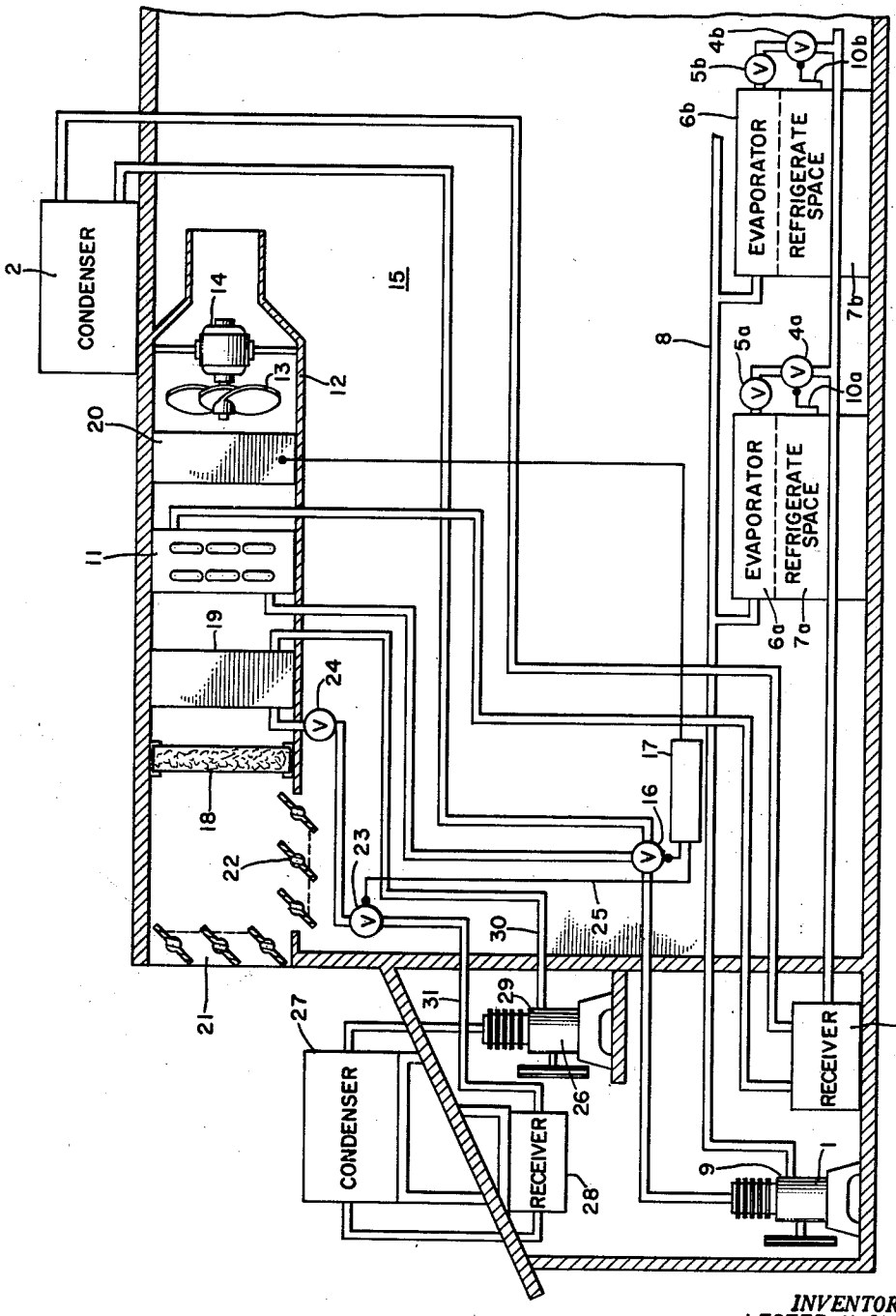
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REFRIGERATION AND HEATING SYSTEM

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REFRIGERATION AND HEATING SYSTEM

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This invention relates to a refrigeration and heating system and more particularly to a system of this type wherein the heat developed and given off in an ordinary refrigeration system may be used to assist in maintaining a room at an optimum temperature.

In the operation of an ordinary refrigeration system of compressing, condensing and expanding a gaseous refrigerant, a considerable amount of heat is necessarily given off during the condensing phase. Normally this heat is dissipated as an undesirable by-product of the refrigeration cycle.

In many markets and stores there are numerous refrigerated boxes or display cases and also the room requires either heating or cooling to maintain a desirable air temperature. It has been the common practice to provide a refrigeration system or systems for operating the refrigerated boxes and display cases and to provide separate and independent apparatus for heating the room or building to obtain the desired air temperature.

