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ES-B1- 2 167 280
US-A- 3 025 681
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US-A- 3 759 059
US-A1- 2001 003 702
US-A1- 2004 129 018

DESCRIPTION

TECHNICAL FIELD OF THE INVENTION

[0001] This invention relates in general to an improved heat recovery system which is intended for air-conditioning and to reduce the cold corridor effect produced in open retail refrigeration cabinets or lines of same.

[0002] The heat evolved by a refrigerant fluid during the prior condensation or cooling process of it is made use of in a condensation unit or in an intermediate heat exchanger housed between that condensation unit and the discharge line of the compressor or of an array of positive or negative temperature compressors, belonging to the refrigerating circuits of refrigeration cabinets to be found in retail outlets; with the aim of using this heat evolved by the refrigerant fluid for air-conditioning and to reduce the cold corridor effect produced in the vicinity of those open retail refrigeration cabinets or lines of same, owing to the direct contact between the external face of the refrigeration air curtain of the refrigeration cabinet and the air inside a retail outlet.

[0003] Therefore, the object of this invention relates to the design of an improved system for making use of the heat released by a refrigerant fluid in a condensation unit or in an intermediate heat exchanger during the prior condensation or cooling process thereof, for air-conditioning and to reduce the cold corridor effect, as described previously.

PRIOR ART OF THE INVENTION

[0004] Retail outlets concerned with the distribution of perishable cold products are fitted with various kinds of refrigeration cabinet designed exclusively for the sale of these food products. Coming within this type of refrigeration cabinet are open retail refrigeration cabinets.

[0005] The products stored in these refrigeration cabinets require for their conservation a refrigerated ambience with certain given temperature levels. On account of their design and with the aim of maintaining the interior of the refrigeration cabinet at a desired refrigeration temperature, they are provided with a refrigerated air curtain, which demarcates the ambience of the retail outlet from the interior ambience of those open retail refrigeration cabinets.

[0006] Open retail refrigeration cabinets continually extract heat from the ambient air of the retail outlet owing to the direct contact existing between the external face of the refrigerated air curtain and the air inside the refrigeration cabinet. For that reason, in the vicinity of open retail refrigeration cabinets there exists an ambient temperature that is appreciably less than in the rest of the retail outlet, which is proportional to the installed cold density, defined on the basis of the ratio existing between the cooling power extracted by open retail refrigeration cabinets and the retail surface area.

[0007] In retail outlets intended for the distribution of perishable food products when open retail refrigeration cabinets are installed facing each other, a phenomenon is produced known as the cold corridor, where the temperature at floor level can be around 5-10 K less than compared to the rest of the retail outlet. This local reduction in temperature in the vicinity of open retail refrigeration cabinets or lines of same produces a certain ambient discomfort for the customer, as a result of which they tend to stay away, leading to a drop in sales, if no special measures are adopted.

[0008] There currently exist methods for mitigating this cold corridor effect, one of which is to use grilles in the lower part of the refrigeration cabinets which, by means of a system of fans, collect the cold air in the corridor and then channel it for extraction.

[0009] There exist other methods in which condensation unit of the refrigeration system is installed in the upper part of open retail refrigeration cabinets (if the cabinets are small the condenser unit is located in the lower part), thereby making use of the heat given off during the condensation process of the refrigerant fluid in order to raise the temperature in the interior of the retail outlet, with the consequent economic drawback if we take into account that during the summer months this heat input then has to be eliminated by the air conditioning system.

[0010] Other systems have been designed, in which the heat released by the refrigerant fluid during the condensation process is made use of, this heat being channelled towards the interior of the retail outlet via a system of ducts designed for this purpose and/or in other cases, the actual air-conditioning of the retail outlet is used.

[0011] US 2001/0003702 A1 discloses an air circulation system for a refrigerated display case comprising a channel having an

outlet opening adapted to be situated below the display case and a blower adapted to be coupled to the display case for directing air to flow into said channel and out of said outlet opening.

[0012] A heat recovery system is known for air-conditioning and reduction of the cold corridor effect, and is described in document ES-2,167,280 of FROST-TROL, SA. This document of the prior art describes an air-conditioning system for retail outlets and/or for distributor shops for perishable food products, which describes a system for making use of the air heated during the condensation process of a refrigerant fluid in the condenser units belonging to the refrigeration circuits of open retail refrigeration cabinets. In this case, the condensation unit is located in the upper part of the refrigeration cabinet, thereby taking advantage of the heat evolved during the condensation of the refrigerant. By means of some channelling ducts the hot air is supplied via the lowest part of the refrigeration cabinet towards the interior of the retail premises, and also to any other place.

