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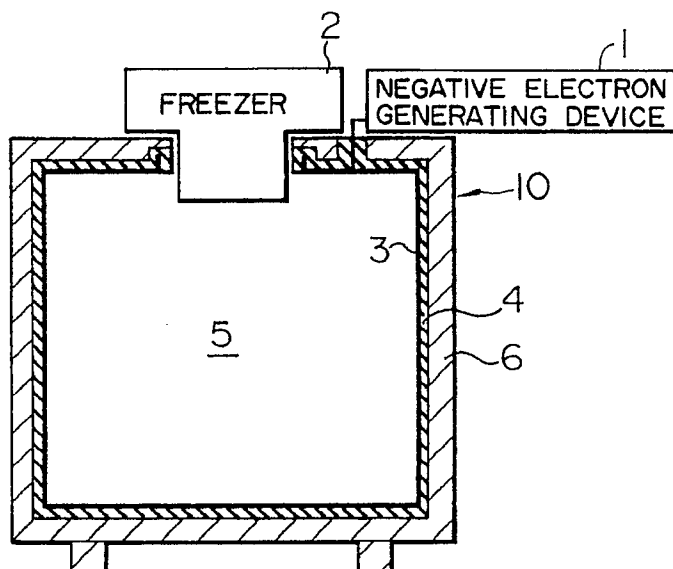
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(54) **An apparatus preventing frost from being formed.**

(57) An apparatus for preventing frost from being formed comprises an electric conductive material lining (3) lined on an inner surface of a wall (6) of a freezing equipment (10) such as a refrigerator and a freezer through an electrical insulating layer (4) and a device (1) for charging negative electrons on said electric conductive material lining (3). In another embodiment, the apparatus comprises a device (13) for electrically insulating a cooling portion (15) of a freezer (2) from a body portion (12) of said freezer and a device (1) for charging negative electrons on said electrically insulated cooling portion (15).

**FIG. 1**



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## Background of the Invention

The present invention relates to an apparatus for preventing frost from being formed on an inner surface of a freezer and on a surface of a cooling portion of a freezing machine.

5 In the conventional freezing equipment such as refrigerator, freezer and freezing machine, when frost is formed on an inner surface of a wall of the refrigerator or the freezer or on a cooling portion of the freezing machine, in order to remove the frost, there have been used a method in which the cooling operation is stopped and a rise in temperature of the inner surface of the wall or the cooling portion is waited to thereby melt and remove the frost, a method in which the frost is melted and removed by making hot gas flow in  
10 the cooling portion. These methods are all defrosting after the frost from being formed. Hitherto, no apparatus for preventing the frost from being formed has been put into practice.

In the conventional defrosting, as explained above, it is waited that the frost is melted due to natural rise in temperature of the frosted portion or the temperature of the frosted portion is forcibly raised. Therefore, there is an energy loss and complex mechanisms to suitably raise the temperature are needed. Further,  
15 accompanying with the rise in temperature of the frosted portion, a rise in temperature of the refrigerated or frozen articles cannot be avoided, so that the defrosting becomes a cause of deterioration in the quality of the articles.

An object of the present invention is to provide an apparatus for preventing the frost from being formed on an inner surface of a wall of a refrigerator or a freezer or a cooling portion of a freezing machine without  
20 raising temperature in the freezing equipment such as the refrigerator, the freezer and the cooling portion of the freezing machine, in other words, without resulting the deterioration in the quality of the refrigerated or frozen articles and any energy loss.

## Summary of the Invention

25 In order to attain the above object, an apparatus for preventing frost from being formed according to the invention is characterized in that an electrical conductive member is lined through an electric insulating material layer on an inner surface of a wall of a freezing equipment such as a refrigerator or a freezer and negative electrons are charged on said electrical conductive member.

30 In another embodiment, a frost preventing apparatus is characterized in that a cooling portion of a freezing machine is electrically insulated from a body portion of a freezing machine and negative electrons are charged on the insulated cooling portion.

