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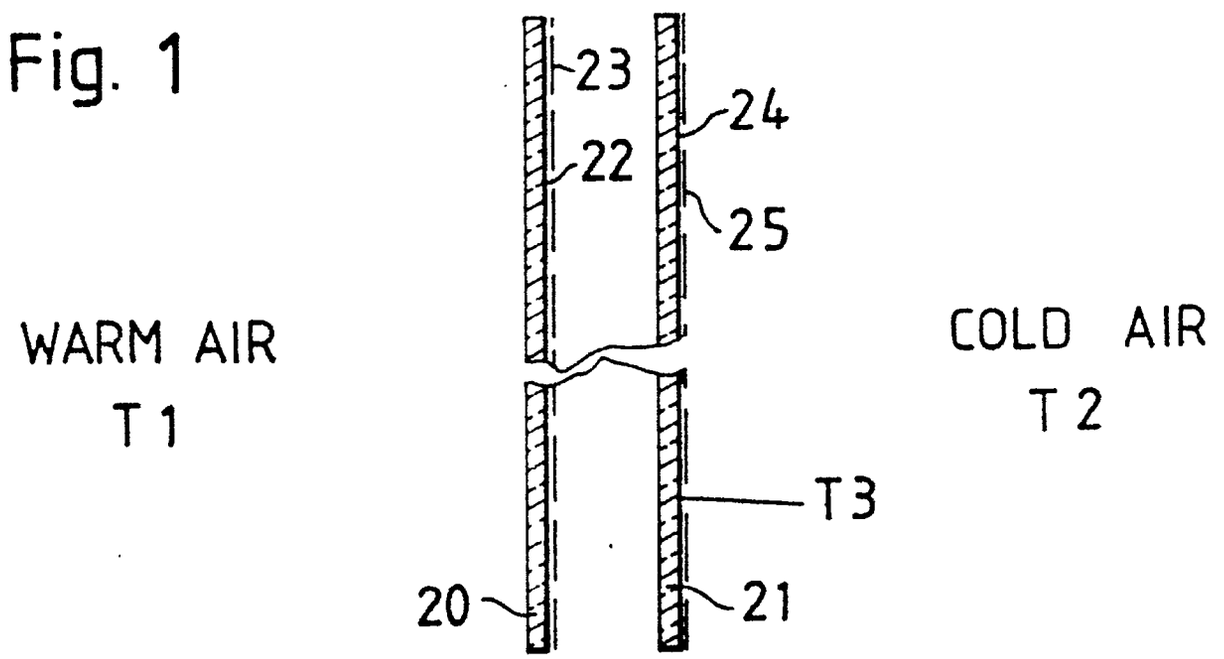
(54) A door construction suitable for refrigerator and freezer spaces.

(57) A door structure suitable for use with refrigerator and freezer spaces of the kind used in everyday commodity stores to display goods on sale, comprises two or more glass panes (20, 21) which together with a frame embracing the edges of the glass panes (20, 21), either completely or partially, form a door leaf. The glass pane (20) which faces towards the warm atmosphere of a shop area is provided on the surface (22) thereof facing away from the shop area with an electrically conductive coating (23), which is operative to heat the pane electrically. The invention is characterized in that the door comprises solely two mutually parallel glass panes (20, 21) of which the glass pane (21) facing towards the colder refrigerator or freezer space is provided solely on the surface (24) thereof which faces towards the colder space with an infrared radiation reflective coating or layer (25).

Fig. 1



EP 0 406 200 A1

A DOOR CONSTRUCTION SUITABLE FOR REFRIGERATOR AND FREEZER SPACES

The present invention relates to a door structure suitable for use with refrigerator and freezer spaces, or chambers, of the kind used, inter alia, in every day commodity food stores to display perishable goods.

Such door structures include two or more glass sheets which, together with a frame embracing the edges of the glass sheets, form a door leaf. The goods are visible through the door, which can opened to allow a customer to take either a refrigerated or frozen article from the display, as the case may be.

