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(54) **Refrigerating cabinet comprising a cabinet body frame**

Kühlschrank umfassend einen Rahmen für Schrankkörper

Armoire frigorifique comprenant un cadre de corps d'armoire

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Description

FIELD OF THE INVENTION

[0001] The present invention relates to the technical field of refrigerating apparatus, and in particular to a cabinet body frame for refrigerating cabinet and refrigerating cabinet.

BACKGROUND OF THE INVENTION

[0002] Various refrigerating apparatuses having refrigerating and freezing functions or additional display function, such as refrigerating cabinet, refrigerating case and refrigerating display cabinet, have already been widely used in people's daily work, lives and business activities. For the sake of simplicity, these apparatuses are herein collectively referred to as "refrigerating cabinet". Although these refrigerating cabinets can bring us infinite convenience and delightful enjoyment, some problems and defects also exist during actual use thereof. For example, various refrigerating cabinets will consume much energy including electrical energy during operation. Since a considerable huge amount of refrigerating cabinets has been put into use currently, such energy consumption is surprisingly enormous. It is therefore necessary to conduct research on this problem and make improvements on this.

[0003] As far as conventional refrigerating cabinets are concerned, electrical heating, fluorescent lamp or some similar components are required to be installed in the cabinet body frame thereof such that the temperature at the outer surface of the cabinet body frame is controlled to be higher than a dew point temperature (e.g., typically about 17°C at normal temperature) in the environment where these components operates, thus preventing foreign wet air from condensing onto the outer surface. There is no doubt that these devices will consume a considerable amount of electrical energy during long term operation day after day, which goes in the contrary way to that of realistic requirements on energy resource saving and environment protection, etc. Moreover, since these heating devices operate in an relatively cold and wet environment for a long time period, it is possible that they will easily fail or get damaged, which increases cost of device maintenance and is adverse to longer time reliable operation of the refrigerating cabinet itself.

[0004] Although US patent No. US4,496,201 issued to Allgeyer and US patent No. US4,741,127 issued to Bockwinkel respectively disclose a glass door for refrigerating or freezing and a refrigerator door having a heat insulating outer frame, the structures of these doors are not only relatively complicated, but also have to be wholly reconstructed for use. It is impossible to remove the aforesaid heating devices by making proper alterations to the structure of existing refrigerating cabinets, so as to achieve the energy saving effect.

[0005] For providing a low-temperature showcase, capable of effectively solving dew condensation to a middle support by using hot air of a condenser or the like through a simple structure JP 2008 025917 A discloses a low-temperature showcase, which comprises a door openably closing the front opening of a display chamber; a middle support provided on an opening part of the display chamber, on the front surface of which the door abuts; a machine chamber formed outside of the heat insulating wall below the display chamber; a cooling unit including the condenser or the like, which is disposed inside of the machine chamber; and a machine chamber cover provided on the front of the machine chamber to be located below the door. The showcase further comprises a vertically extending groove formed in a depressed shape on the front surface of the middle support; a middle support duct member closing the groove to form a middle support duct within the groove; and an exhaust port formed on the upper surface of the machine chamber cover to blow air discharged from a condenser fan into the middle support duct.

[0006] To obtain a heat insulating box body with a design plate comprising a single part for facilitating processing, and heating the design plate efficiently to prevent dew condensation JP 2000 046461 A proposes a heat insulating box body comprising a box body main body provided with a plurality of rooms wherein the inside thereof partitioned by a partition plate is lower than room temperature, and a plurality of opening and closing doors or the like provided corresponding to each room. A radiation pipe is internally installed close to the door side end part of the partition plate, a design plate is installed on the side of the doors for forming a void part, and an air vent hole is provided for flowing the air inside the void part to the design plate.

SUMMARY OF THE INVENTION

[0007] Firstly, according to an aspect of the invention, a refrigerating cabinet is provided so that the above-mentioned and other problems existing in the prior art can be effectively solved. The refrigerating cabinet of the invention comprises a cabinet body, at least one cabinet door and a cabinet body frame mounted to the cabinet body, the at least one cabinet door is mounted to the cabinet body frame, wherein the refrigerant cabinet is a vertical refrigerant cabinet and the cabinet body frame comprises at least two mullions, whose positions correspond to the positions of the sides of the cabinet door in a close state, the cabinet body frame comprises an attached layer made of material having low thermal conductivity and provided above at least a portion of the outer surface of at least one of the mullions, and the attached layer is arranged to be spaced apart from the outer surface by an air gap communicating with atmosphere, wherein the attached layer is provided above the outer surface of at least one of the mullions through a first connector and a second connector which are spaced apart from each other and the attached layer is arranged to be in parallel with

the outer surface, and the attached layer is configured to have the same width as that of the outer surface of the at least one of the mullions where the attached layer is provided, the first connector and the second connector are made of the same material and divide the outer surface of said at least one of the mullions into a first section, a second section and a third section in order along the at least one of the mullions.

[0008] According to another embodiment of the refrigerating cabinet of the invention, optionally, the thickness dimension of the air gap is set according to the following equation:

$$\delta = \frac{\lambda_a A_b + \lambda_b A_a}{A_b A_a} * \left(\frac{T_c - T_f}{\alpha A_c \left(T_r - T_c \right)} - R_c \right)$$

where δ stands for the thickness dimension of the air gap; λ_a stands for the thermal conductivity coefficient of air; λ_b stands for the thermal conductivity coefficient of the first connector and the second connector; T_c stands for the temperature of the outer surface of the attached layer, which should be higher than the dew point in the outer environment where the cabinet body frame is located; T_f stands for the temperature of the outer surface of the cabinet body frame with the attached layer provided thereon; T_r stands for the temperature of environment where the cabinet body frame is located; R_c stands for the thermal impedance of the attached layer; α stands for the natural convective heat transfer rate of air; A_c stands for the width dimension of the attached layer; A_b stands for the sum of the respective width dimensions A_2 and A_4 of the first connector and the second connector along the cross-section direction of the cabinet body frame, i.e., $A_b = A_2 + A_4$; A_a stands for the sum of the respective width dimensions A_1, A_3 and A_5 of the first, second and third sections along the cross-section direction of the cabinet body frame, i.e., $A_a = A_1 + A_3 + A_5 = A_c - A_b$.

[0009] According to another embodiment of the refrigerating cabinet of the invention, optionally, T_c is predefined in the range of 6°C-25°C, T_f is predefined in the range of 5°C-15°C, and/or T_r *is* predefined in the range of 15°C-30°C. More preferably, T_c, T_f and T_r are predefined to be 17°C, 12°C and 25°C respectively.

[0010] According to still another embodiment of the refrigerating cabinet of the invention, optionally, the thickness dimension of the air gap is in the range from 3 mm to 10 mm.

[0011] According to another embodiment of the refrigerating cabinet of the invention, optionally, the cabinet door is made of glass.