When the negative electrons are charged on the electric conductive lining or the cooling portion, any frost is not formed thereon by an action of the negative electrons.

35 According to the invention, it is prevented that the frost is formed on an inner surface of a wall of the refrigerator and the freezer or a cooling portion of the freezing machine. Accordingly, there is no need to raise the temperature in the refrigerator or freezer in order to remove the frost and thereby it is avoided to result the deterioration in the quality of the refrigerated or frozen articles. Further, as there is no energy loss to remove the frost, it is possible to reduce the running cost of the refrigerator, the freezer and the like.  
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## Brief Description of the Drawings

Fig. 1 is a vertical cross sectional view of a refrigerator to which an apparatus for preventing frost from being formed according to the invention is applied; Fig. 2 is a vertical sectional view of a refrigerator  
45 including a freezing machine to which an apparatus for preventing frost from being formed according to the invention is applied.

## Detailed Description of the Preferred Embodiments

50 With reference to the accompanying drawings, an apparatus for preventing frost from being formed according to the invention is explained.

Fig. 1 shows an embodiment in which an apparatus for preventing frost from being formed according to the invention is applied to a refrigerator 10. An electric insulating material 4 is adhered on an inner surface of a wall 6 of the refrigerator 10. On a surface of the electric insulating material 4, an electric conductive  
55 member 3 is lined so as to surround an interior 5 of the refrigerator 10. A freezing machine 2 is mounted on the wall 6 at a top portion thereof and the freezing machine 2 makes cooled air flow down in the interior 5 of the refrigerator 10. A negative electron generating device 1 is provided on an exterior of the wall 6. The negative electron generating device 1 utilizes a high voltage electrostatic transformer and an alternating

current 100 V is impressed on a primary side of the transformer and one pole of a secondary side thereof of high voltage is insulated and only the other one pole is connected with the electric conductive member 3. Thus, negative electrons due to the electric induction are charged on the electric conductive material 3. It has been found that with respect to the value of the electric current on the primary side of the high voltage electrostatic transformer, 0.02 A ~ 0.3 A per 1 m<sup>2</sup> of an electrode is optimum.

Fig. 2 shows an embodiment in which an apparatus for preventing frost from being formed according to the invention is applied to a freezing machine. The freezing machine 2 mounted on the upper portion of the refrigerator 11 comprises a body portion 12 including a compressor, a condenser, an expansion valve and the like provided at the exterior of the refrigerator 11 and a cooling portion (an evaporator) 14 with heat dissipating fins 15 provided at the interior of the refrigerator 11. The cooling portion 14 is made of an electric conductive metal tube and is connected with the body portion 12 of the freezing machine through electric insulating joints 13 so that it is electrically insulated from the body portion 12. A negative electron generating device 1 is provided at the exterior of the wall 6. In the same way as the explained embodiment, an alternating current of 100 V is impressed on the primary side and one pole of the secondary side of high voltage is electrically insulated and only the other pole is connected with the cooling portion 14. Thus, negative electrons are charged on the cooling portion 14.

A result of comparative tests between the refrigerator and the freezer to which the apparatus for preventing frost from being formed according to the invention is applied and the conventional ones will be shown hereinafter (1) ~ (4).

(1) Temperature in refrigerator -3 °C;  
Temperature of the ambient air 10 °C;  
Humidity 50 %

Past Time	12 hrs.	24 hrs.	a week	a month
Frost Condition				
invention	NO	NO	NO	NO
prior art	NO	NO	thin frost	heavy frost

(2) Temperature in refrigerator -3 °C;  
Temperature of the ambient air 10 °C;  
Humidity 70 %

Past Time	12 hrs.	24 hrs.	a week	a month
Frost Condition				
invention	NO	NO	NO	NO
prior art	NO	thin frost	some frost	heavy frost

(3) Temperature in refrigerator -25 °C;  
Temperature of the ambient air 10 °C;  
Humidity 50 %

Past Time	12 hrs.	24 hrs.	a week	a month
Frost Condition				
invention	NO	NO	NO	NO
prior art	thin frost	thin frost	some frost	heavy frost

(4) Temperature in refrigerator -25 °C;  
 Temperature of the ambient air 20 °C;  
 Humidity 70 %

Past Time	12 hrs.	24 hrs.	a week	a month
Frost Condition				
invention	NO	NO	NO	NO
prior art	thin frost	some frost	heavy frost	heavy frost

A result of comparative tests between the freezing machine to which the apparatus for preventing frost from being formed according to the invention is applied and the conventional ones will be shown hereinafter.

