APPLICATION ACCEPTED AND AMENDMENTS ALLOWED 28-11-89

FORM 1
REGULATION 9

COMMONWEALTH OF AUSTRALIA

PATENTS ACT 1952-1973

594257

APPLICATION FOR A PATENT

We MITSUBISHI JUKOGYO KABUSHIKI KAISHA; KABUSHIKI KAISHA KOBE SEIKO SHO and MITSUI O.S.K. LINES, LTD.

of 5-1 Marunouchi 2-chome, Chiyoda-ku, TOKYO, JAPAN; 3-18 Wakinohama 1-chome, Chuo-ku, Kobe-shi, Hyogo-ken, JAPAN and Osaka Building, 6-32 Nakanoshima 3-chome, Kita-ku, Osaka-shi, OSAKA, JAPAN, respectively

hereby apply for the grant of a Patent for an invention entitled:

REFRIGERATING AND HUMIDITY-~~REGURATING~~ REGULATING SYSTEM FOR USE IN A CONTAINER

which is described in the accompanying complete specification. This Application is a Convention Application and is based on the Application(s) numbered: 62-163098 for a Patent or similar protection made in Japan on 27 October 1987.

Our address for service is:

GRIFFITH HACK & CO.
71 YORK STREET
SYDNEY N.S.W. 2000
AUSTRALIA

DATED this 19th day of October, 1988.

MITSUBISHI JUKOGYO KABUSHIKI KAISHA; KABUSHIKI KAISHA KOBE SEIKO SHO and MITSUI O.S.K. LINES, LTD.
By their Patent Attorneys

GRIFFITH HACK & CO.

SOO3071 19/10/88

AUSTRALIAN PATENT OFFICE LS

TO: THE COMMISSIONER OF PATENTS
COMMONWEALTH OF AUSTRALIA

1470A:rk

FP/MHI-3157(豪)

ASSIGNEE-APPLICANT

COMMONWEALTH OF AUSTRALIA

PATENTS ACT 1952 (AS AMENDED)

DECLARATION IN SUPPORT OF AN APPLICATION FOR A PATENT

(Name of applicant) In support of an Application made by: Mitsubishi Jukogyo Kabushiki Kaisha, Kabushiki Kaisha Kobe Seiko Sho and Mitsui O.S.K. Lines, Ltd.

(Title) for a patent for an invention entitled: REFRIGERATING AND HUMIDITY-REGULATING SYSTEM FOR USE IN A CONTAINER

(Full name of signatory) (Address of signatory) We, Shoji Ueda of Mitsubishi Jukogyo Kabushiki Kaisha of 5-1,Marunouchi 2-chome, Chiyoda-ku, Tokyo, Japan;
Masayuki Tatsuno, General Manager of Patent & Licencing Dept. of Kabushiki Kaisha Kobe Seiko Sho of 3-18, Wakinohama 1-chome, Chuo-ku, Kobe-shi, Hyogo-ken, Japan and
Kiichiro Aiura,President of Mitsui O.S.K. Lines,Ltd. of Osaka Building,6-32,Nakanoshima 3-chome, Kita-ku,Osaka-shi, Osaka, Japan
do solemnly and sincerely declare as follows:

1. We are authorised by the above mentioned applicants for the patent to make this Declaration on their behalf.

2. The name and address of each actual inventor of the invention is as follows:

(Insert details of inventor/s)

Toshio Yamashita,	c/o Nagoya Air-Conditioning & Refrigeration Machinery Works of Mitsubishi Jukogyo Kabushiki Kaisha, 1, Aza Asahimachi 3-chome, Nishibiwajima-cho, Nishikasugai-gun, Aichi-ken, Japan;
Keitaro Hayami,	- do -
Shizuo Fujimoto,	c/o Mitsui O.S.L. Lines, Ltd., 1-1, Toranomon 2-chome, Minato-ku, Tokyo, Japan;
Hisaaki Yokota,	5-21, Hamatake 3-chome, Chigasaki-shi, Kanagawa-ken, Japan and
Akira Hasegawa,	731-1, Tehiro, Kamakura-shi, Kanagawa-ken, Japan

(Insert details of assignment, etc.) and the fact(s) upon which the applicants are entitled to make this application are as follows:

The applicants are entitled to apply for a patent by virtue of an assignment from the inventors to the applicants.

