereby substantially reducing the overhead costs of the store.

The advantages of the present invention are preferably attained by passing the condenser cooling fluid, after it has been passed over the condenser and been heated thereby, to heat exchange means over which air may be blown to raise the temperature of the air. The air, thus, heated is then passed through suitable ducts and discharged at desired locations within the store to supplement or replace the heating system of the store or to raise the temperature of the air adjacent the display cases from which the heat has been withdrawn.

Accordingly, it is an object of the present invention to provide a novel refrigerated display case and area heater.

Another object of the present invention is to provide novel means for refrigerating a display case and employing the heat removed therefrom to supplement or replace the heating system of the store.

A further object of the present invention is to provide novel means for utilizing the heat discharged by the condenser of a refrigerated display case to supplement or replace the heating system of a store.

A specific object of the present invention is to provide a novel system embodying a refrigerated display case and an area heater comprising means for refrigerating the display case, means in the form of a condenser located in a position remote from said display case, heat exchange means for recovering from the condenser, heat removed from the display case, and means receiving heat from the heat exchange means operable to return such heat to an area adjacent to the display case.

These and other objects and features of the present invention will be apparent from the following detailed

description taken with reference to the figure of the accompanying drawing.

The figure of the drawing is a diagrammatic representation of a system including a plurality of refrigerated display cases and an area heater embodying the present invention.

In that form of the invention chosen for purposes of illustration in the drawing a plurality of refrigerated cases are shown at 2, 2A, 2B, 2C, etc. and may be arranged along an aisle or at other suitable locations within a store, market or the like. The refrigerated cases may be of the same or different types as required in any particular installation. Thus, the refrigerated case 2 may be of the self-service type having an access opening 4 in the front thereof through which customers may reach to obtain articles on display. While this type of refrigerated display case is currently favored in chain stores and supermarkets, it is frequently found that cold refrigerated air spills out of the access opening and cools the adjacent aisle or area to such an extent as to be uncomfortable to children or customers wearing light summer clothing or shorts.

Additional cases of refrigerated equipment may be included in the system; and as shown diagrammatically, the refrigerated case 2A may be used for the storage and display of frozen foods, case 2B may be an ice cream cabinet, and 2C may represent a walk-in cooler for the bulk storage of products. Each case is provided with an evaporator 6 together with suitable or conventional control means such as expansion valves, thermostats, time clocks, or other control means (not shown) for establishing and maintaining the desired temperature within that case or equipment.

All of the evaporators 6 of the various cases to be refrigerated are supplied with refrigerant from a common system including a compressor 8, a condenser 10 and refrigerant supply and return lines 12 and 14 to which the various condensers 6 are connected in parallel. In this way, heat withdrawn from the refrigerated cases 2, 2A, 2B, 2C, etc. may be discharged through the common refrigerant condenser 10. A condenser cooling system indicated at 16 includes a pump 18 for circulating cooling water about the refrigerant condenser 10. The temperature of the cooling water thus circulated is raised by heat exchange with the refrigerant condenser and is passed from the refrigerant condenser to the pump 18 through the pump supply line 20. From the pump 18, the resulting heated water flows through a discharge line 22 to an evaporator-condenser 24 or other heat exchange means where the heated water gives up its heat and is again rendered relatively cool. The water thus cooled is thus returned to the common refrigerant condenser 10 through a return line 26 and passes back to the pump 18 through the pump supply line 20 for continuous recirculation and recooling.

Systems of this character are in common use today, and it is usual to locate the compressor, condenser and refrigerant handling elements of the system in remote positions with respect to the cases to be refrigerated. Thus, the compressor 8 and refrigerant condenser 10 may be located in a basement or machine room, or in the rear of the building in which the refrigerated equipment is positioned. However, the water cooling condenser-evaporator 24 or other means employed for cooling the water circulated about the refrigerant condenser 10 is usually located on the roof of the building or in some other location where the heat extracted from the refrigerated cases and refrigerant condenser can be readily dissipated to the air at the exterior of the building.