When the door is closed, the door surface which faces towards the colder storage space will have a lower temperature than the door surfaces which faces towards the warmer shop area.

One problem with doors of this kind is that the outer door surface i.e. the door surface which faces the warm and humid store air, is cooled to a lower temperature than ambient temperature, such that the surface becomes fogged by condensation of moisture contained in the shop air onto said surface. Naturally, such fogging will obscure the view through the door. Another problem is that when the door is opened, moisture in the store air will condense on the inner surface of the door, i.e. the surface which normally faces towards the colder refrigerator or freezer space.

The first of these problems has been solved, by using a door in the form of a sealed glazing unit, containing two or three panes of glass, wherein the outer pane on the rear side of the unit is provided with an electrically conductive coating, which heats the pane electrically. The sealed glazing units used in such door structures normally comprise three glass panes.

The use of a sealed glazing structure of high thermal insulating ability, however results in a high temperature gradient across the door, which means that, in use, the temperature of the inner door surface will be very low. This results in fogging of said surface when the door is opened, e.g. by a customer, and in some cases on moisture freezing solid on said surface. Subsequent to reclosing the door, this moisture or frost will disappear in time, due to the low dew point prevailing in the refrigerator or freezer space, as the case may be. Because such refrigerator or freezer spaces are equipped with forced convection coolers the mist and frost will disappear relatively quickly, as opposed to the case when no forced convection is found.

However, the time normally taken for such mist or frost to disappear completely is of relatively long duration. The problem resides in the inability of the mist to disappear quickly enough, before the door is again opened by the next customer, which results in further fogging of the door surfaces, and so on. These circumstances can, in some cases, result in the build-up of frost or ice on the inner surface of the door. In many instances, the transparency of the door is greatly impaired or lost completely as a result of such fogging and frosting of the door surface, which seriously detracts from the effectiveness of the display.

Since the decisive factor as to whether or not the door is kept free from mist formation on its glass surface is the time lapsed between successive opening of the door, it is important to endeavour to reduce the time taken to dispel the mist formed on the glass surfaces as a result of opening the door.

The present invention provides a door structure with which the time taken to clear the inner surface of the door, i.e. the time taken for mist or frost to disappear, is greatly reduced. Thus, the invention will enable the goods on display to be seen clearly.

Accordingly, the present invention relates to a door structure suitable for use with refrigerator and freezer spaces or chambers of the kind used in stores to display everyday commodity products, said door structure including two or more glass panes which together with a frame which embraces the edges of the glass panes, either completely or partially, forms a door leaf and in which door structure the glass pane which faces towards the warm atmosphere of a shop area is provided on the surface thereof remote from said shop area with an electrically conductive coating or layer for heating the glass pane electrically. The inventive door structure is characterized in that it comprises only two mutually parallel glass panes, of which the glass pane facing towards the colder refrigerator or freezer space is provided with an infrared radiation reflecting coating on solely the surface thereof facing towards the colder space.

The invention will now be described in more detail with reference to an exemplifying embodiment thereof illustrated in the accompanying drawing and also with reference to comparison doors constructed in accordance with known techniques, in which drawing

- Figure 1 illustrates an embodiment according to the present invention
- Figure 2 illustrates a first embodiment according to known techniques
- Figure 3 illustrates a second embodiment according to known techniques.

Figures 1-3 are schematic sectional views of a glass door constructed in accordance with the invention. The words "warm air" found on the draw-

ing refer to the air present in the shopping locality or like area. The words "cold air" relate to the air present in the refrigerator or freezer space. The reference signs "T1" and "T2" refer to the temperature of the warm air and the temperature of the cold air respectively.

Figure 2 illustrates schematically a door structure of conventional design, in which the door comprises three mutually parallel glass panes 1, 2, 3, of which the surface 4 of the outer pane facing away from the warm space is provided with an electrically conductive coating 5 which is operative to heat the pane 1. The electrically conductive coating, or layer, is shown in broken lines.