(Delete paragraphs 3 and 4 for Non-Convention application) 3. The basic application(s) as defined by Section 141 of the Act was(were) made as follows:

Country ...Japan..... on .October.27,.1987.....
in the name(s) .Mitsubishi Jukogyo Kabushiki Kaisha,.....
and in .....Kabushiki Kaisha Kobe Seiko Sho and Mitsui O.S.K.Lines,Ltd. on .....
in the name(s) .....
and in ..... on .....
in the name(s) .....

4. The basic application(s) referred to in the preceding paragraph of this Declaration was(were) the first application(s) made in a Convention country in respect of the invention the subject of this application.

(Place and date of signing) Declared at Tokyo,Japan this 11th day of November 19 88

Mitsubishi Jukogyo Kabushiki Kaisha
Kabushiki Kaisha Kobe Seiko Sho
Mitsui O.S.K.Lines,Ltd.

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(71) Applicant(s)
MITSUBISHI JUKOGYO KABUSHIKI KAISHA; KABUSHIKI KAISHA KOBE SEIKO SHO; MITSUI O. S. K. LINES, LTD.

(72) Inventor(s)
TOSHIO YAMASHITA; KEITARO HAYAMI; SHIZUO FUJIMOTO; HISAAKI YOKOTA; AKIRA HASEGAWA

(74) Attorney or Agent
GRIFFITH HACK & CO. SYDNEY

(57) Claim

1. A refrigerating and humidity-regulating system for a container, the system comprising a refrigerating unit having a humidity-regulating apparatus assembled therein, which humidity-regulating apparatus includes a solid adsorptive material, air heating means and air blowing means, and is provided with an air circulation route for circulating inside air and outside air through said air heating means and then said solid adsorptive material.

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PATENTS ACT 1952 Form 10

COMPLETE SPECIFICATION

FOR OFFICE USE

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Lodged:

Complete Specification–Lodged:
Accepted:
Lapsed:
Published:

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Related Art:

This document contains the amendments made under Section 49 and is correct for printing.

TO BE COMPLETED BY APPLICANT

Name of Applicant: MITSUBISHI JUKOGYO KABUSHIKI KAISHA; KABUSHIKI KAISHA KOBE SEIKO SHO and MITSUI O.S.K. LINES, LTD.

Address of Applicant: 5–1 Marunouchi 2–chome, Chiyoda–ku, TOKYO, JAPAN; 3–18 Wakinohama 1–chome, Chuo–ku, Kobe–shi, Hyogo–ken, JAPAN and Osaka Building, 6–32 Nakanoshima 3–chome, Kita–ku, Osaka–shi, OSAKA, JAPAN, respectively

Actual Inventor: Toshio Yamashita; Keitaro Hayami; Shizuo Fujimoto; Hisaaki Yokota and Akira Hasegawa

Address for Service: GRIFFITH HACK & CO.
71 YORK STREET
SYDNEY NSW 2000
AUSTRALIA

Complete Specification for the invention entitled:

REFRIGERATING AND HUMIDITY–REGULATING SYSTEM FOR USE IN A CONTAINER

AUSTRALIAN PATENT OFFICE LS

The following statement is a full description of this invention, including the best method of performing it known to me/us:–

1470A:rk

REFRIGERATING AND HUMIDITY-REGULATING SYSTEM FOR USE IN A CONTAINER

BACKGROUND OF THE INVENTION:

Field of the Invention:

The present invention relates to a refrigerating and humidity-regulating system for a container to be used for the purpose of accommodating freights in a cold storage or refrigerated condition and performing marine or over-land transportation.

Description of the Prior Art:

Heretofore, in the case where it is necessary to humidify inside air of the above-mentioned type of container, as shown in Fig. 8, a humidifier 02 is disposed within a refrigerating unit 01, and the inside air within a container 03 is circulated as indicated by arrows.