DESCRIPTION OF THE INVENTION

[0013] In accordance with the present invention, a system is proposed which permits the drawbacks mentioned above to be diminished by means of designing an improved system for heat recovery in which the heat evolved by a refrigerant fluid during the prior condensation or cooling process is made use of in a condensation unit or in an intermediate heat exchanger housed between that condensation unit and the discharge line of a compressor or of an array of positive or negative temperature compressors, or of any refrigeration system.

[0014] Starting from this premise, the inventive system is applicable to open retail refrigeration cabinets or lines of same designed for the retail of perishable food products, for positive or negative temperatures. The system comprises a unit for the recovery and exploitation of the heat, as well as a unit for distributing and supplying heated air towards the interior of a retail outlet or a large retail store or an area to be air-conditioned, or any other place.

[0015] The heat recovery and exploitation unit contains a heat exchanger housed in the unit for distributing and supplying heated air, an intermediate heat exchanger and/or a condenser unit, an insulated tank and a circulation pump.

[0016] The intermediate heat exchanger and/or the condensation unit is arranged in the discharge line of the compressor or of the array of compressors, with the aim of making use of the heat evolved by the refrigerant fluid during the condensation or cooling process of the latter. The intermediate heat exchanger and/or the condensation unit can be housed in a machine room intended for this purpose or outside of it or in open retail refrigeration cabinets or lines of same.

[0017] The heat evolved by the refrigerant fluid is absorbed in the condensation unit and/or in the heat exchanger by a secondary working fluid. The recirculation of the secondary fluid is carried out using a circulation pump, interconnected with an insulated tank and with the heat exchanger that is housed in the duct for channelling and supplying the hot air. The geometry, design and number of heat exchangers used in the heat recovery and exploitation unit will depend on the installed cooling power.

[0018] The unit for distributing and supplying heated air towards the interior of the area to air-condition comprises an air suction grille, an interchangeable filter, a fan unit interconnected with the regulation system for the system and some air diffusers located in the lower part of the open retail refrigeration cabinet. The unit for distributing and supplying heated air can be housed in the rear part of an open retail refrigeration cabinets or outside of it.

[0019] The entire inventive assembly is provided with a device for regulating and controlling certain established conditions of comfort for the permanence of people and customers in general in these retail outlets.

[0020] As well as establishing a comfortable climate for the customers, the inventive system described above has the advantage of gradually reducing the relative humidity of the air inside a retail outlet or in a large retail store or in an area to air-condition, or anywhere else, thereby helping to reduce the installed cooling power and the overall energy consumption of these retail outlets.

[0021] Below, in order to facilitate a better understanding of this descriptive specification and forming an integral part thereof, some figures are attached in which, on an illustrative rather than limiting basis, the object of the invention has been represented.

BRIEF DESCRIPTION OF THE FIGURES

[0022]

Figure 1 shows a perspective view of an open retail refrigeration cabinet forming the object of the invention. In this case, a curtain of refrigerated air is shown (m_{1A}) and a flow of hot air (m_{2A}), generated starting from the exploitation of the heat evolved during the prior condensation or cooling process of a refrigerant fluid. Via certain ducts for channelling and pulsing (4, 7) of air and certain air diffusers (8), the flow of heated air (m_{2A}) is introduced into the interior of a retail outlet or a large retail store or an area to air-condition, via the lower part of the open retail refrigeration cabinets or lines of same.

Figure 2 shows a view in cross-section of an open retail refrigeration cabinet taking as reference the line A-A of figure 1, interconnected with an embodiment of the refrigeration circuit for a system that is embodied with the invention.

Figure 3A and 3B shows in perspective different alternatives for the embodiment of the duct for the channelling (4) and supplying the heated air (7), forming the object of the present invention.

Figure 4 represents a general view of the improved system for heat recovery for air-conditioning and to reduce the cold corridor effect forming the object of this invention. In this case it shows the direction of recirculation of the heated air (m_{2A}), generated and pulsed by the lower part of the open retail refrigeration cabinet by means of some heat diffusers (8). The flow of hot air is sucked via a suction grille (2), suitably arranged in a particular position above the open retail refrigeration cabinet, in the inlet duct of the unit for distributing and supplying heated air (1).

