United States Patent [19]

Masuda

[11] **3,772,897**

[45] **Nov. 20, 1973**

[54] **DEFROSTER FOR A REFRIGERATING SYSTEM**

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[73] Assignee: **Sakura Refrigerating & Heating Engineering Co., Ltd.**, Tokyo, Japan

[22] Filed: **Sept. 13, 1972**

[21] Appl. No.: **288,666**

[30] **Foreign Application Priority Data**

Mar. 21, 1972 Japan 47/27494

[52] **U.S. Cl.** **62/282**, 62/82

[51] **Int. Cl.** **F25d 21/10**

[58] **Field of Search** 62/82, 282

[56] **References Cited**

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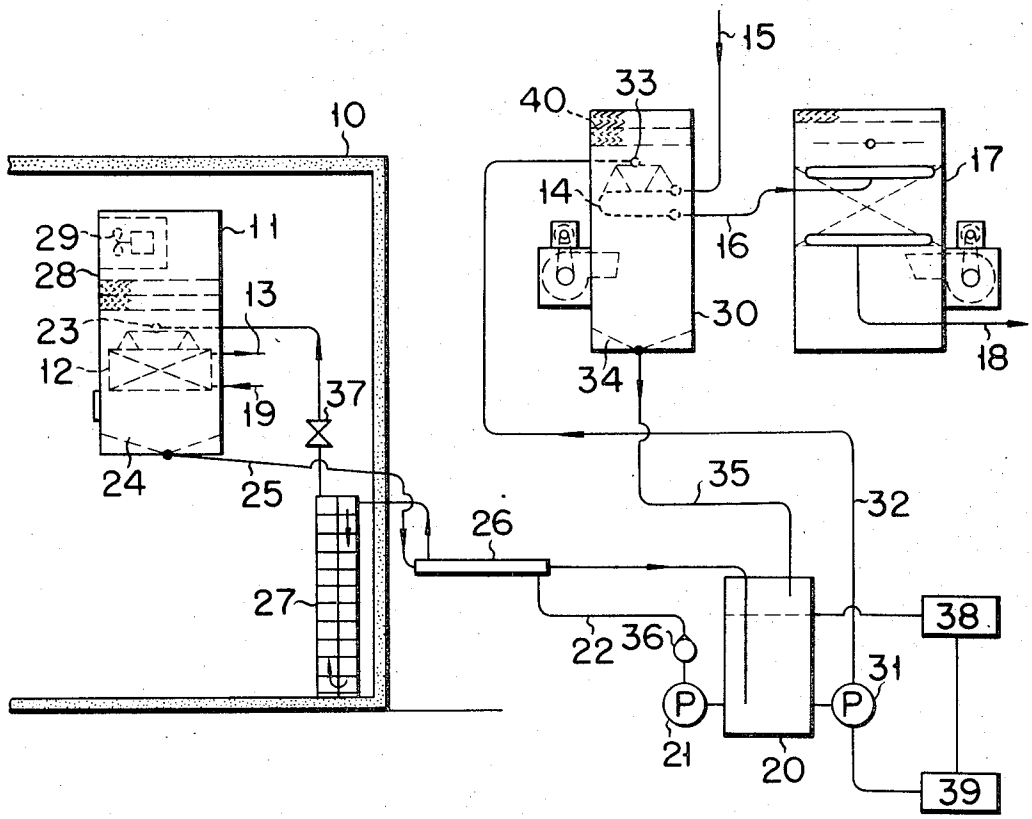
Primary Examiner—William J. Wye