The inside air sucked into the refrigerating unit 01 through its top portion is, after accelerated by a blower 04, cooled in the course of passing through a cooling coil 05, and subsequently it is blown out through the bottom portion of the refrigerating unit 01, after humidified by the humidifier 02.

As the humidifier 02, an ultrasonic humidifier, a steam type humidifier, a centrifugal humidifier, etc. can be used, and to the humidifier 02 is supplied water from a water tank 06 disposed within the container 03.

When this humidifying method is employed, since it is necessary to dispose the water tank 06 for supplying water to the humidifier 02, not only a freight loading space within the container 03 is reduced, but also in the event that the container is transported for a long period of time, it is necessary to pay attention to supplement of water into the water tank 06, or there is an inconvenience that the water within the water tank 06 may possibly become corrupt.

In the case where it is necessary to dehumidify inside air of the container, as shown in Fig. 9, a dehumidifying coil 07 is disposed within a refrigerating unit 01.

The inside air is, as indicated by arrows, sucked into the refrigerating unit 01 through its top portion and made to pass through the dehumidifying coil 07 via a blower 04 and a cooling coil 05, and during this process, moisture in the inside air is removed by making it dew on the surface of the dehumidifying coil 07. The water dewed on the dehumidifying coil 07 is collected in a drain pan 08 and discharged to the outside of the refrigerating unit 01.

When this dehumidifying method is employed, since the dehumidifying coil 07 is cooled to a temperature lower than a dew point of the inside air and moisture in

the inside air is removed by making it dew on the surface of the dehumidifying coil 07, dehumidification up to a relative humidity of RH 50% is a limit, hence it is extremely difficult to maintain a humidity lower than that value, and also, within a low temperature atmosphere, the moisture adhered to the dehumidifying coil 07 would freeze, resulting in lowering of a heat transfer efficiency and degradation of a dehumidifying effect. In order to deal with this problem, if the dehumidifying coil 07 is heated to melt the ice adhered to this coil, the molten water would give moisture to the inside air, and so, there is an inconvenience that the dehumidifying effect would be reduced to half.

SUMMARY OF THE INVENTION:

It is, therefore, one object of the preferred embodiment of the present invention to provide a refrigerating and humidity-regulating system for a container that is free from the above-mentioned disadvantages of the humidity-regulating system in the prior art.

In a preferred embodiment of the present invention there is provided a refrigerating and humidity-regulating system for a container, in which there is no need to dispose a water tank within a container for humidifying the inside air.

Another specific embodiment of the present invention provides a refrigerating and humidity-regulating system for a container, in which the limit of dehumidification is improved without deteriorating the dehumidifying effect.

According to one form of the present invention, there is provided an improved refrigerating and humidity-regulating system for a container, the system comprising a refrigerating unit having a humidity-regulating apparatus assembled therein, which humidity-regulating apparatus includes a solid adsorptive material, air heating means and air blowing means, and is provided with an air circulation route for circulating inside air and outside air through the

air heating means and then the solid adsorptive material.

According to the present invention, owing to the above-mentioned structural feature, in the case, of humidifying inside air, outside air is circulated through the air circulation route, and during this process, moisture in the outside air is made to be adsorbed by the solid adsorptive material. Subsequently, inside air is circulated through the air circualation route, and during this process, after the inside air has been heated by the air heating means, it is humidified by taking moisture away from the solid adsorptive material. On the other hand, in the case of dehumidifying inside air, the inside

air is circulated through the air circulation route, and during this process, the inside air is dehumidified by making moisture in the inside air to be adsorbed by the solid adsorptive material. Subsequently, outside air is circulated through the circulation route, and during this process, after the outside air has been heated by the air heating means, it takes moisture away from the solid adsorptive material and is discharged to the outside.