DESCRIPTION OF A PREFERRED EMBODIMENT

[0023] Making reference to figures 1 to 4, an improved system has been illustrated intended for air-conditioning and to reduce the cold corridor effect. The inventive system, whose embodiment by way of example will be explained below, is applicable to open retail refrigeration cabinets or lines of same, designed for the retailing of perishable food products, arranged in a retail outlet or in a large retail store or in an area to air-condition or any other place.

[0024] In whatever case, the inventive system comprises a recovery and exploitation system for the heat evolved by a refrigerant fluid during the condensing or cooling of it, as well as a unit for distributing and supplying the heated air via the lower part of the open retail refrigeration cabinets or lines of same towards the interior of a retail outlet or a large retail store or an area to be air-conditioned, or any other place.

[0025] The heat recovery and exploitation unit contains a heat exchanger (6) housed in the unit for distributing and supplying heated air (1), an intermediate heat exchanger (15) and/or a condenser unit (16) located in the discharge line of the compressor (14), an insulated tank (17) and a circulation pump (18), as well as the other conventional automata necessary for regulating the refrigerating facility.

[0026] The unit for distributing and supplying the heated air (1) contains an air suction grille (2), an interchangeable filter (3), fan (5), some air diffusers (8) arranged inside the ducts for channelling (4) and pulsing the heated air (7), as well as a device for regulating and controlling (19) the ambient conditions in the vicinity of open retail refrigeration cabinets or lines of same.

[0027] For the purposes of embodying the present invention, via the upper part of an open retail refrigeration cabinet or lines of same, at least one fan (5) housed in the channelling duct (4) sucks a flow of air (M_{2A}) from the interior of a retail outlet or a large retail store or an area to be air-conditioned, or any other place, via some suction grilles (2) located in the inlet duct of the unit for distributing and supplying the heated air (1). The airflow (M_{2A}) is pulsed via some interchangeable filters (3) and at least one heat exchanger (6), arranged in the duct for channelling (4) of the heated air.

[0028] As it passes through the heat exchanger (6), the air is heated owing to the thermal exchanger that is produced with the secondary fluid air (M_{1F}) of the heat recovery unit. The hot air is distributed and pulsed to the interior of a retail outlet or a large retail store or an area to be air-conditioned, or any other place, by means of some air diffusers (8) housed in the lower part of the open retail refrigeration cabinets or in lines of same.

[0029] The supplying the heated airflow (M_{2A}) to the interior of a retail outlet or a large retail store or an area to be air-conditioned or any other place is regulated by means of a control device (19), which employs certain measuring devices (20, 21) suitably distributed in the ambience to air-condition, together with the other conventional automata belonging to the refrigeration circuits of open retail refrigeration cabinets; which permits the temperature of the air to be maintained in the vicinity of the open retail refrigeration cabinets or lines of same under certain pre-established conditions; generating a microclimate of comfort for the

customers of the retail outlet for the retail of perishable products.

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- US20010003702A1 [0011]
- ES2167280 [0012]

