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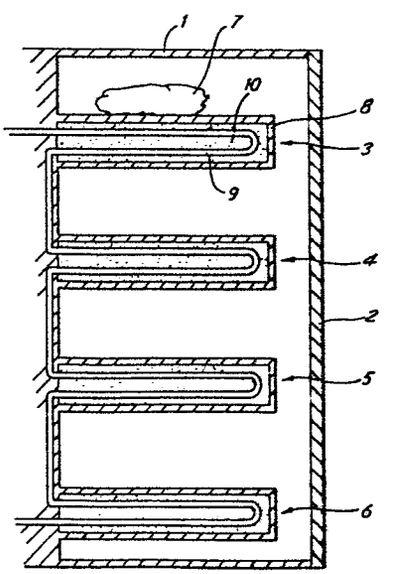
(54) Improvements in or relating to freezers.

(57) A freezer, having an outer housing (1) and a door (2), contains a number of shelves (3 to 6) upon which frozen food (7) is stored.

Each shelf comprises a casing (8) filled with brine solution (10) having an eutectic temperature a few degrees lower than the desired operating temperature of the freezer. An evaporator coil (9), forming part of a refrigeration system, including a compressor, of the freezer, is immersed in the brine solution (10) in each casing.

During the night storage period, the compressor is run on cheap rate electricity and the brine solution (10) gives up heat energy, thereby undergoing a phase change.

During the daytime, the compressor is stopped and the brine solution (10) slowly absorbs heat energy from within the freezer, thereby slowly undergoing a reverse phase change and maintaining a substantially constant desired operating temperature of the freezer.



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IMPROVEMENTS IN OR RELATING TO FREEZERS

This invention relates to freezers.

In conventional freezers, the interior temperature tends to vary, thus necessitating frequent control by switching the compressor on and off to maintain the desired operating temperature within the freezer.

The running of a freezer can therefore prove to be rather expensive, as the starting and stopping of the compressor at frequent intervals requires a substantial amount of energy.

It is therefore an object of the present invention to provide a cold store which operates substantially at a specific temperature and thereby to reduce the frequency of operation of the compressor, thus achieving an energy saving.

It is a further object of the invention to so proportion the cold store that it becomes possible to operate the compressor substantially only during a night storage period on a cheap rate of electricity, in particular "Economy 7", and to maintain substantially the desired temperature within the freezer during the remaining time period.

According to one aspect of the present invention there is provided a freezer characterised in that it incorporates a cold store having an eutectic temperature less than a desired operating temperature of the freezer.

According to another aspect of the invention there is provided a freezer as set forth in the immediately preceding paragraph wherein the cold store has an evaporator coil of a refrigeration system of the freezer contained therein, thereby

substantially limiting the lowest operating temperature of the evaporator to the temperature of the cold store.

Incorporating the evaporator coil within the cold store can therefore substantially improve refrigeration efficiency.

Moreover, as a consequence of night-time operation of the compressor, ambient temperatures are likely to be lower than during the day-time, which consequently lowers the condensing temperature of the refrigeration system, thereby further improving refrigeration efficiency.

In a preferred embodiment, the cold store comprises a brine solution, having an appropriate eutectic temperature, which gives up heat energy and thus undergoes a phase change, during the operation of the compressor, and which slowly absorbs heat energy from within the freezer and thus undergoes a reverse phase change, when the compressor is not in operation.

The invention will now be further described by way of example only with reference to the accompanying drawing, the single figure of which shows a schematic sectional view of the food storage compartment of a freezer incorporating the present invention.

Referring to the figure, an upright freezer, having an outer housing 1 and a door 2, contains a number of shelves, labelled 3 to 6 respectively, upon which items of frozen food, such as that shown at 7, are stored.

Each shelf comprises a casing 8, which is filled with a brine solution 10 having an eutectic temperature a few degrees lower than the desired operating temperature of the freezer, the brine solution 10 also having an evaporator coil 9 immersed therein.

The respective evaporator coils in each shelf are connected in series and form part of a refrigeration system of known construction including a compressor (not shown in the diagram), which is situated to the rear of the food storage compartment of the freezer.

During the night storage period of approximately seven

hours duration, the compressor is run (to the extent necessary) on a cheap rate of electricity, such as "Economy 7," so that, due to the evaporator coils being immersed within the brine solution, heat energy is transferred from the brine solution, which thus undergoes a phase change, into the evaporator coils, thus providing a cold store within each shelf.

At the end of the night storage period, operation of the compressor is stopped, and it should not be required to run again until the following night storage period.

During the daytime, the brine solution then slowly absorbs heat energy from within the freezer, so that the solution undergoes a reverse phase change over a substantial length of time, thus maintaining a substantially constant desired operating temperature within the freezer.

However, the brine solution may be substantially greater in volume in one phase than the other, so that, to accommodate for the volume increase, it may be necessary to provide an air gap between the surface of the solution within the casing 8 and the upper surface of the casing.

If such a gap is to be provided, it may also prove necessary to provide means for ensuring good thermal contact between the upper surface of the casing, upon which the food items are placed, and the solution. These means may comprise, for example, protuberances extending down from the upper surface of the casing into the solution.

It can clearly be seen that this arrangement in accordance with the present invention should provide a substantial energy saving, as the compressor is only run during a period of cheap rate of electricity, and thus this substantially lowers the running cost of a freezer of this kind, as well as providing improved refrigeration efficiency due to lower night-time ambient temperatures, which reduce the temperature difference between the evaporator and condensor of the refrigeration system.

Alternative embodiments incorporating the present invention may, of course be envisaged, such as the use of sachets

containing a brine solution, which may be deposited in various positions within the freezer.