Thus, according to the present invention, by means of the subject refrigerating and humidity-regulating system, not only cooling of inside air of a container but also humidification and dehumidification of the inside air become possible. Moreover, the dehumidifying effect is so large that a humidity of the inside air can be maintained at a low level. In addition, since a water tank is not necessitated in contrast to the prior art system, there is no need to sacrifice a freight loading space for the water tank, also there is no fear that water in a water tank may become corrupt even upon a long period transportation, and further it is unnecessary to pay attention to supplement of water. Furthermore, since a dehumidifying coil is not necessitated as is the case with the prior art, mechanisms and operations for removing ice or frost adhered to the dehumidifying coil, also become unnecessary.

The above-mentioned and other objects, features and advantages of the present invention will become more apparent by reference to the following description of preferred embodiments of the invention taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS:

In the accompanying drawings:

Figs. 1 to 3 jointly show a first preferred embodiment of the present invention;

Fig. 1 is a vertical cross-section view of a container;

Fig. 2(A) is a vertical cross-section view of a humidity-regulating apparatus;

Fig. 2(B) is another vertical cross-section view of the same taken along line B-B in Fig. 2(A) as viewed in the direction of arrows;

Fig. 3(A) is an operation diagram upon humidification;

Fig. 3(B) is an operation diagram upon dehumidification;

Figs. 4 and 5 jointly show a second preferred embodiment of the present invention;

Fig. 4(A) is a vertical cross-section view of a refrigerating unit;

Fig. 4(B) is another vertical cross-section

view of the same taken along line B-B in Fig. 4(A) as viewed in the direction of arrows;

Fig. 5(A) is an operation diagram upon humidification;

Fig. 5(B) is an operation diagram upon dehumidification;

Figs. 6 and 7 jointly show a third preferred embodiment of the present invention;

Fig. 6 is a vertical cross-section view of a container;

Fig. 7(A) is a vertical cross-section view of a humidity-regulating apparatus;

Fig. 7(B) is another vertical cross-section view of the same taken along line B-B in Fig. 7(A) as viewed in the direction of arrows;

Fig. 8 is a vertical cross-section view showing outline of humidification in a container in the prior art; and

Fig. 9 is a vertical cross-section view showing outline of dehumidification in a container in the prior art.

DESCRIPTION OF THE PREFERRED EMBODIMENTS:

A first preferred embodiment of the present invention will be described with reference to Figs. 1 to 3.

In Fig. 1, reference numeral 1 designates a container, which is provided with a refrigerating unit 2. The refrigerating unit 2 comprises a blower 3 and a cooling coil 4, so that inside air of the container 1 is sucked through its top portion, accelerated by the blower 3, and after cooled by the cooling coil 4, discharged through its bottom portion to be circulated through the container 1 as shown by arrows. Within the refrigerating unit 2 is assembled a humidity-regulating apparatus 5, and as will be apparent from Fig. 2, this humidity-regulating apparatus 5 includes a solid adsorptive material 6 formed as a fixed bed, air heating means 7 such as an electric heater or the like and an axial flow type fan 8, these being contained within a casing 9 which forms an air circulation route. At the top portion of the casing 9 are provided an inside air intake port 10 and an outside air intake port 11, and these inside air intake port 10 and outside air intake port 11 are adapted to be alternately opened and closed by a damper 13 that is driven by a damper motor 12. In addition, at the bottom portion of the casing 9 are provided an inside air blow-out port 14 and an outside air blow-out port 15, and these inside air blow-out port 14 and outside air blow-out port 15 are adapted to be alternately opened and closed by a damper 17 that is driven by a damper motor 16.

The damper motors 12 and 16 are synchronously energized, and when the dampers 13 and 17 occupy the positions depicted by solid lines, outside air is sucked into the casing 9 through the outside air intake port 11, and is circulated through the fan 8, the air heating means 7, the solid adsorptive material 6 and the outside air blow-out port 15. When the dampers 13 and 17 occupy the positions depicted by dash lines, inside air is sucked into the casing 9 through the inside air intake port 10, and is circulated through the fan 8, the air heating means 7, the solid adsorptive material 6 and the inside air blow-out port 14.