[0012] According to still another embodiment of the refrigerating cabinet of the invention, optionally, the refrigerating cabinet further comprises a dew-receiving member for receiving the dew, which is provided at the lower end of the mullion provided with the attached layer. Further, the dew-receiving member is configured in a slot shape or a plate shape.

[0013] According to yet another embodiment of the refrigerating cabinet of the invention, optionally, the refrigerating cabinet further comprises an electrical heating component for heating, which is provided near the inner surface of the cabinet body frame.

[0014] As compared with the prior art, the employment of the refrigerating cabinet of the invention can sufficiently and effectively prevent foreign wet air from condensing onto the outer surface of the refrigerating cabinet without providing heating components such as electrical heater. For example, the condensed dew is prevented from being exposed onto the outer surface of the intermediated mullion of the vertical refrigerating cabinet in an unpleasant and baffling manner. Therefore, not only the control over manufacture cost of refrigerating cabinet is facilitated and the operation reliability is improved, but also the operational energy consumption of refrigerating cabinet can be saved so that the operational expense of the apparatus is considerably reduced. By estimation, the utilization of the invention can save 28%-63% of the direct energy consumption while achieving significant technical effects. The invention exhibits significant importance in the realization of goals such as reduction of carbon emission, energy saving and environment protection.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] The technical solutions of the invention will be described in further details hereinafter in connection with the accompanying drawings and the embodiments.

Fig. 1 is a schematic perspective structure view of an embodiment of the refrigerating cabinet according to the invention, wherein the refrigerating cabinet is a vertical refrigerating cabinet and has a plurality of cabinet doors.

Fig. 2 is a partial sectional view of the portion A in Fig. 1, wherein an inner operational area C of the refrigerating cabinet and an outer environmental area D are co-currently illustrated in a schematic manner.

Fig. 3 is a partial sectional view of another embodiment of the refrigerating cabinet according to the invention taken at a portion corresponding to the portion A in Fig. 1, wherein an inner operational area C of the refrigerating cabinet and an outer environmental area D are co-currently illustrated in a schematic manner.

Fig. 4 is a partial schematic perspective structure view of still another embodiment of the refrigerating cabinet according to the invention.

Fig. 5 is a schematic principle view explaining how to calculate the thickness dimension of the air gap according to the embodiment of the refrigerating cab-

inet of Fig. 1.

Fig. 6 is a schematic principle view explaining how to calculate the thermal impedance according to the embodiment of the refrigerating cabinet of Fig. 1.

DETAILED DESCRIPTION OF THE INVENTION

[0016] Firstly, it is noted that the basic structure, design principle as well as the characteristics and advantages of the refrigerating cabinet according to the invention will be specifically described hereinafter by way of example; however, all of the description is intended for illustrative purpose only and should not be construed as limiting the invention in any way. Moreover, any individual technical feature described or implied in each embodiment set forth herein or any individual technical feature shown or implied in the drawings can also be combined randomly among these technical features (or equivalents thereof), so as to obtain more other embodiments of the invention that may have not been set forth directly herein.

[0017] Secondly, it is clearly noted that the orientation terms such as "outer", "inner" and "lower", as used herein are respectively completely consistent with the corresponding orientations as shown by a refrigerating cabinet placed in a conventional way when in use and as commonly understood. Therefore, these orientation terms should not be construed as limiting the invention in any way. Moreover, the term "low thermal conductivity material" as used herein refers to any material which has a thermal conductivity coefficient lower than that of air. Such materials comprise, but are not limited to, vacuum foaming materials such as vacuum insulation panel.

[0018] Moreover, it is noted that in some of the drawings, some features of the invention may have been simplified, omitted, scaled up/down or partially exaggerated appropriately so that the specific structure of the invention can be explained more clearly.

[0019] Fig. 1 is a schematic perspective structure view of an embodiment of the refrigerating cabinet according to the invention. Besides, Fig. 2 further shows partial detailed features of the embodiment of Fig. 1. The various constituent parts of the refrigerating cabinet of the invention and the ways how they are connected and arranged will be described in detail hereinafter with reference to these drawings.

[0020] As shown in Fig. 1, in the above-described embodiment, the refrigerating cabinet 1 is illustratively shown as a vertical refrigerating cabinet which comprises a cabinet body 2, a 5 cabinet door 3 and a cabinet body frame 4, wherein the cabinet body frame 4 designed and manufactured according to the invention is mounted to the cabinet body 2, and the cabinet door 3 is mounted to the cabinet body frame 4. The mullions 5 shown in Fig. 1 belong to a part of the cabinet body frame 4 and the positions of the mullions 5 correspond to the positions of the sides of the cabinet door 3 in a close state in these figures. By way of) example, Fig. 1 shows that the refrigerating cabinet has five cabinet doors. For the sake of simplicity of the figures, all the identical features in the drawings are denoted in the alternative way. It is understood that the invention can be applied to other non-vertical refrigerating cabinets (e.g., horizontal refrigerating cabinet, etc.) as actually required by applications, and any number of cabinet doors can be configured in the refrigerating cabinet 5 flexibly.

[0021] A main object of the invention is to eliminate the heating devices for preventing wet air from condensing in existing refrigerating cabinet so as to thoroughly overcome the prior art defects as described above, which is a very challenging task though. Therefore, in order to achieve the above object of the invention, sufficient improvements which employ a completely different design from the prior art, have been made on the structure of cabinet body frame of refrigerating cabinet in the invention.

[0022] Referring to Figs. 1 and 2, an attached layer 6 is provided above the outer surface 10 of the mullions 5 of the cabinet body frame 4 in the embodiment of the invention. The attached layer 6 employs a material having low conductivity, and when the attached layer 6 is mounted, an air gap 7 is maintained between the attached layer 6 and the outer surface 10 of the mullions 5 so as to keep them spaced apart from each other. As shown in Fig. 2, the air gap 7 keeps in communication with the outer environment area D of the refrigerating cabinet. Since air in the air gap 7 has a characteristic of low thermal conductivity coefficient and the materials itself of the attached layer 6 has such a characteristic as being low in thermal conductivity, when these two characteristics are combined together through an elaborate design in the invention, not only a phenomenon that wet air condense into dew onto the attached layer 6 can be well prevented, but also the influence of outer atmosphere on the temperature of the outer surface 10 of the mullions 5 can be ideally controlled to be within a desired range depending on design requirements. That is, without use of any heating components, on one hand, the invention enables the outer surface of the attached layer 6 to keep dry constantly, and on the other hand, the invention enables outer wet air to condense merely (or condense in a restricted manner) on the outer surface 10.