Alternative solutions may also be utilised, as long as they have eutectic temperatures less than the desired operating temperature of the freezer.

It will be appreciated that the present invention could be incorporated within a chest freezer, as well as an upright freezer as in the preferred embodiment. However, due to the distribution of food in a chest freezer, it may be necessary to use a combination of both cold store sachets and shelves to ensure that a substantially constant desired temperature is maintained within the whole volume of the freezer.

CLAIMS

1. A freezer characterised in that it incorporates a cold store having an eutectic temperature less than a desired operating temperature of the freezer.

2. A freezer as claimed in Claim 2 wherein the cold store has an evaporator coil of a refrigeration system of the freezer contained therein, thereby substantially limiting the lowest operating temperature of the evaporator to the temperature of the cold store.

3. A freezer as claimed in Claim 1 or 2 wherein the cold store comprises a brine solution, having an appropriate eutectic temperature, which gives up heat energy, thereby undergoing a phase change, during operation of a compressor of a refrigeration system of the freezer, and which absorbs heat energy from within the freezer over a substantial period of time, thereby undergoing a reverse phase change, when the compressor is not in operation.

4. A freezer as claimed in Claim 3 including at least one shelf comprising a casing, said casing being filled with said brine solution.

5. A freezer as claimed in Claim 4 wherein said brine solution in said casing of said at least one shelf has an evaporator coil of a refrigeration system of the freezer immersed therein.

6. A freezer as claimed in Claim 5 wherein each evaporator coil immersed in the brine solution of the casing of each shelf is connected in series in said refrigeration system.

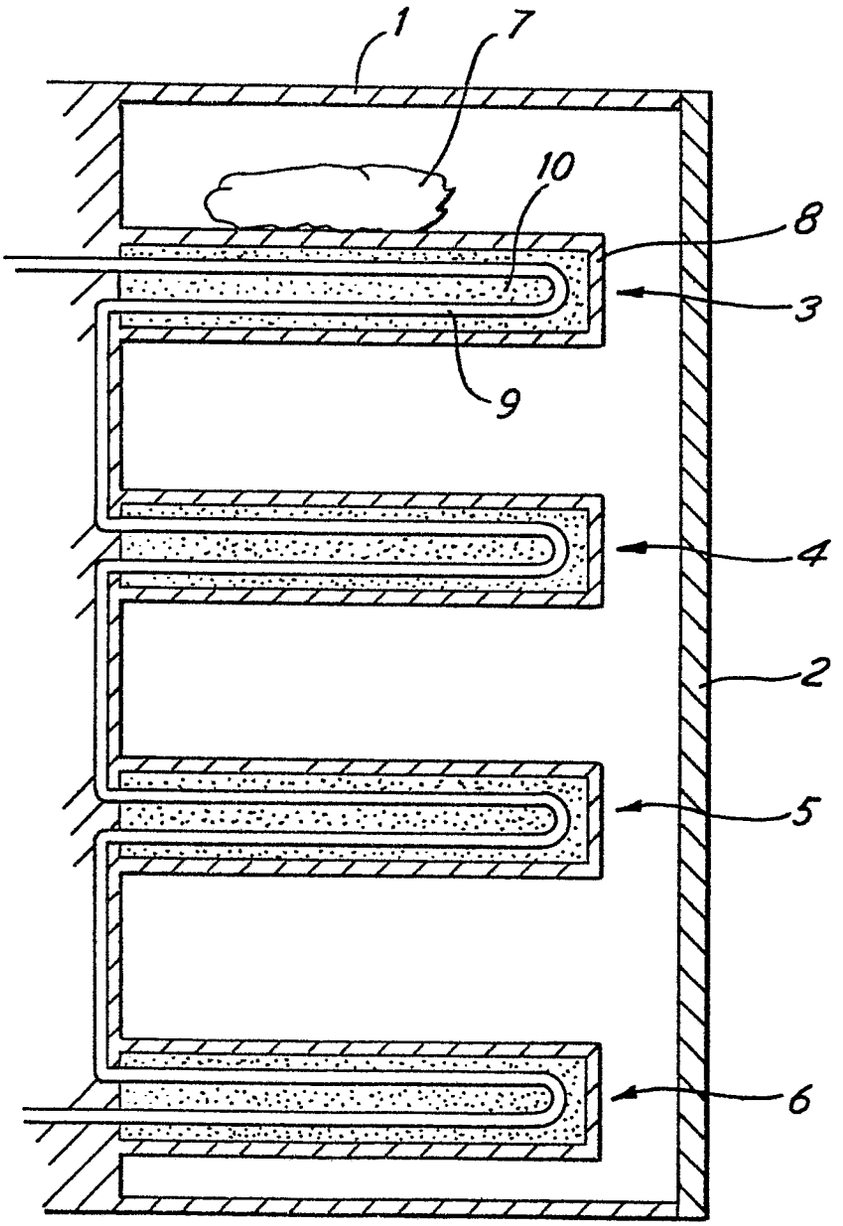
7. A freezer as claimed in Claim 4, 5 or 6 wherein an air gap is provided between the surface of said brine solution in said casing and an upper surface of said casing.

8. A freezer as claimed in Claim 7 wherein means are provided in said casing to ensure substantially good thermal contact between said upper surface and said brine solution.

9. A freezer as claimed in Claim 8 wherein said means

comprises protuberances extending in a generally downward direction from said upper surface and into said brine solution.

10. A freezer as claimed in Claim 1, 2 or 3 wherein said cold store comprises at least one sachet containing brine solution, said at least one sachet being deposited within the freezer.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