A door of this construction will constitute an effective insulation between the shop locality and the refrigerator or freezer chamber. One drawback with a door of this construction, however, is that the effective insulation afforded by the door will cause the temperature of the inner surface 10 of the inner pane 3 to be so low as to result in fogging and frosting of the surface, as mentioned in the introduction. Practical trials have shown that when the warm air has a temperature T1 of +25° C and the cold air has a temperature T2 of -23° C, the inner surface of the inner glass pane will have a temperature of -19° C. Obviously, when this door is opened and said surface is exposed to the warm, humid shop air, mist will rapidly form on the inner pane 3. Because the temperature of the glass pane 3 is as low as -19° C, it will take considerable time, approximately 75 seconds, for the mist to disappear after closing the door.

In these trials, the doors were held open for about 6-8 seconds, which corresponds to the normal time a door is held open when a customer removes goods from the refrigerator or freezer space.

Figure 3 illustrates another known door construction, in which the door comprises two glass panes 6, 7. In this known door construction, the surface of the outer glass pane 6 facing away from the warm shop space is provided with an electrically conductive coating or layer 8 of said kind. Furthermore, the surface of the inner glass pane 7 facing away from the colder space is provided with a coating 9 which reflects infrared radiation.

In the case of this door construction, the infrared reflective coating 9 prevents radiation incident on the door from the shop locality from passing into the refrigerator or freezer space, this radiation being reflected back to the shop locality. Consequently, a large part of the infrared light is absorbed by the glass pane 6, as distinct from the case when no infrared reflective coating is provided. In turn, this means that the outer glass pane 6 will be warmer than in the case when no infrared reflective coating is provided.

Because of the inferior insulation afforded by a double glazing unit as compared with a triple glazing unit, i.e. insulation against the penetration of heat from the store locality, the temperature of the inside 11 of the inner pane 7 will be slightly higher, namely -18° C, compared with a door constructed in accordance with Figure 2, with all other conditions being equal.

It will be understood that the fact of whether the inner surface of the glass pane has a temperature of -18° C or -19° C has no significant importance. In the case of a door constructed in accordance with Figure 3, it will take about 70 seconds before the door is again free from fogging, after opening and closing the door. The corresponding time period for a door constructed in accordance with Figure 2 is about 75 seconds, as beforementioned.

The door constructed in accordance with the present invention comprises only two mutually parallel glass panes 20, 21. The surface 22 of the glass pane 20 facing towards the warm atmosphere of the shop locality is provided with an electrically conductive coating or layer 23, operative to heat the pane electrically. The glass pane 21 facing towards the colder refrigerator or freezer space is provided solely on the surface 24 thereof facing towards said colder space with an infrared radiation reflective coating or layer 25. Such an infrared reflective coating has a relatively low emissivity factor, which may be as low as 0.2 for instance.

According to one preferred embodiment of the invention, the infrared reflective coating has an emissivity factor beneath 0.2, preferably 0.12 or lower.

The effect of the invention is that at the aforesaid temperatures T1 and T2, the inner surface 24 of the inner glass pane will have a temperature T5 of -15° C, which means that mist forming on the door will have disappeared within a time lapse of about 35 seconds from the moment of closing the door, which is approximately half the time taken with doors of known construction.

This effect is based on the understanding that the low emissivity factor of the infrared coating will cause the radiation exchange between the inner surface 24 of the inner pane and the interior of the refrigerator or freezer space and the goods present therein to be much lower than in the case of the door construction according to Figure 3, since in this latter case the inner surface 11 of the inner glass pane 7 has an emissivity factor of about 0.9. In the case of the aforementioned experiments, the infrared reflective coating had an emissivity factor of 0.12. Heating of the inner glass pane is also assisted to a minor extent by the infrared radiation from the locality incident on the inner glass pane.

It will therefore be obvious that when the in-

frared reflective coating is applied to the inner surface of the inner glass pane, i.e. in accordance with the invention, instead of on the outer surface of the inner glass pane, in accordance with Figure 3, the time taken for the glass to clear will be shortened from about 70 seconds to about 35 seconds, when all other conditions are equal.