In the case of humidifying inside air of the container 1, at first the dampers 13 and 17 are driven by means of the damper motors 12 and 16, respectively, to be switched to the positions shown by solid lines in Fig. 2-(A), and thereby the inside air intake port 10 and the inside air blow-out port 14 are closed, while the outside air intake port 11 and the outside air blow-out port 15 are opened. Then, the fan 8 is driven, but the air heating means 7 is not electrically energized. Thus, outside air is sucked by the fan 8 through the outside air intake port 11 into the casing 9, then in the course of flowing through the solid adsorptive material 6 via the air heating means 7, moisture in the outside air is adsorbed

by the adsorptive material 6, and thereafter the outside air is discharged to the outside through the outside air blow-out port 15. When a predetermined period of time has elapsed and the solid adsorptive material 6 has sufficiently adsorbed moisture in the outside air, the dampers 13 and 17 are switched and occupy the positions shown by dash lines in Fig. 2(A), and as soon as the outside air intake port 11 and the outside air blow-out port 15 are closed and the inside air intake port 10 and the inside air blow-out port 14 are opened, the air heating means 7 is electrically energized. Then, the inside air is sucked by the fan 8 through the inside air intake port 10 into the casing 9, and in the course of flowing through the air heating means 7 it is heated up to a high temperature. Further, in the course of flowing through the solid adsorptive material 6 under this high temperature condition, the inside air is humidified by taking moisture away from the solid adsorptive material 6 which has sufficiently adsorbed moisture, thereafter it is blown out from the inside air blow-out port 14, and thus it is circulated through the inside of the container 1. By repeating the above-mentioned operations alternately at a predetermined repetition cycle as shown in Fig. 3(A), the inside air within the container 1 can be gradually humidified.

In the case of dehumidifying the inside air, at first the dampers 13 and 17 are switched to the positions shown by solid lines in Fig. 2(A), and at the same time the fan 8 is driven and the air heating means 7 is electrically energized. Then the outside air enters through the outside air intake port 11 and the fan 8 into the air heating means 7, where it is heated up to a high temperature, under this high temperature condition it enters into the solid adsorptive material 6, and after it has taken moisture reserved in the solid adsorptive material 6 away from the solid adsorptive material 6, it flows out to the outside through the outside air blow-out port 15. When a predetermined period of time has elapsed and the solid adsorptive material 6 has been sufficiently dewatered and dried, the dampers 13 and 17 are switched to the positions indicated by dash lines in Fig. 2(A), and at the same time, electrical energization of the air heating means 7 is cut off. Then, in the course of the inside air flowing through the solid adsorptive material 6 via the inside air intake port 10, the fan 8 and the air heating means 7, moisture in the inside air is adsorbed by the solid adsorptive material, and thereafter the inside air is blown out through the inside air blow-out port 14. By repeating the above-mentioned operations alternately at a predetermined repetition cycle as shown

in Fig. 3(B), the inside air can be gradually dehumidified.

A second preferred embodiment of the present invention is shown in Figs. 4 and 5. In these figures, a pair of humidity-regulating apparatuses 5A and 5B are assembled in parallel to each other within a refrigerating unit 2. Each of the pair of humidity-regulating apparatus 5A and 5B has the same structure as the humidity-regulating apparatus shown in Fig. 2, and provision is made such that inside air and outside air are alternately fed to the respective ones of the pair of humidity-regulating apparatuses 5A and 5B. Upon humidification of inside air, humidification and interruption are alternately repeated at a predetermined repetition cycle as shown in Fig. 5(A), while upon dehumidification of inside air, dehumidification and interruption are alternately repeated at a predetermined repetition cycle as shown in Fig. 5(B).