PATENTKRAV

1. Forbedret varmegenvindingssystem til klimatisering og til reduktion af den kuldekorridor-effekt, der frembringes i nærheden af et åbent detailhandelskøleskab eller linjer af samme, der er placeret i det indre af et detailsalgssted eller en stor detailhandel eller området, 5 der skal klimatiseres for præsentation, hvilket varmegenvindingssystem omfatter en enhed til distribution og tilførsel af opvarmet luft (1) via den nedre del af det åbne detailhandelskøleskab eller linjer af samme mod det indre af detailsalgsstedet eller den store detailforretning eller det område, der skal klimatiseres, for præsentation; kendetegnet ved, at det endvidere omfatter 10 en enhed til genvinding og udnyttelse af varme omfattende en kondenseringsenhed (16) og/eller en varmeveksler (15), hvor varme udviklet ved hjælp af et kølemiddel anvendes til at opvarme et andet arbejdsfluid (M1F); en isoleret beholder (17) og en cirkulationspumpe (18) til cirkulering af det andet arbejdsfluid (M1F) til en varmeveksler (6) placeret i enheden til fordeling og tilførsel af opvarmet luft (1), hvor en strøm af luft (M2A) udsuges fra det indre af 15 detailsalgsstedet eller den store detailforretning eller området, der skal klimatiseres, opvarmes ved hjælp af det andet arbejdsfluid (M1F).
2. Forbedret varmegenvindingssystem, ifølge krav 1, hvor enheden til distribution og tilførsel af opvarmet luft (1) endvidere omfatter en luftsugningsrist (2), hvor igennem strømmen af luft 20 (M2A) udsuges fra det indre af detailsalgsstedet eller den store detailforretning eller området, der skal klimatiseres; et middel til kanalisering og pulsering af den udsugede luftstrøm (M2A) (4, 7) og luftdiffusorer (8) placeret ved den nedre del af det åbne detailhandelskøleskab.
3. Forbedret varmegenvindingssystem, ifølge et hvilket som helst af de foregående krav, 25 kendetegnet ved, at det endvidere omfatter en styreenhed (19) til regulering og bevaring af temperaturen i nærheden af det åbne detailhandelskøleskab eller linjer af samme, der omfatter måleanordninger (20, 21) fordelt i de omgivelser, der skal klimatiseres.

DRAWINGS

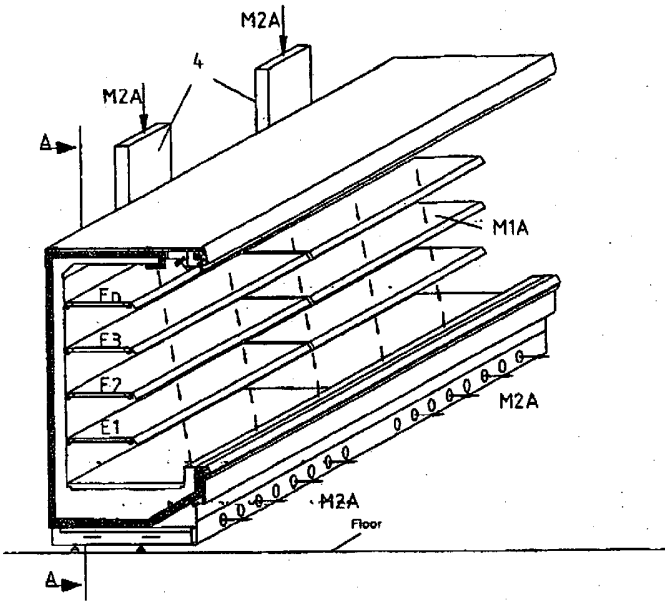


FIG. 1

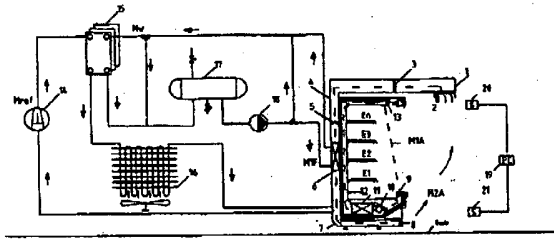


FIG. 2

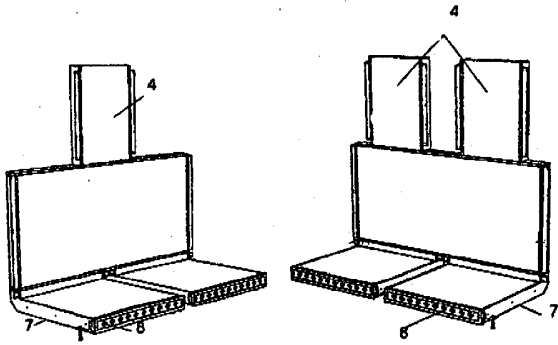


FIG. 3A

FIG. 3B

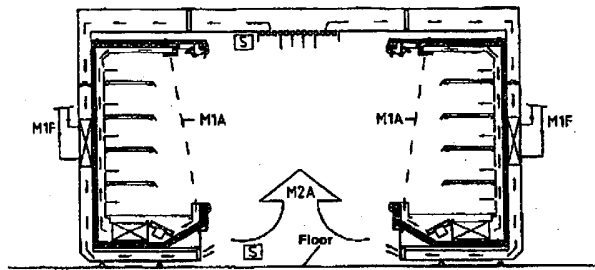


FIG. 4