In accordance with the present invention, the heat removed from the refrigerated cases 2, 2A, 2B, 2C,

etc. is at least partially recovered and utilized to raise the temperature of the air in the aisles or spaces adjacent the refrigerated cases or in other areas which require localized heating. For this purpose, systems embodying the present invention are provided with a heat recovery circuit indicated generally at 28 through which part or all of the heated water received from the refrigerant condenser 10 may be circulated to recover heat removed from the refrigerated equipment and return it to areas adjacent such equipment or elsewhere as desired. Thus as shown in the drawing, a valve 30 may be located in the pump discharge line 22 or at any other suitable point for diverting part or all of the heated water received from pump 18 and refrigerant condenser 10 to the heat recovery circuit 28. For this purpose, a hot water line 32 extends from the pump discharge line 22 and valve 30 to a coil or heat exchanger 34 from which the water is returned to the pump supply line 20 through the return line 36. The heat exchanger 34 is provided with a blower 38 by which air is forced over the hot water coils or other elements of the heat exchanger 34 so as to raise the temperature of the air and thereby recover heat which has been extracted or removed from the refrigerated cases 2, 2A, 2B, 2C, etc. by the refrigerant condenser 10. The air thus heated is forced by blower 38 through a duct 40 to a manifold 42 provided with warm air conduits 44 or other means presenting warm air outlets 46. The warm air outlets 46 are preferably located adjacent and may be formed as a part of one or more of the refrigerated cases 2, 2A, 2B, 2C, etc. The outlets 46 may thus be arranged to raise the temperature of the air in the aisles adjacent those cases or equipment which tend to spill cold refrigerated air into the aisles. Moreover, the amount of heat returned to any aisle or area of the store or market may be controlled by means of suitable dampers or valves 48 in the conduits 44 and such valves may, if desired, be controlled by temperature responsive means such as the thermostats 50 or the like located in the aisle or other area to be heated.

In this way, the heat removed from the equipment in refrigerating the same is actually returned to those areas adjacent the equipment or where most needed so as to counteract the adverse effects or spillage of refrigerated air from the equipment or the creation of low temperatures adjacent thereto for any other reason.

The present invention accordingly not only provides for the utilization of heat extracted from the refrigerated equipment in a store, market or other establishment which has heretofore been lost or dissipated to the air or water exterior to the store, but also serves to overcome or compensate for refrigeration losses incident to operation of the equipment.

The system can, of course, be employed in winter as well as summer, and the amount of heat returned to any particular location or area of the store can be controlled to assure conditions of comfort and temperature as desired. It will, therefore, be apparent that the sys-

tem is capable of many and varied applications and uses and may be employed when any number or type of refrigerated display cases or other equipment are incorporated in the system. It should, therefore, be understood that the particular embodiment of the invention shown diagrammatically in the drawing and described above is intended to be illustrative only and is not intended to limit the scope of the invention.

I claim:

1. A refrigerated display case and area heater comprising a display case, means for refrigerating said display case, said refrigerating means including a refrigerant condenser located at a position remote from said display case, means for passing water in heat exchanging relation with said refrigerant condenser so as to cool said condenser and heat the water, heat exchange means receiving water heated by the refrigerant condenser, a blower for forcing air over the latter heat exchange means, and duct means for directing heated air received from said blower and latter heat exchange means to said display case, the duct means forming a part of the display case and having an outlet opening through which heated air may be discharged into an area adjacent said refrigerated display case.

2. A system embodying a plurality of refrigerated display cases located adjacent an aisle and each having an evaporator therein for refrigerating air in the case, a common refrigerant condenser to which all of said evaporators are connected, said common condenser being located at a point remote from said display cases and including heat exchange means associated with the condenser for recovering heat therefrom, a blower for forcing air over said heat exchange means to raise the temperature of the air, a duct receiving heated air from the heat exchange means and extending to the aisle adjacent to which the display cases are located, said duct having at least one outlet near the cases through which the heated air may be discharged for raising the temperature of the air in the aisle adjacent the cases.

3. A system as defined in claim 2 wherein the condenser is cooled by water circulated through the heat exchange means.

4. A system as defined in claim 2 wherein said duct is provided with an outlet adjacent each of the cases and means are provided for selectively controlling the flow of air through said outlets.

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