[0023] In this way, as shown in Fig. 2, the cabinet door 3 employs a glass door in the vertical refrigerating cabinet and three layers of glass 15 are embedded in a spaced apart relationship from each other in the glass door frame 14 of the cabinet door 3. When the cabinet door 3 is in a closed state, it is fitted onto the attached layer 6 through sealing members 13 and 14 (e.g., made of resilient rubber material etc.) provided on the cabinet door 3. As for the attached layer 6, it is mounted to the outer surface 10 of the cabinet body frame 4 through two spaced apart connectors 11, 12; meanwhile, the attached layer 6 is in parallel with the outer surface 10 and an air gap 7 is maintained between them. The two connectors 11 and 12 can be made of the same material (e.g., bonding material,

metallic material, etc.), and can be further configured to have exactly the same profile dimensions. By way of providing the attached layer 6 and the air gap 7 as described above, it is achieved that the heat exchange effect between hot air having a higher temperature in the outer environment area D of the refrigerating cabinet and cold air having a lower temperature in the inner environment area C of the refrigerating cabinet will not have influence on foreign wet air so that the wet air will not condense onto the attached layer 6 to form dew, and furthermore, even when the dew is present on the outer surface 10 of the mullions 5, the pleasant appearance of the refrigerating cabinet will not be impaired. Fig. 2 further schematically illustrates an illumination component 18 provided inside the refrigerating cabinet. The illumination component 18 provides an illuminating function, and at the same time, the heat emitted therefrom can also help to further prevent or eliminate the phenomenon of foreign wet air condensing onto the outer surface 10 of the mullions 5.

[0024] Although it has been described above that a main object of the invention is to eliminate the heating devices for preventing wet air from condensing in existing refrigerating cabinet, for some special considerations such as reserving the heating devices for emergency needs, or having to provide them as particularly required by some customers, such heating devices can also be provided in the refrigerating cabinet of the invention. Fig. 3 shows such an embodiment which is substantially similar to the embodiment in Fig. 1 with an only exception that an electrical heating component 9 is additionally provided adjacent to the inner surface of cabinet body frame 4 such as the illustrated mullions 5 so that a heating operation can be performed as needed, which also further prevent or eliminate the phenomenon of foreign wet air condensing onto the outer surface 10 of the mullions 5 more effectively.

[0025] The above-described attached layer 6 is configured to have the same width as that of the cabinet body frame 4 at a corresponding position where the attached layer 6 is provided. The above-described attached layer 6 is arranged to be in parallel with the outer surface 10 of the cabinet body frame 4 at a position where the attached layer 6 is provided. Of course, depending on the requirements of some applications, the attached layer 6 can be arranged to have a different width from that of the corresponding cabinet body frame 4 in some embodiments not part of the present invention; alternatively, also in some embodiments not part of the present invention, the attached layer 6 can be arranged to be not in parallel with the outer surface 10 of the cabinet body frame 4, e.g., when the cabinet door 3 of the refrigerating cabinet 1 is arranged to be not completely perpendicular to the mounting plane of the refrigerating cabinet 1.

[0026] As shown in Fig. 4, in still another embodiment of the refrigerating cabinet of the invention, a dew-receiving member 8 can be further provided and mounted at a lower end position of the mullion 5. Through the dew-receiving member 8, dew that may be condensed onto the outer surface 10 of the mullions 5 and then flows down along the outer surface 10 of the mullions 5 under gravity force, can be better received and will naturally evaporate on the dew-receiving member 8 over time. Preferably, the dew-receiving member 8 is configured into a slot shape or a plate shape. Fig. 4 schematically illustrates a perspective structure of components including the mullions 5, the attached layer 6, the dew-receiving member 8 in slot shape, etc.

[0027] As for the air gap 7, it constitutes a key essential point of the modification design of the invention and is thus to be explained in further details hereinafter.

[0028] According to the design concepts of the invention, in normal situations, the thickness dimension of the air gap 7 can be set in a range from 3 mm to 10 mm. According to some particular applications, the thickness dimension of the air gap 7 can also be further calculated and set accurately. For example, with respect to the embodiment shown in Fig. 1, Figs. 5 and 6 show the illustrative schematic views explaining the corresponding principles of designing and calculating the thickness dimension of the air gap 7.

[0029] With reference to Fig. 5, the attached layer 6 in this example is mounted to the outer surface 10 of the cabinet body frame 4 through connectors 11 and 12 that are spaced apart from each other. For reasons of clarity, the two connectors are both shown with hatches in the figure. The connectors 11 and 12 divide the cabinet body 4 into three sections, i.e., a first section 16, a second section 17 and a third section 18 in order along a cross-section direction of the cabinet body frame 4 (or more specifically, along the mullion 5). As shown in Fig. 5, the respective width of the first section 16, the second section 17 and the third section 18 along the cross-section direction of the cabinet body frame 4 are denoted as A_1, A_3 and A_5 respectively, while the respective width of the first connector 11 and the second connector 12 along the cross-section direction of the cabinet body frame 4 are denoted as A_2 and A_4 respectively. For ease of expression hereinafter, the sum of the sizes of A_1, A_3 and A_5 is denoted as the symbol A_a, i.e., $A_a = A_1 + A_3 + A_5$, and the sum of the sizes of A_2 and A_4 is denoted as the symbol A_b, i.e., $A_b = A_2 + A_4$. Meanwhile, a symbol A_c is used to denote a width dimension of the cabinet body frame 4 along the cross-section direction thereof in Fig. 6, and it is obvious that $A_c = A_a + A_b = A_1 + A_2 + A_3 + A_4 + A_5$.

[0030] Through a thermodynamics analysis, the heat transfer between the outer surface 10 of the cabinet body frame 4 and the outer environment area D includes heat conduction in the air gap 7 and the attached layer 6 as well as natural convective conduction between the attached layer 6 and the outer environment area D. Therefore, the amount of heat transferred by the air gap 7 and the attached layer 6 can be expressed by the following equation (1) :

$$Q = \frac{T_c - T_f}{\sum R} = \alpha A_c (T_r - T_c) \qquad (1)$$

where α stands for the natural convective heat transfer rate of air, the value of which may be generally set between 5 and 20 depending particularly on the convection conduction conditions in the outer environment where the cabinet body frame is located; T_c stands for the temperature of the outer surface of the attached layer 6, which should be higher than the dew point in the outer environment where the cabinet body frame 4 is located (the specific value of dew point depends on air temperature and relative humidity conditions at the place where the cabinet body frame 4 is located), the value of T_c is generally predefined in the range of 6°C-25°C and is preferably set as 17°C; T_f stands for the temperature of the outer surface 10 of the cabinet body frame 4 with the attached layer 6 provided thereon, the value of which can be generally predefined in the range of 5°C-15°C so as to obtain a well-designed frame and is preferably set as 12°C; T_r stands for the temperature of environment where the cabinet body frame 4 is located, the value of which can be generally predefined in the range of 15°C-30°C, preferably in the range of 25°C-27°C, and more preferably set as 25°C. When designing and determining the specific thickness dimension of the air gap 7, if the value of environment temperature is selected to be a lower value in the above range of T_r, it is advantageous for preventing foreign wet air from condensing onto the outer surface of the refrigerating cabinet; and if a higher value of environment temperature is selected (e.g. 30°C), although it will be adverse for avoiding the occurrence of the above-described condensing phenomenon of wet air, this problem can be solved by additionally providing the aforesaid electrical heating component which will be activated when necessary. Therefore, it is noted that since the aforesaid temperature parameters T_c, T_f and T_r can be set in a respective certain range of temperature respectively, the specific thickness size of the air gap 7 can be selected in an interval of size. When the respective preferable values for these temperature parameters T_c, T_f and T_r are selected simultaneously, the preferable value of thickness dimension of the air gap 7 can be obtained.