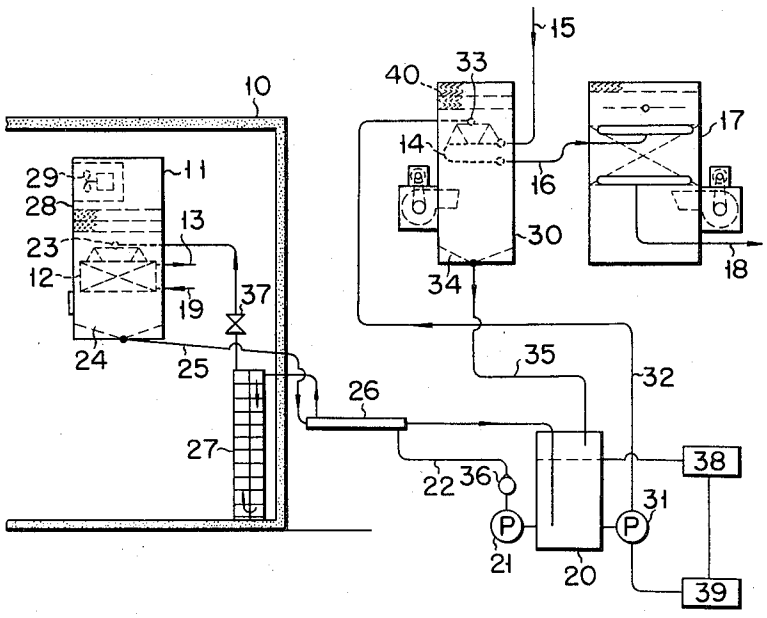
Attorney—Robert D. Flynn et al.

[57] **ABSTRACT**

A defroster removes a frost deposited onto an evaporator of a refrigerating system. The defroster is so constructed that an anti-freezing solution preliminarily introduced and cooled within the refrigerating box of the system is sprayed onto the frost to lower the fusing point thereof and the anti-freezing solution diluted by the frost is sprayed onto the heat radiating coil member of the system to cause the water contained in the solution to be evaporated, thus increasing its concentration.

3 Claims, 1 Drawing Figure

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DEFROSTER FOR A REFRIGERATING SYSTEM

The present invention relates to a defroster, particularly to a defroster for removing a frost deposited onto an evaporator of a refrigerating system.

It is generally known that a refrigeration capacity is lowered due to a frost deposited onto an evaporator such as a fin coil in a refrigerator, freezer etc. in general. There has been heretofore proposed a variety of defrosters such as for example a hot-gas type, electric heater type currently in use. The conventional defroster, however, can not be operated during a refrigeration cycle due to a high heat involved. Therefore, in order to attain a defrost it is necessary to stop or interrupt the refrigeration operation. For this reason a temperature within a refrigerator is increased during the operation of the defroster by the deenergization of a refrigerating cycle system and/or the heating operation of the defroster. Even after resuming the refrigerating cycle it is impossible to lower the temperature within the refrigerator up to a predetermined level unless lapsed for a predetermined period of time. During the time period various inconveniences will also be caused. Furthermore, the refrigeration operation of the refrigerating cyclic system is intermittently effected in the prior art refrigerator, resulting in an added operation cost.

The object of the present invention is to provide a defroster capable of being incorporated easily into a refrigerating cycle system and capable of removing a frost deposited during the refrigeration cycle onto the evaporator without stopping or interrupting the refrigeration operation and without using a high temperature which causes some inconveniences in the refrigeration treatment.

In the defroster according to the present invention use is positively made of the heat of a high-temperature high-pressure gaseous refrigerant circulating in the high pressure side of a refrigerating cycle system in general. An anti-freezing solution preliminarily introduced and cooled in a refrigerating or cold box for a predetermined period of time is sprayed onto a frost-deposited evaporator to cause the frost to lower its fusing point. Then, the anti-freezing solution diluted by the front is sprayed onto the means, through which a high-temperature high-pressure gaseous refrigerant is passed, to cause the water in the diluted solution to be evaporated, thus increasing its concentration. The so concentrated liquid is again used for defrosting.

According to an aspect of the invention there is provided a defroster for a refrigerating cycle system having a refrigerating box definging a space therein, an evaporator for refrigerating said space and a heat radiating member through which a heated refrigerant is passed; comprising a tank for receiving a anti-freezing solution, first means for supplying the anti-freezing solution from the tank to the evaporator so as to lower the fusing point of the frost deposited on the evaporator to melt the frost, second means for collecting and return1ng to the tank the anti-freezing solution diluted by the thawed frost, third means for supplying the anti-freezing solution from the tank to the heat radiating member to evaporate it for concentration, fourth means for collecting and returning to the tank the concentrated anti-freezing solution, and pre-cooling means mounted in the refrigerating box to cool the anti-freezing solution passing through the first means by a cold atmosphere in the space of the box.