It is therefore an object of this invention to provide a refrigeration system in which means are provided for using the heat developed in the refrigeration cycle to assist in maintaining the air in a room or building within an optimum temperature range.

Another object of this invention is to provide a heating and refrigeration system in which means are provided for refrigerating one or more separated boxes or cases and using the heat extracted from said refrigerated spaces to heat the air of a room or building.

Another object of this invention is to provide a unique and novel air conditioning means for heating or cooling a room as part of a refrigeration system having two condensers, each of sufficient capacity to condense the total output of compressed refrigerant from the compressor, with one condenser positioned within a room for heating the air and having a valve for dividing the output of the compressor between the two condensers.

Other objects and advantages of this invention, it is believed, will be apparent from the following detailed description of a preferred embodiment thereof as illustrated in the accompanying drawing.

The drawing is a diagrammatic view of a refrigerating and heating system embodying the preferred form of the invention illustrated as incorporated within a building.

The refrigeration system employed in this invention includes a refrigerating cycle wherein a gaseous refrigerant such as ammonia, Refrigerant 12, Refrigerant 22 or one of the other commonly used refrigerating gases is compressed in a compressor 1 to a pressure such that when the gas is passed through a condenser 2 sufficient heat will be extracted from the compressed refrigerant for it to be condensed to a liquid. The condensed refrigerant passes from the condenser to a receiver 3 and from the receiver passes through one or more control valves *4a* and *4b* and thence through expansion valves *5a* and *5b* to the respective evaporator *6a* and *6b* whereby the liquid refrigerant is expanded and evaporated taking heat from the surrounding air within the associated refrigerated spaces *7a* and *7b* and expanding the refrigerant to a gas. The gas is then returned through an appropriate manifold 8 to the intake 9 of the compressor 1.

The refrigerated spaces *7a* and *7b* may be used for any appropriate purpose such as display cases, walk-in boxes, holding boxes, etc., as required in the particular installation. The control valves *4a* and *4b* are thermostatically controlled by any convenient means, such as electrical lead *10a* and *10b*, respectively, associated with the refrigerated spaces whereby the flow of refrigerant through the associated expansion valves *5a* and *5b* is controlled to maintain a predetermined temperature range within said spaces.

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A second condenser 11 is positioned within an air duct 12. A fan 13 having a motor 14 is positioned within the air duct 12 for drawing air through the duct and discharging said air into room 15. Other air ducts (not shown) may be associated with the discharge of the said fan 13 for supplying air to other rooms (not shown).

The volume of compressed refrigerant produced by the compressor is divided between the first condenser 2 and the second condenser 11 by the valve 16; the percentage of compressed refrigerant supplied to each being variable by the valve 16 which is operated by thermostatic control means 17 being sensitive to the temperature in room 15. The control means 17 may be set to maintain the room 15 within a predetermined temperature range and is adapted to actuate the valve 16 to divert compressed refrigerant to condenser 11 when the room needs heating and to divert the quantity of compressed refrigerant to condenser 2 which is not needed for heating purposes. Condenser 2 is located apart from room 15 so that the operation of said condenser does not affect the temperature in said room.

Also positioned within the air duct 12 are an air filter 18, an evaporator 19, and an auxiliary heater 20. Vents 21 and 22 are provided for varying the intake air to duct 12 between outside air and air from within room 15 as needed to maintain the desired air conditions.

The evaporator 19 is of the type heretofore described and is operated when the temperature in room 15 exceeds the pre-determined range, thereby cooling the air discharged by fan 13. The compressed-condensed refrigerant is supplied to evaporator 19 through control valve 23 and thence through expansion valve 24, the control valve 23 being actuated by thermostatic control means 17 by any convenient means such as electrical lead 25. The thermostatic control means 17 only opens control valve 23 when valve 16 is positioned to divert all the compressed refrigerant to condenser 2 thereby avoiding heating (by condenser 11) and cooling (by evaporator 19) of the same air discharged by fan 13. As illustrated in the drawings, the compressed-condensed refrigerant necessary to operate evaporator 19 is compressed in compressor 26, passes through condenser 27 where it is condensed to a liquid as in the above described cycle and then into receiver 28. From receiver 28 the liquid passes through conduit 31, through valve 23 to valve 24 where it is expanded to pass through evaporator 19. The refrigerant evaporated in evaporator 19 returns to the intake 29 of compressor 26 through conduit 30. The condenser 27 is preferably located outside the building to avoid affecting the air temperature of room 15. In some installations where proper climatic conditions and refrigeration requirements are present, it may be possible to operate evaporator 19 through the use of compressor 1 and condenser 2 rather than compressor 26 and condenser 27 thereby eliminating the need for compressor 26 and condenser 27.