[0031] As for $\sum R$ in the above equation, reference can be made to the schematic view showing a model for calculating thermal impedance of the embodiment provided in Fig. 7, wherein R_a stands for thermal impedance of air, R_b stands for thermal impedance of the connectors 11 and 12, and R_c stands for thermal impedance of the attached layer 6. According to this calculation model, it is known that:

$$\sum R = R_c + \frac{R_b \cdot R_a}{R_b + R_a} \qquad (2)$$

[0032] When the above equations (1) and (2) are combined, the following equation (3) can be derived:

$$\frac{T_c - T_f}{R_c + \frac{R_b \cdot R_a}{R_b + R_a}} = \alpha A_c (T_r - T_c) \qquad (3)$$

[0033] Then, the following equation (4) can be further derived:

$$\frac{R_b \cdot R_a}{R_b + R_a} = \frac{T_c - T_f}{\alpha A_c (T_r - T_c)} - R_c \qquad (4)$$

[0034] According to actual operational conditions of the refrigerating cabinet, the specific values of T_f and T_r can be obtained. Moreover, since T_c is set to be higher than dew point under current outer environment as actually required, the dew pointed is also determined. Thus, the value of $\frac{T_c - T_f}{\alpha A_c (T_r - T_c)} - R_c$ can be determined. For ease of subsequent expression, this value is expressed as R_{mix}, then:

$$\frac{R_b \cdot R_a}{R_b + R_a} = R_{mix}$$

[0035] Again, as shown in Fig. 5, since the thickness of the air gap 7 is identical to the thickness of the connector 11 (or connector 12), a symbol δ is employed in an uniform manner for ease of expression. Thus, the following equation (5) can be derived:

$$\frac{\frac{\delta}{\lambda_b} A_b \cdot \frac{\delta}{\lambda_a} A_a}{\frac{\delta}{\lambda_b} A_b + \frac{\delta}{\lambda_a} A_a} = R_{mix} \qquad (5)$$

[0036] In the above equation, λ_a stands for the heat conductivity coefficient of air, λ_b stands for the heat conductivity coefficient of connectors 11 and 12.

[0037] Therefore, the following equation (6) can be derived:

$$\delta = \frac{\lambda_a A_b + \lambda_b A_a}{A_b A_a} * R_{mix} \qquad (6)$$

[0038] Therefore, the thickness dimension of the air gap 7 can be finally calculated and configured according to the following calculation equation:

$$\delta = \frac{\lambda_a A_b + \lambda_b A_a}{A_b A_a} * \left(\frac{T_c - T_f}{\alpha A_c (T_r - T_c)} - R_c \right)$$

[0039] In summary, the application of the invention can dispense with various heating devices provided for solving the problem of condensed dew in existing refrigerating cabinet, and the amount of energy consumption can be significantly reduced so that a considerable amount of long term expense can be saved. Moreover, since the invention presents a compact structure and pleasant appearance and is easy to manufacture, mount and maintain, etc., not only can it be applied to newly manufactured refrigerating cabinets so as to realize the advantageous technical effects as described above, but it can also be applied to the numerous kinds of various old type refrigerating cabinets currently in use very conveniently so that these cabinets can be reconstructed at a low cost to achieve the desired advantageous technical effects.

[0040] Several particular embodiments have been listed above in order to set forth the cabinet body frame for refrigerating cabinet and the refrigerating cabinet of the invention in detail. These individual examples are provided merely for the purpose of explaining the principles and embodiments of the invention and are not intended to limit the invention. Those skilled in the art can make various modifications and variations without departing from the scope of the invention. Further, the attached layer can be provided above only part of the mullions of the refrigerating cabinet as actually required, rather than being provided above all the mullions. Still further, the cabinet door body of the refrigerating cabinet can be made of other non-glass materials. Therefore, all the equivalent technical solutions should fall within the scope of the invention and should be defined by the appended claims of the invention.

Claims

1. A refrigerating cabinet (1) comprising a cabinet body (2), at least one cabinet door (3) and a cabinet body frame (4) mounted to the cabinet body (2), the at least one cabinet door (3) is mounted to the cabinet body frame (4), wherein the refrigerating cabinet (1) is a vertical refrigerating cabinet (1) and the cabinet body frame (4) comprises at least two mullions (5), whose positions correspond to the positions of the sides of the cabinet door (3) in a close state, the cabinet body frame (4) comprises an attached layer (6) made of material having low thermal conductivity and provided above at least a portion of the outer surface (10) of at least one of the mullions (5), and the attached layer (6) is arranged to be spaced apart from the outer surface (10) by an air gap (7) communicating with atmosphere,
characterized in that the attached layer (6) is provided above the outer surface (10) of at least one of the mullions (5) through a first connector (11) and a second connector (12) which are spaced apart from each other and the attached layer (6) is arranged to be in parallel with the outer surface (10), and the attached layer (6) is configured to have the same width as that of the outer surface (10) of the at least one of the mullions (5) where the attached layer (6) is provided, the first connector (11) and the second connector (12) are made of the same material and divide the outer surface (10) of the at least one of the mullions (5) into a first section (16), a second section (17) and a third section (18) in order along the at least one of the mullions (5).

2. The refrigerating cabinet (1) according to claim 1, wherein the thickness dimension (δ) of the air gap (7) is set according to the following equation:

$$\delta = \frac{\lambda_a A_b + \lambda_b A_a}{A_b A_a} * \left(\frac{T_c - T_f}{\alpha A_c (T_r - T_c)} - R_c \right)$$

where δ stands for the thickness dimension of the air gap (7); λ_a stands for the thermal conductivity coefficient of air; λ_b stands for the thermal conductivity coefficient of the first connector (11) and the second connector (12); T_c stands for the temperature of the outer surface (10) of the attached layer (6), which should be higher than the dew point in the outer environment where the cabinet body frame (4) is located; T_f stands for the temperature of the outer surface (10) of the cabinet body frame (4) with the attached layer (6) provided thereon; T_r stands for the temperature of environment where the cabinet body frame (4) is located; R_c stands for the thermal impedance of the attached layer (6); α stands for the natural convective heat transfer rate of air; A_c stands for the width dimension of the attached layer (6); A_b stands for the sum of the respective width dimensions A_2 and A_4 of the first connector (11) and the second connector (12) along the cross-section direction of the cabinet body frame (4), i.e., $A_b = A_2 + A_4$; A_a stands for the sum of the respective width dimensions A_1 , A_3 and A_5 of the first, second and third sections along the cross-section direction of the cabinet body frame (4), i.e., $A_a = A_1 + A_3 + A_5 = A_c - A_b$.