(5) Temperature in refrigerator -3 °C;

Past Time	12 hrs.	24 hrs.	a week	a month
Frost Condition				
invention	NO	NO	NO	NO
prior art	NO	thin frost	heavy frost	non operative

(6) Temperature in refrigerator -10 °C;

	Past Time	12 hrs.	24 hrs.	a week	a month
5	Frost Condition				
	invention	NO	NO	NO	NO
10	prior art	thin frost	heavy frost	non operative	non operative

(7) Temperature in refrigerator -25 ° C;

	Past Time	12 hrs.	24 hrs.	a week	a month
15	Frost Condition				
20	invention	NO	NO	NO	NO
	prior art	heavy frost	non operative	non operative	non operative

(8) Temperature in refrigerator -40 ° C;

	Past Time	12 hrs.	24 hrs.	a week	a month
30	Frost Condition				
35	invention	NO	NO	NO	NO
	prior art	heavy frost	non operative	non operative	non operative

As easily understood from the comparative tests shown hereinbefore, the frost forming preventing apparatus according to the invention has a remarkable effect to prevent the forming of the frost.

#### Claims

1. An apparatus for preventing frost from being formed characterized in that an electric conductive material (3) is lined on an inner surface of a wall (6) of a freezing equipment (10) such as a refrigerator and a freezer through an electric insulating material (4) and negative electrons are charged on said electric conductive material lining (3).
2. An apparatus for preventing frost from being formed characterized in that a cooling portion (15) of a freezing machine (2) is electrically insulated from a body portion (12) of said freezing machine (2) and negative electrons are charged on said insulated cooling portion (15).

FIG. 1

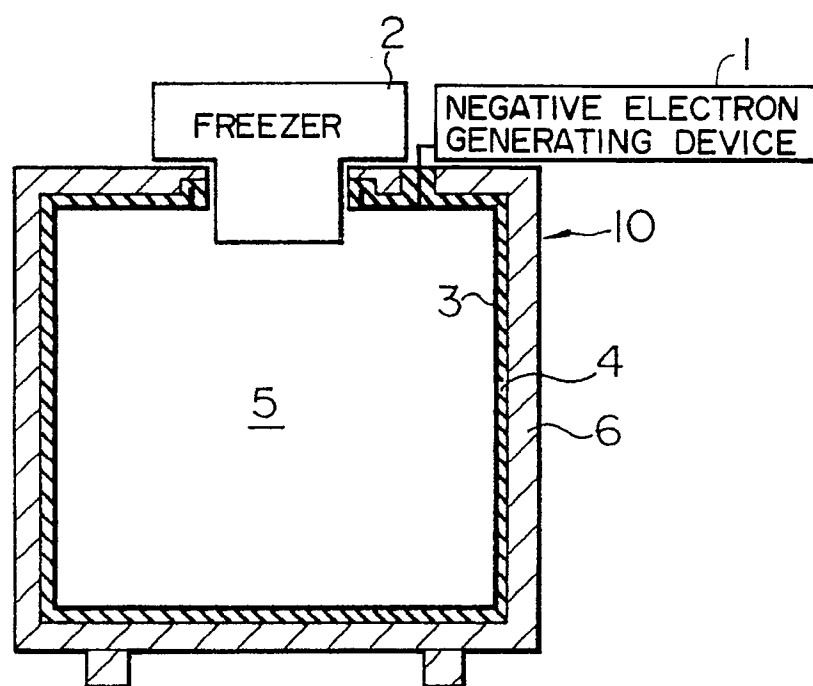


FIG. 2