FIGURE is a schematic, systematic view showing a defroster according to an embodiment of the present invention.

Explanation is now made of a defroster according to an embodiment of the present invention, as applied in a refrigerating cycle system. Since the refrigerating cycle system as shown in the FIGURE may be of a generally known type, explanation is restricted only to the evaporator and condenser thereof.

In a unit cooler casing **11** provided in the space of a refrigerating box **10** there is housed an evaporator **12** consisting of fin coils. The evaporator **12** constituting one essential element of the known refrigerating cycle system is connected through a pipe **13** to the input terminal of a compressor not shown. Connected through a pipe **15** to the output terminal of the compressor is a heat radiating coil **14** as will later be described. The coil **14** is connected through a pipe **16** to the input terminal of a condenser **17.** The output terminal of the condensor **17** is connected through a pipe **18** to a receiver and then an expansion valve not shown, and through a pipe **19** to the evaporator.

A refrigerant performs a predetermined refrigerating function through a cycle including the evaporator, compressor, condenser receiver and expansion valve as is well known in the art.

A defrosting device according to the present invention comprises an anti-freezing solution circulating system for defrosting, an anti-freezing solution concentrating system and an anti-freezing solution reservoir tank **20** shared with both the systems.

The anti-freezing solution circulating system includes an inlet pipe **22** having one end connected to the tank **20** and the other end thereof extending within the casing **11** to introduce the anti-freezing solution in to the casing from the tank **20** under the pumping action of a pump **21.** Situated above the evaporator coil **12** within the casing **11** is the extended end of the pipe **22** which sprays the anti-freezing solution through its nozzle **23** onto a frost layer deposited on the fin coil. Below the coil **12** there is provided a funnel-like tray **24** for collecting the sprayed solution containing the water melted from the frost. To the outlet of the tray **24** is connected one end of an outlet pipe **25** the other end of which is connected to the tank **20.** The arrangement permits the anti-freezing solution collected within the tray to be returned to the tank.

At the inlet pipe **22** there are provided a pre-cooler **27,** manually operating valve **37** and check valve **36** for sending, for a predetermined time period, a controlled amount of pre-cooled anti-freezing solution onto the evaporator. The pre-cooler **27** is disposed at the corner in the space of the refrigerating box **10** to give not so much affect to the refrigeration effect, and the anti-freezing solution is cooled by a lower temperature atmosphere within the refrigerator. The pre-cooler **27** may take a variety of forms but, as a preferable form, use is made of bent rectangular pipes arranged one over the other at a multi-stepped, spaced-apart relation to raise a cooling effect with a smaller space occupied. The anti-freezing solution led through check valve **36** from the tank **20** is sent to the pre-cooler **27** where it is held and pre-cooled for a predetermined period of time. The pre-cooled liquid, as required, is supplied at

a desired flow amount onto the evaporator **12** through a check valve **36.**

In the embodiment according to the present invention, to assist the cooling function of the pre-cooler **27** the inlet and outlet pipes **22** and **25** are associated with each other outside the refrigerator **10** to constitute a heat exchanger **26.** The heat exchanger **26** functions to cool that anti-freezing solution passing through the inlet pipe **22** raised to a relatively high temperature for the reasons set out below by that relatively low-temperature anti-freezing solution passing through the outlet pipe **25** thereby precool the former solution before entry into a pre-cooler **27.** The heat transfer, for example, may be formed by either arranging the portions of the inlet pipe and outlet pipe at a coaxial array, or spirally winding the portion of the outlet pipe around the portion of the inlet pipe. Since the anti-freezing solution is sufficiently cooled by these two cooling mechanisms **26, 27** before being sprayed onto the evaporator **12,** it will be understood that no refrigeration capability will be lowered, even if the anti-freezing solution is sprayed onto the evaporator.

Disposed above the nozzle **23** in the unit cooler casing **11** is an eliminator **28** for preventing an escape from the casing **11** of the anti-freezing solution sprayed from the nozzle **23.** Also located above the eliminator **28** is a blower **29** for generating an upward directing air stream within the casing **11** to enhance a defrosting effect.