The auxiliary heater 20 may be of any convenient type and size capable of supplying sufficient additional heat to maintain the room 15 within the predetermined temperature range when all the compressed refrigerant is diverted to the condenser 11 and the heat extracted from said refrigerant is insufficient to maintain said temperature range. The auxiliary heater 20 also is operable to maintain the room temperature when the compressor need not be operated to supply refrigerant to the evaporators. To assure the proper co-ordinating of operation of the heater 20 with the operation of condenser

11 and evaporator 19 to prevent simultaneous heating and cooling of air passing through duct 12 and resultant inefficiency. I prefer to control the operation of heater 20 with thermostatic control means 17 which also controls the supply of refrigerant furnished condenser 11 and evaporator 19.

In ordinary operation, the system requires no manual regulation after the initial settings to maintain the one or more refrigerated spaces and the room or building within their respective predetermined temperature ranges. Each of the compressors operates upon demand of their associated evaporators by commonly employed means. Thus the requisite function of heating a room or building is accomplished as an adjunct to operating refrigerated display cases or boxes at no appreciable increase in cost of operation.

Having fully described my invention, it is to be understood that I do not wish to be limited to the details herein set forth or illustrated in the drawings, but my invention is of the full scope of the appended claims.

I claim:

1. In an integral refrigeration and heating system for maintaining a room within a predetermined temperature range and refrigerating at least one refrigerated space including a compressor for compressing a refrigerant gas, a first condenser in communication with the room, a second condenser positioned outside the room, said condensers for condensing the compressed refrigerant gas, an evaporator positioned near said first condenser and in communication with the room, means for circulating air past the first condenser and said evaporator, thermostatically controlled valve means associated with the room for selectively feeding the compressed refrigerant gas to said first condenser in response to the room temperature, second thermostatically controlled valve means associated with the room for directing compressed-condensed refrigerant to the said evaporator for evaporating the said refrigerant to absorb heat from the air circulating past said evaporator in the event the first valve means is diverting all the compressed refrigerant to the second condenser and the air temperature of the room exceeds the maximum predetermined temperature, and at least one other evaporator positioned in each refrigerated space for evaporating compressed-condensed refrigerant to absorb heat from the refrigerated space.

2. In an integral refrigeration and air condition system for maintaining a room within a predetermined temperature range and refrigerating at least one refrigerated space including a first compressor for compressing a refrigerant gas, a first condenser in communication with the room, a second condenser positioned outside the room, said first and second condensers for condensing the refrigerant gas compressed in said first compressor, a second compressor for compressing a refrigerant gas, a third condenser positioned outside said room for condensing the refrigerant gas compressed in said second compressor, an evaporator adjacent said first condenser for evaporating the compressed refrigerant gas condensed in said third condenser to absorb heat from the air within the room, means for continuously circulating air past the said first condenser and said evaporator to said room, thermostatically controlled valve means for selectively feeding refrigerant for operating the said first condenser and said evaporator for maintaining the air temperature in the room within the predetermined range, and at least one other evaporator positioned in each said refrigerated space for evaporating the compressed refrigerant condensed in said first and second condensers to absorb heat from said refrigerated spaces.

3. In an integral refrigeration and air condition system for maintaining a room within a predetermined temperature range and refrigerating at least one refrigerated space including a first compressor for compressing a refrigerant gas, a first condenser in communication with the room, a second condenser positioned outside the room, said first and second condensers for condensing the refrigerant gas compressed in said first compressor, a second compressor for compressing a refrigerant gas, a third condenser positioned outside the room for condensing the refrigerant gas compressed in said second compressor, an evaporator adjacent said first condenser for evaporating the compressed refrigerant gas condensed in said third condenser to absorb heat from the air within the room, a heat generating means adjacent said first condenser and said evaporator to said room, means for continuously circulating air past the said first condenser, said heat generating means and said evaporator, thermostatically controlled valve means for selectively operating the said first condenser, said heat generating means and said evaporator for maintaining the air temperature in the room within the predetermined range, said thermostatically controlled valve means having means for selectively feeding the refrigerant gas from said first compressor to said first and second condensers, and at least one other evaporator positioned in each said refrigerated space for evaporating the compressed refrigerant condensed in said first and second condensers to absorb heat from said refrigerated spaces.