3. The refrigerating cabinet (1) according to claim 2, **characterized in that** T_c is predefined in the range of 6°C-25°C, T_f is predefined in the range of 5°C-15°C, and/or T_r is predefined in the range of 15°C-30°C.

4. The refrigerating cabinet (1) according to claim 3, **characterized in that** T_c, T_f and T_r are predefined to be 17°C, 12°C and 25°C respectively.

5. The refrigerating cabinet (1) according to claim 1, **characterized in that** the thickness dimension of the air gap (7) is in the range from 3mm to 10 mm.

6. The refrigerating cabinet (1) according to any one of claims 1-5, **characterized in that** the cabinet door (3) is made of glass.

7. The refrigerating cabinet (1) according to any one of claims 1-6, **characterized in that** the refrigerating cabinet (1) further comprises a dew-receiving member (8) for receiving the dew, which is provided at the lower end of the at least one of the mullions (5) provided with the attached layer (6).

8. The refrigerating cabinet (1) according to claim 7, **characterized in that** the dew-receiving member (8) is configured in a slot shape or a plate shape.

9. The refrigerating cabinet (1) according to any one of claims 1-6, **characterized in that** the refrigerating cabinet (1) further comprises an electrical heating component (9) for heating, which is provided near the inner surface of the cabinet body frame (4).

Patentansprüche

1. Kühlregal (1) umfassend einen Regalkörper (2), mindestens eine Regaltür (3) und einen Regalkörper-Rahmen (4), der an dem Regalkörper (2) montiert ist, wobei die mindestens eine Regaltür (3) an dem Regalkörper-Rahmen (4) montiert ist, wobei das Kühlregal (1) ein vertikales Kühlregal (1) ist und der Regalkörper-Rahmen (4) mindestens zwei Pfosten (5) umfasst, deren Positionen den Positionen der Seiten der Regaltür (3) in einem geschlossenen Zustand entsprechen, wobei der Regalkörper-Rahmen (4) eine angebrachte Schicht (6) umfasst, die aus Material hergestellt ist, welches eine niedrige Wärmeleitfähigkeit aufweist, und die über mindestens einem Abschnitt der äußeren Fläche (10) von mindestens einem der Pfosten (5) vorgesehen ist, und wobei die angebrachte Schicht (6) dazu angeordnet ist, um durch einen Luftzwischenraum (7), welcher mit der Atmosphäre kommuniziert, von der äußeren Fläche (10) beabstandet zu sein,
dadurch gekennzeichnet, dass die angebrachte Schicht (6) über der äußeren Fläche (10) des mindestens einen der Pfosten (5) durch ein erstes Verbindungsstück (11) und ein zweites Verbindungsstück (12), welche voneinander beabstandet sind, vorgesehen ist und dass die angebrachte Schicht (6) dazu angeordnet ist, um parallel zu der äußeren Fläche (10) zu sein und die angebrachte Schicht (6) dazu ausgebildet ist, die gleiche Breite aufzuweisen, wie die der äußeren Fläche (10) des mindestens einen der Pfosten (5), wo die angebrachte Schicht (6) vorgesehen ist, wobei das erste Verbindungsstück (11) und das zweite Verbindungsstück (12) aus dem gleichen Material hergestellt sind und die äußere Fläche (10) des mindestens einen der Pfosten (5) in einen ersten Abschnitt (16), einen zweiten Abschnitt (17) und einen dritten Abschnitt (18) in Reihenfolge entlang des mindestens einen der Pfosten (5) teilen.

2. Kühlregal (1) nach Anspruch 1, wobei die Dickenabmessung (δ) des Luftzwischenraums (7) gemäß folgender Gleichung eingestellt ist:

$$\delta = \frac{\lambda_a A_b + \lambda_b A_a}{A_b A_a} * \left(\frac{T_c - T_f}{\alpha A_c (T_r - T_c)} - R_c \right)$$

wobei δ für die Dickenabmessung des Luftzwischenraums (7) steht; λ_a für den Wärmeleitfähigkeitskoeffizienten von Luft steht; λ_b für den Wärmeleitfähigkeitskoeffizienten des ersten Verbindungsstücks (11) und des zweiten Verbindungsstücks (12) steht; T_c für die Temperatur der äußeren Fläche (10) der angebrachten Schicht (6) steht, die höher sein sollte, als der Taupunkt in der äußeren Umgebung, in welcher sich der Regalkörper-Rahmen (4) befindet; T_f für die Temperatur der äußeren Fläche (10) des Regalkörper-Rahmens (4) mit der darauf vorgesehenen angebrachten Schicht (6) steht; T_r für die Temperatur der Umgebung steht, in welcher sich der Regalkörper-Rahmen (4) befindet; R_c für den Wärmewiderstand der angebrachten Schicht (6) steht; α für die natürliche konvektive Wärmeübertragungsrate von Luft steht; A_c für die Breitenabmessung der angebrachten Schicht (6) steht; A_b für die Summe von jeweiligen Breitenabmessungen A_2 und A_4 des ersten Verbindungsstücks (11) und des zweiten Verbindungsstücks (12) entlang der Querschnittsrichtung des Regalkörper-Rahmens (4) steht, d. h, $A_b = A_2 + A_4$; A_a für die Summe von jeweiligen Abmessungen A_1, A_3 und A_5 des ersten, zweiten und dritten Abschnitts entlang der Querschnittsrichtung des Regalkörper-Rahmens (4) steht; d. h. $A_a = A_1 + A_3 + A_5 = A_c - A_b$.

3. Kühlregal (1) nach Anspruch 2, **dadurch gekennzeichnet, dass** T_c im Bereich von 6 °C - 25 °C vordefiniert ist, T_f im Bereich von 5 °C - 15 °C vordefiniert ist und/oder T_r im Bereich von 15 °C - 30 °C vordefiniert ist.

4. Kühlregal (1) nach Anspruch 3, **dadurch gekennzeichnet, dass** T_c, T_f und T_r als 17 °C, 12 °C bzw. 25 °C vordefiniert sind.

5. Kühlregal (1) nach Anspruch 1, **dadurch gekennzeichnet, dass** die Dickenabmessung des Luftzwischenraums (7) im Bereich von 3 mm bis 10 mm liegt.

6. Kühlregal (1) nach einem der Ansprüche 1-5, **dadurch gekennzeichnet, dass** die Regaltür (3) aus Glas hergestellt ist.