The anti-freezing solution concentrating circulation system includes a concentrator **30,** in which the heat radiating coil **14** is contained, and an inlet pipe **32** for introducing, under the action of a pump **31,** the anti-freezing solution from the tank **20** into the concentrator **30.** Mounted at the end of the inlet pipe **32** and within the concentrator is a nozzle **33** which is situated above the coil **14.** Through the nozzle **33** the anti-freezing solution from the tank **20** is sprayed onto the heat radiating coil **14.** This will cause some water contained in the sprayed solution to be evaporated since the high-temperature refrigerant is passed through the heat radiating coil **14.** From this it will be understood that during the spraying the anti-freezing solution will be concentrated. Arranged below the radiating coil **14** within the concentrator is a funnel-like tray **34** for collecting the so-concentrated anti-freezing solution. The outlet of the tray **34** is connected to the reservoir tank **20** through an outlet pipe **35.** As a result the concentrated anti-freezing solution is returned to the tank.

Within the concentrator **30** an eliminator **40** is provided to trap droplets of the anti-freezing solution thereon, thereby preventing the dissipation of the solution. As a result only water vapor can be passed upwardly. Below the coil **14** there is disposed a blower for facilitating heat dissipation of the coil **14.**

On the tank **20,** for example, a liquid-level measuring device **38** of floating type is provided for measuring the liquid level of the anti-freezing solution within the tank. This device is connected to a switch means **39** for selectively driving the pump **31.** As a result when the anti-freezing solution within the tank **20** is reached at more than a predetermined level, i.e., the solution has its concentration reduced the pump **31** automatically starts its operation to get the concentration system into warks.

Let us now explain the refrigeration cycle of the defroster according to the present invention, i.e., the aspect of sending to the condenser **17** a high-temperature and high-pressure gaseous refrigerant caused by the compressor and the aspect of cooling the inside of the refrigerating box **10** through evaporation of the liquefied refrigerant in the evaporator coil **12.**

The anti-freezing solution within the tank **20** is raised to a fairly high-temperature through the concentrating circulation system which is then sent through the heat exchanger **26** to the pre-cooler **27** where it is precooled for a predetermined period of time. Then it is sent to the nozzle **23,** through which it is sprayed onto the coil **12** to cause the frost deposited thereon to be thawed. The anti-freezing solution diluted by the thawed water is collected in the tray **24** and sent back to the tank **20** by way of the pipe **25.** In this case the anti-freezing solution so returned to the tank is diluted and extended by the thawed water. However, according to the present invention the diluted solution is concentrated through the concentration cycle to maintain at all times constant the concentration of the anti-freezing solution within the tank. That is, the anti-freezing solution within the tank is sprayed onto the radiator coil **14** through which the high-temperature refrigerant is passed so that the diluted anti-freezing solution is evaporated to cause it to be concentrated. The so-concentrated high-temperature anti-freezing solution is collected in the tray **34** and then returned to the tank **20,** where it is mixed with the diluted anti-freezing solution from the defrosting cycle. Thus, the concentration of the solution within the tank **20** is maintained constant.

The defrosting circulation system of the defroster according to the present invention may be operated either continuously during the operation of the refrigeration cycle, or intermittently by means of a timer etc. Otherwise the defrosting circulation system of the defroster may be operated only for a predetermined period of time, taking into consideration the extent to which a frost is deposited onto the coil **12.** Though as the concentration means diluting anti-freezing solution the heat radiating coil is used in the present embodiment, the other means, such as for example a condenser, through which a high-temperature gaseous refrigerant is passed, may be used.

What is claimed is:

1. A defroster for a refrigerating cycle system having a refrigerating box defining a space therein, an evaporator for refrigerating said space and a heat radiating member through which a heated refrigerant is passed; comprising a tank for receiving an anti-freezing solution, first means for supplying the anti-freezing solution from the tank to the evaporator so as to lower the fusing point of the frost deposited on the evaporator to melt the frost, second means for collecting and returning to the tank the anti-freezing solution diluted by the thawed frost, third means for supplying the anti-freezing solution from the tank to the heat radiating member to evaporate it for concentration, fourth means for collecting and returning to the tank the concentrated antifreezing solution, and pre-cooling means mounted in the refrigerating box to cool the anti-freezing solution passing through the first means by a cold atmosphere in the space of the box.