4. In an integral refrigeration and air condition system for maintaining a room within a predetermined temperature range and refrigerating at least one refrigerated space including a first compressor for compressing a refrigerant gas, a first condenser in communication with the room, a second condenser positioned outside the room, said first and second condensers for condensing the refrigerant gas compressed in said first compressor, a second compressor for compressing a refrigerant gas, a third condenser positioned outside the room for condensing the refrigerant gas compressed in said second compressor, an evaporator adjacent said first condenser for evaporating the compressed refrigerant gas condensed in said third condenser to absorb heat from the air within the room, a heat generating means adjacent said first condenser and said evaporator to said room, means for continuously circulating air past the said first condenser, said heat generating means and said evaporator, air inlet means to the said air circulating means for selectively admitting air from the room or air from outside the room, thermostatically controlled valve means for selectively operating the said first condenser, said heat generating means and said evaporator for maintaining the air temperature in the room within the predetermined range, said thermostatically controlled valve means having means for selectively feeding the refrigerant gas from said first compressor to said first and second condensers, and at least one other evaporator positioned in each said refrigerated space for evaporating the compressed refrigerant condensed in said first and second condensers to absorb heat from said refrigerated spaces.

5. An air circulating and temperature regulating system for controlling the temperature of a room having at least one refrigerated space therein, comprising a temperature regulating chamber having air inlet means from said room and from outside said room, damper means to control the air intake through said air inlet means in inverse proportion, air moving means for continuously circulating air through said chamber and to said room, a first closed refrigeration system including a first condenser within said chamber and a second condenser outside of said room and evaporator means for said refrigerated space, valve means responsive to the temperature of said room for variably dividing the entire refrigerant flow of said first closed refrigeration system between said first and second condensers, and a second closed refrigeration system including a third condenser outside said room and second evaporator means within said chamber, and means responsive to the temperature of said room for controlling the operation of said second refrigeration system to provide refrigerant flow to said second evaporator means.

6. An air circulating and temperature regulating system for controlling the temperature of a room having at least one refrigerated space therein, comprising an air temperature conditioning chamber having air inlet means from said room and from outside said room, variable damper means to control the air intake through said air inlet means in inverse proportion, air moving means for continuously circulating air through said chamber and to said room, a first closed refrigeration system including a compressor having a hot gaseous refrigerant discharge, a first condenser within said chamber, a second condenser outside of said chamber and room and first evaporator means for removing heat from said refrigerated space and providing a refrigerant heat load; valve means having a thermostatic control responsive to the temperature of said room for variably dividing the hot gaseous refrigerant discharge of said compressor between said first and second condensers for regulating the heat exchange from said first condenser to the air circulated through said chamber, and a second closed refrigeration system including a third condenser outside said room and second evaporator means within said chamber, and other means responsive to said thermostatic control for operating said second refrigeration system to provide refrigerant flow to said second evaporator means for cooling air circulated through said chamber only when said valve means isolates said first condenser and diverts the entire refrigerant discharge from said compressor to said second condenser.

7. The air circulating and temperature regulating system of claim 6 in which the said valve means has means for variably and proportionably dividing the hot gaseous refrigerant discharge of said compressor between said first and second condensers in proportional amounts corresponding to the air heating required in said conditioning chamber for achieving the desired room temperature as sensed by said responsive thermostatic control.

8. An air circulating and temperature regulating system for maintaining the ambient temperature of a room at a preselected level wherein at least one refrigerated space is positioned in such room, comprising the combination of: an air temperature conditioning chamber having selectively variable air inlet means from said room and from outside said room, air moving means for continuously circulating air from said air inlet means through said chamber and to said room; a first closed refrigeration system including a compressor having a hot gaseous refrigerant discharge and a suction intake, a first condenser within said chamber, a second condenser outside of said chamber and room, and first evaporator means for removing heat from said refrigerated space and providing a heat load to the said compressor intake; a second closed refrigeration system including a second compressor, a third condenser outside said room, and a second evaporator means within said chamber; a thermostatic control means responsive to the temperature of said room; valve means operatively controlled by said thermostatic control means in response to variations of room temperature from the preselected level for selectively feeding the hot gaseous refrigerant discharge from said first compressor between said first and second condensers for regulating the heat exchange from said first condenser to the air circulated through said chamber, and other means operatively controlled by said thermostatic control means in response to room temperatures above the predetermined level with the entire refrigerant discharge of the first compressor supplied to said second condenser for operating said second refrigeration system to in turn operate said second evaporator means for cooling the air circulated through said chamber for maintaining the room temperature at the predetermined level.

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