7. Kühlregal (1) nach einem der Ansprüche 1-6, **dadurch gekennzeichnet, dass** das Kühlregal (1) ferner ein tauaufnehmendes Element (8) zum Aufnehmen des Taus umfasst, das auf dem unteren Ende des mindestens einen der Pfosten (5) bereitgestellt ist, der mit der angebrachten Schicht (6) versehen ist.

8. Kühlregal (1) nach Anspruch 7, **dadurch gekennzeichnet, dass** das tauaufnehmende Element (8) in einer Schlitzform oder einer Plattenform konfiguriert ist.

9. Kühlregal (1) nach einem der Ansprüche 1-6, **dadurch gekennzeichnet, dass** das Kühlregal (1) ferner ein elektrisches Heizelement (9) zum Heizen umfasst, das nahe der inneren Fläche des Regalkörper-Rahmens (4) vorgesehen ist.

Revendications

1. Armoire frigorifique (1) comprenant un corps d'armoire (2), au moins une porte d'armoire (3) et un cadre de corps d'armoire (4) monté sur le corps d'armoire (2), l'au moins une porte d'armoire (3) étant montée sur le cadre de corps d'armoire (4), dans laquelle l'armoire frigorifique (1) est une armoire frigorifique verticale (1) et le cadre de corps d'armoire (4) comprend au moins deux montants intermédiaires (5) dont les positions correspondent aux positions des côtés de la porte d'armoire (3) dans un état fermé, le cadre de corps d'armoire (4) comprend une couche fixée (6) constituée d'une matière présentant une faible conductivité thermique et prévue au-dessus d'au moins une partie de la surface extérieure (10) d'au moins un des montants intermédiaires (5), et la couche fixée (6) est agencée de manière à être séparée de la surface extérieure (10) par une lame d'air (7) communiquant avec l'atmosphère,
caractérisée en ce que la couche fixée (6) est prévue au-dessus de la surface extérieure (10) d'au moins un des montants intermédiaires (5) au travers d'un premier connecteur (11) et d'un second connecteur (12) qui sont séparés l'un de l'autre et la couche fixée (6) est agencée de manière à être parallèle à la surface extérieure (10), et la couche fixée (6) est configurée pour avoir une largeur identique à celle de la surface extérieure (10) de l'au moins un des montants intermédiaires (5) où est prévue la couche fixée (6), le premier connecteur (11) et le second connecteur (12) sont constitués de la même matière et divisent la surface extérieure (10) de l'au moins un des montants intermédiaires (5) en une première partie (16), une deuxième partie (17) et une troisième partie (18) dans l'ordre le long de l'au moins un des montants intermédiaires (5).

2. Armoire frigorifique (1) selon la revendication 1, dans laquelle la dimension d'épaisseur (δ) de la lame d'air (7) est établie selon l'équation suivante :

$$\delta = \frac{\lambda_a A_h + \lambda_h A_a}{A_h A_a} * \left(\frac{T_c - T_f}{\alpha A_c (T_r - T_c)} - R_c\right)$$

où δ représente la dimension d'épaisseur de la lame d'air (7) ; λ_a représente le coefficient de conductivité thermique de l'air ; λ_h représente le coefficient de conductivité thermique du premier connecteur (11) et du second connecteur (12) ; T_c représente la température de la surface extérieure (10) de la couche fixée (6), qui doit être supérieure au point de rosée du milieu extérieur où se trouve le cadre de corps d'armoire (4) ; T_f représente la température de la surface extérieure (10) du cadre de corps d'armoire (4) avec la couche fixée (6) prévue sur celui-ci ; T_r représente la température du milieu où se trouve le cadre de corps d'armoire (4) ; R_c représente l'impédance thermique de la couche fixée (6) ; α représente le coefficient de transfert de chaleur de l'air par convection naturelle ; A_c représente la dimension de largeur de la couche fixée (6) ; A_h représente la somme des dimensions de largeur respectives A_2 et A_4 du premier connecteur (11) et du second connecteur (12) le long de la direction de section transversale du cadre de corps d'armoire (4), soit $A_h = A_2 + A_4$; A_a représente la somme des dimensions de largeur respectives A_1, A_3 et A_5 des première, deuxième et troisième parties le long de la direction de section transversale du cadre de corps d'armoire (4), soit $A_a = A_1 + A_3 + A_5 = A_c - A_h$.

3. Armoire frigorifique (1) selon la revendication 2, **caractérisée en ce que** T_c est prédéfinie dans la plage de 6 °C à 25 °C, T_f est prédéfinie dans la plage de 5 °C à 15 °C et/ou T_r est prédéfinie dans la plage de 15 °C à 30 °C.

4. Armoire frigorifique (1) selon la revendication 3, **caractérisée en ce que** T_c, T_f et T_r sont prédéfinies pour être égales à 17 °C, 12 °C et 25 °C respectivement.

5. Armoire frigorifique (1) selon la revendication 1, **caractérisée en ce que** la dimension d'épaisseur de la lame d'air (7) se situe dans la plage de 3 mm à 10 mm.

6. Armoire frigorifique (1) selon l'une quelconque des revendications 1 à 5, **caractérisée en ce que** la porte d'armoire (3) est en verre.

7. Armoire frigorifique (1) selon l'une quelconque des revendications 1 à 6, **caractérisée en ce que** l'armoire frigorifique (1) comprend en outre un organe de réception de rosée (8) pour recevoir la rosée, qui est prévu à l'extrémité inférieure de l'au moins un des montants intermédiaires (5) pourvu de la couche fixée (6).

8. Armoire frigorifique (1) selon la revendication 7, **caractérisée en ce que** l'organe de réception de rosée (8) est configuré sous forme de fente ou sous forme de plaque.

9. Armoire frigorifique (1) selon l'une quelconque des revendications 1 à 6, **caractérisée en ce que** l'armoire frigorifique (1) comprend en outre un élément de chauffage électrique (9) pour chauffage, qui est prévu à proximité de la surface intérieure du cadre de corps d'armoire (4).