2. A defroster according to claim **1,** further including a heat exchanger constituted by the parts of the first and second means to cool the anti-freezing solution in

the first means by the anti-freezing solution in the second means.

3. A defroster according to claim 1 wherein said tank has a device measuring the liquid level in the tank and switch means connected to the device to operate the third means when the anti-freezing solution in the tank is reached at more than a predetermined level.

* * * * *

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,772,897 Dated November 20, 1973

Inventor(s) Fujio MASUDA

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

In the Abstract:

line 1, change "removes" to --for removing--;
line 2, after "systems" delete ". The defroster".

Column 1, line 3, after "defroster," insert --and more--;
line 4, delete "a" (second occurrence);
lines 6 and 7, delete "a";
line 10, after "type," insert --and an--;
line 13, delete "a"
insert --the--;
line 15, after "reason" delete "a" and
insert --, the--;
line 21, delete "up";
lines 21 and 22, delete "unless lapsed for a predetermined" and insert --in a short--;
line 22, after "During" change "the" to --this--;
line 26, after "resulting in" delete "an";
line 31, after "removing" delete "a";
between lines 36 and 37 insert the heading --Summary of the Invention--;
line 46, after "means" delete ",";
line 53, change "definging" to --defining--;
line 55, after "passed" delete ";" insert --.--;
line 56, delete "comprising" insert --The defroster comprises--; change "a" (last occurrence) to --an--;

USCOMM-DC 60376-P69
★ U.S. GOVERNMENT PRINTING OFFICE : 1969 O—366-334.

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,772,897 Dated November 20, 1973

Inventor(s) Fujio MASUDA

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

-2-

Column 2, between lines 2 and 3 insert the heading
--Brief Description of the Drawing--;
line 3, change "FIGURE" to --The single Figure--;
between lines 5 and 6 insert the heading
--Detailed Description of the Drawing--;
line 12, after "space" change "of" to --within--;
line 14, change "consisting of" to --including--;
line 50, after "tray" insert --24--;
line 52, change "operating" to --operated--;
line 62, after "other" change "at" to --in--;
line 63, after "raise" change "a" to --the--;
last line, change "at" to --with--;

Column 3, line 1, after "desired" insert --amount of--;
after "flow" delete "amount";
line 2, change "a" to --the--;
line 12, after "pipe 25" insert --to--;
line 15, after "outlet pipe" change "at" to --in--;
line 20, change "no" to --the--;
line 21, after "will" insert --not--;
line 24, after "preventing" change "an" to --the--;
line 27, change "upward directing" to --upwardly directed--;
line 28, change "a" to --the--;
line 58, change "floating" to --the float--;
line 62, delete "is reached at more" and insert --reaches a level higher--;

FORM PO-1050 (10-69)

USCOMM-DC 60376-P69
* U.S. GOVERNMENT PRINTING OFFICE : 1969 O—366-334.

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,772,897 Dated November 20, 1973

Inventor(s) Fujio MASUDA

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

- 3 -

Column 3, line 64, after "reduced" insert --,--;
line 65, change "get" to --start--;
line 66, change "warks" to --operation--;
line 67, delete "Let us now explain" and insert --There will now be explained--;

Column 4, line 4, change "lique-" to --liqui- --;
lines 19 and 20, delete "at all times constant"
line 21, after "the tank" insert --constant at all times--;
line 27, change "tray 34" to --tray 24--;
line 40, after "which" delete "a"; change "onto" to --on--; delete "Though" insert --While a heat radiating coil is used--;
line 42, delete "the heat radiating coil is used";
line 43, before "other" delete "the";
line 59, delete "concentration" insert --concentrating the anti-freezing solution--;
line 66, change "constituted by" to --comprised of--;

Column 5, line 4, change "has" to --includes--;

Column 6, last line, delete "is reached at more" insert --reaches a level higher--.

Signed and sealed this 4th day of June 1974.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents

FORM PO-1050 (10-69)

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