The invention has been described in the aforegoing with reference to one embodiment thereof. It will be understood, however, that the infrared reflective coating may have an emissivity factor still lower than 0.12, to advantage. A lower emissivity factor will result in an even warmer inside surface of the inner glass pane.

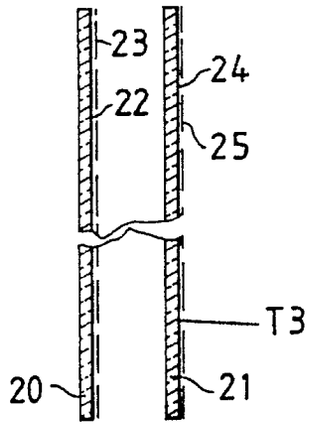
The present invention shall not be considered to be restricted to the afore-described embodiments, since modifications can be made within the scope of the following claims.

Claims

1. A door structure suitable for use with refrigerator and freezer spaces of the kind normally used in everyday commodity stores to display goods on sale, said door structure comprising two or more glass panes which together with a frame which embraces the edges of the glass panes, either completely or partially, form a door leaf, in which the glass pane facing towards the warm atmosphere of a shop area is provided on the surface thereof remote from said shop area with an electrically conductive coating effective to heat the glass pane electrically, characterized in that the door comprises solely two mutually parallel glass panes (20,21) of which the glass pane (21) facing towards the colder refrigerator or freezer space is provided solely on the surface (24) thereof facing towards said colder space with an infrared radiation reflective coating (25).

2. A door structure according to Claim 1, characterized in that said infrared reflective coating (25) has an emissivity factor beneath 0.2, preferably 0.12 or lower.

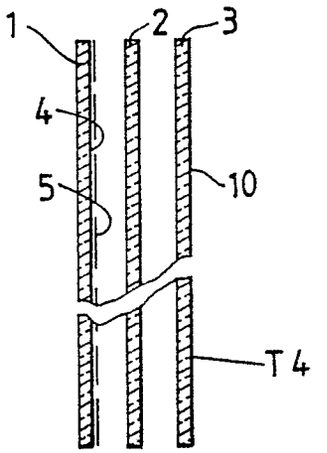
Fig. 1



WARM AIR
T 1

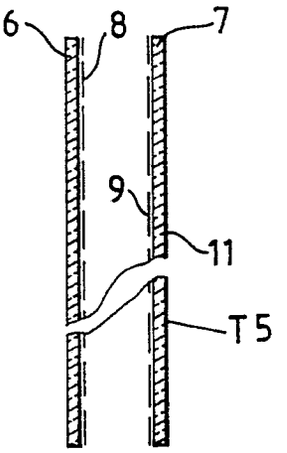
COLD AIR
T 2

Fig. 2



PRIOR ART

Fig. 3



PRIOR ART

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EUROPEAN SEARCH REPORT

Application Number

EP 90 85 0246

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X	US-A-4 035 608 (STROMQUIST) * Column 2, line 61 - column 4, line 46; figures 1,2 *	1	A 47 F 3/04
Y		2	
Y	EP-A-0 236 286 (TERMOFROST) * Column 3, line 7 - column 6, line 35; figures 1-4 *	2	
A		1	
X	US-A-4 206 615 (SOBAJIMA) * Column 4, line 17 - column 14, line 40; figure 2-A' *	1	
A	GB-A-2 199 360 (FLACHGLAS) * Page 10, line 4 - page 11, line 21; figure *	1,2	
A	US-A-4 382 177 (HEANEY) * Column 5, line 44 - column 9, line 35; figures 1-10 *	1,2	
A	GB-A-1 364 712 (PPG INDUSTRIES) * Page 3, lines 34-126; figures 1-5 *		TECHNICAL FIELDS SEARCHED (Int. Cl.5) A 47 F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	27-09-1990	BOETS A.F.J.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

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