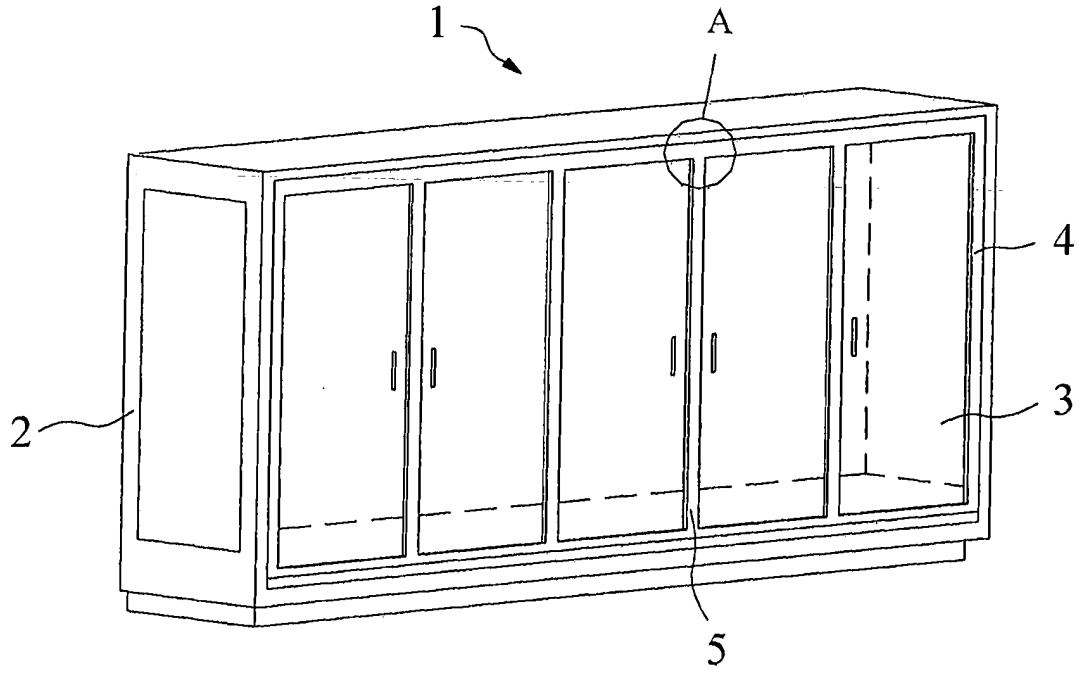


Fig. 1

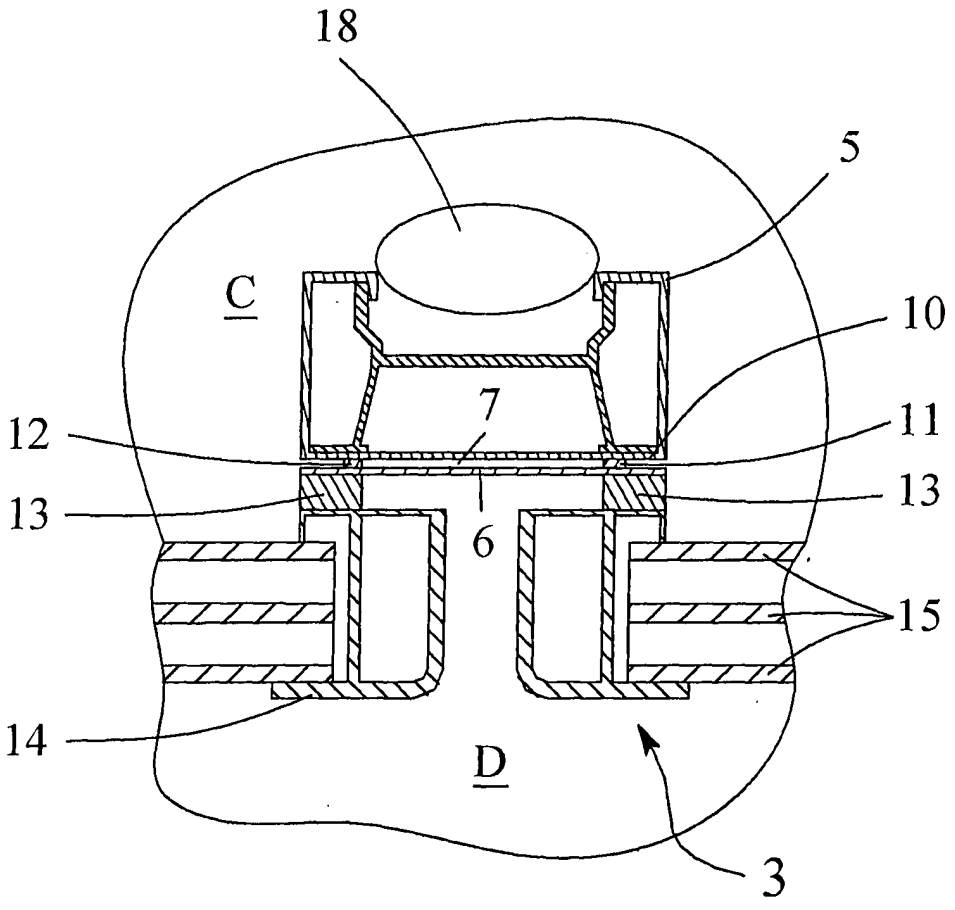


Fig. 2

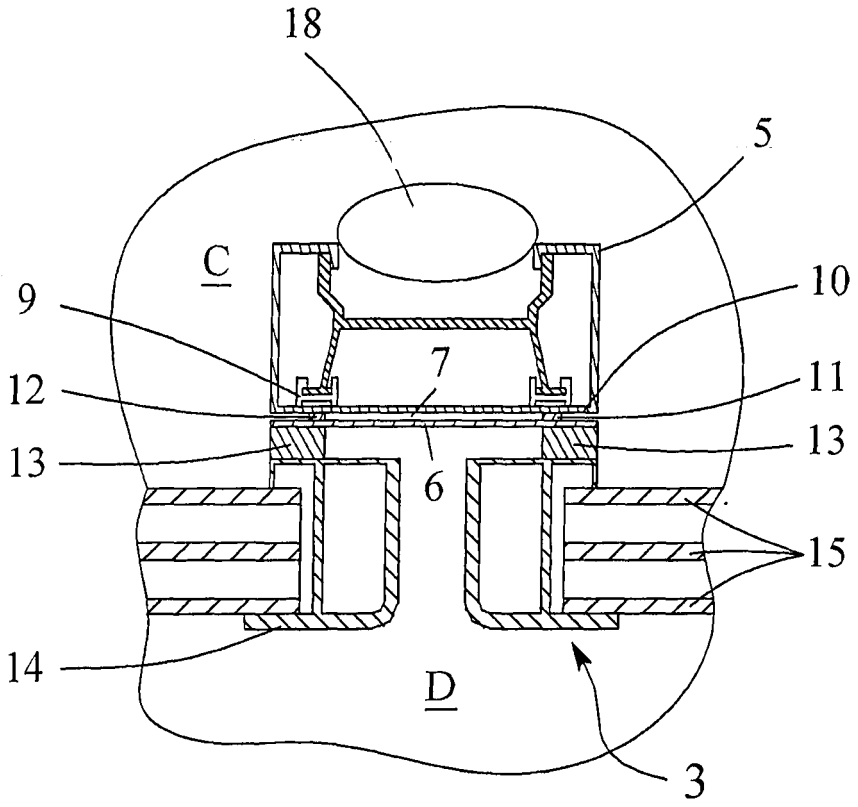


Fig. 3

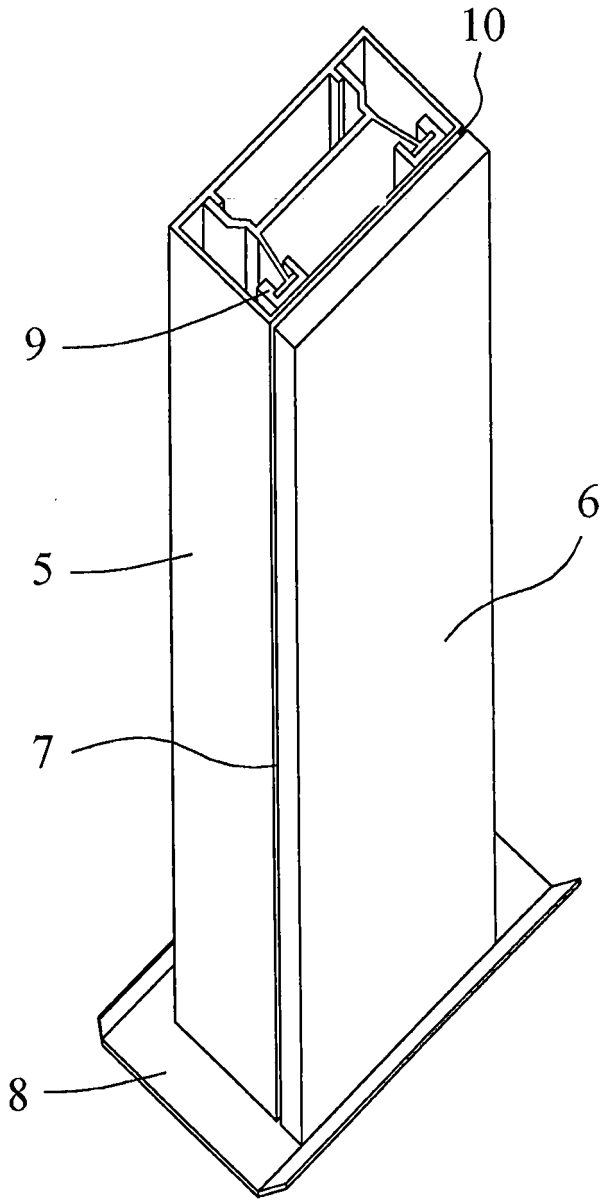


Fig. 4

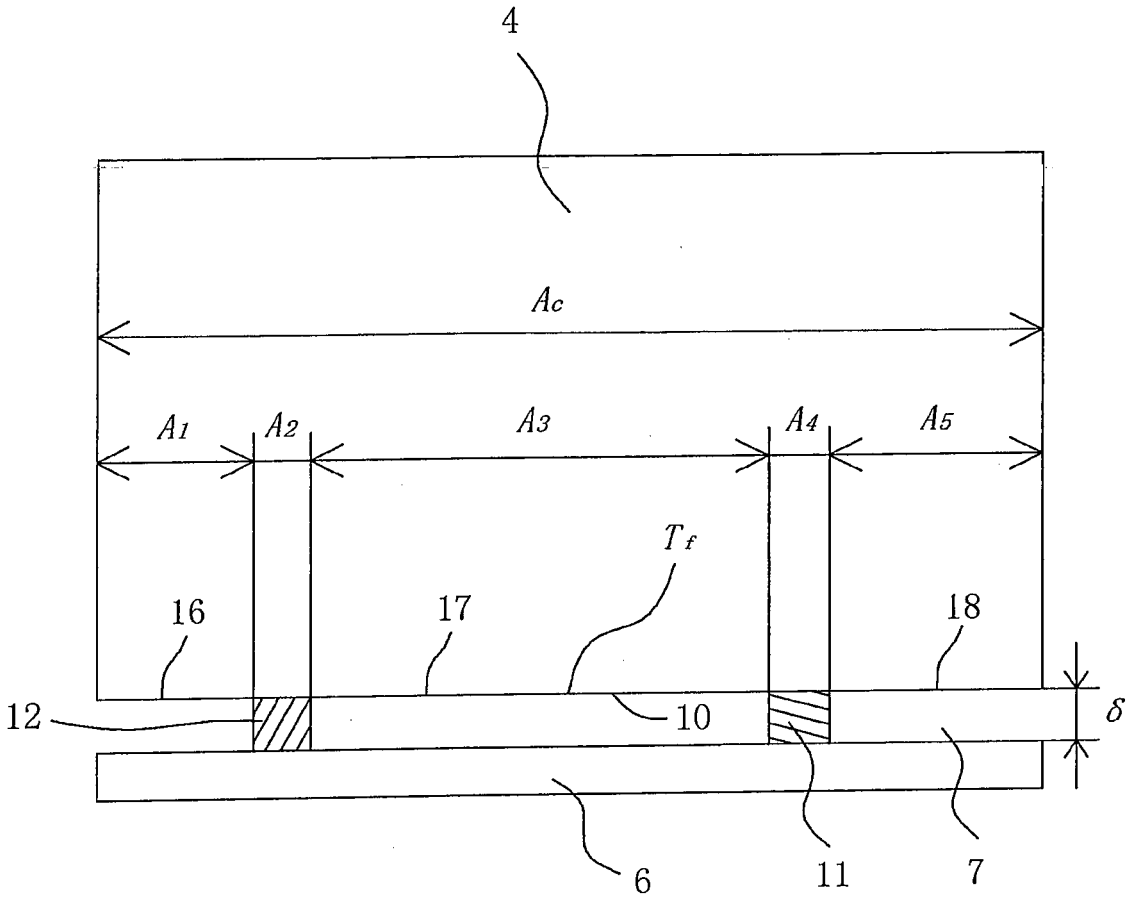


Fig. 5

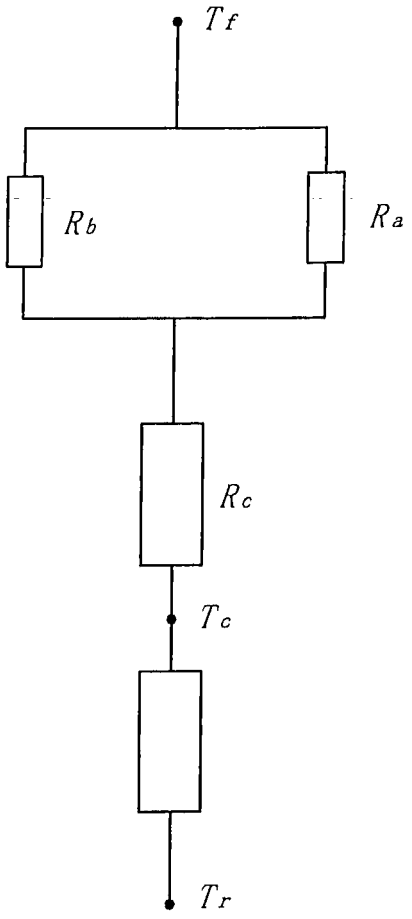


Fig. 6

REFERENCES CITED IN THE DESCRIPTION

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