A third preferred embodiment of the present invention is shown in Figs. 6 and 7. As shown in Fig. 6, in a refrigerating unit 2 is assembled a humidity-regulating apparatus 20, and as shown in Fig. 7 this humidity-regulating apparatus 20 comprises a casing 21 which forms an air circulation route, a cylindrical solid adsorptive material 22 disposed within the casing 21 rotatably about its own axis, a partition wall 24 for partitioning the inside and the outside of this cylindrical solid adsorptive

material 22 into an inside air circulation zone 23a and an outside air circulation zone 23b, a radial-flow type fan 25a disposed within the inside air circulation zone 23a and rotationally driven about the center axis of the cylindrical solid adsorptive material 22, another radial-flow type fan 25b disposed within the outside air circulation zone 23b and coaxially coupled to the above-mentioned fan 25a, air heating means 26a such as an electric heater or the like disposed between the fan 25a and the solid adsorptive material 22 within the inside air circulation zone 23a, air heating means 26b such as an electric heater or the like disposed between the fan 25b and the solid adsorptive material 22 within the outside air circulation zone 23b, a motor 27 for driving the fans 25a and 25b, and a motor 28 for rotationally driving the solid adsorptive material 22. The casing 21 is provided with an inside air intake port 29 and an inside air blow-out port 30 both communicating with the inside air circulation zone 23a, and also it is provided with an outside air intake port 31 and an outside air blow-out port 32 both communicating with the outside air circulation zone 23b.

In the case of humidifying inside air, the air heating means 26a is electrically energized, but the air heating means 26b is not electrically energized. Then, outside air sucked by the fan 25b through the outside

air intake port 31 into the outside air circulation zone 23b passes through the unenergized air heating means 26b and the solid adsorptive material 22, and it is discharged from the outside air blow-out port 32. Meanwhile, the cylindrical solid adsorptive material 22 is slowly rotated in the direction of arrows by the motor 28, and during its half revolution passing through the outside air circulation zone 23b, it adsorbs moisture from the outside air. On the other hand, inside air is sucked by the fan 25a through the inside air intake port 29 into the inside air circulation zone 23a, and in the course of flowing through the energized air heating means 26a, it is heated up to a high temperature, then under this high-temperature condition it enters into the solid adsorptive material 22, where it is humidified by taking moisture away from the solid adsorptive material 22, and thereafter it is discharged from the inside air blow-out port 30. The solid adsorptive material 22 is dewatered by giving the moisture adsorbed from the outside air to the inside air during its half revolution passing through the inside circulation zone 23a, and under this dewatered condition it enters again into the outside air circulation zone 23b.

In the case of dehumidifying inside air, the air heating means 26b is electrically energized, but the air heating means 26a is not electrically energized.

Accordingly, inside air is sucked by the fan 25a through the inside air intake port 29 into the inside air circulation zone 23a, and when it flows through the solid adsorptive material 22 via the air heating means 26a, it is dehumidified and thereafter discharged through the inside air blow-out port 30. At the same time, outside air is sucked by the fan 25b through the outside air intake port 31 into the outside air circulation zone 23b, and in the course of flowing through the energized air heating means 26b, it is heated up to a high temperature, then under this high-temperature condition it enters into the solid adsorptive material 22, where it takes moisture away from the solid adsorptive material 22, and thereafter it is discharged to the outside from the outside air blow-out port 32.

As will be apparent from the detailed description above, according to the present invention, since a humidity-regulating apparatus including a solid adsorptive material, air heating means and air blowing means and provided with an air circulation route for circulating inside air and outside air through the above-mentioned air heating means and the above-mentioned solid adsorptive material in that sequence, is assembled in a refrigerating unit, in the case of humidifying inside air, moisture in outside air is made to be adsorbed by the solid adsorptive

material, and subsequently, inside air is humidified by making it pass through the solid adsorptive material after it has been heated up. In the case of dehumidifying inside air, it is dehumidified by making moisture in the inside air to be adsorbed by the solid adsorptive material. And by making outside air flow through the solid adsorptive material after having been heated, the outside air takes moisture away from the solid adsorptive material, and then it is discharged to the outside. Thus, by means of the subject refrigerating and humidity-regulating system, not only cooling of inside air of a container but also humidification and dehumidification of the inside air become possible. Moreover, the dehumidifying effect is so large that a humidity of the inside air can be maintained at a low level. In addition, since a water tank is not necessitated in contrast to the prior art system, there is no need to sacrifice a freight loading space for the water tank, also there is no fear that water in a water tank may become corrupt even upon a long period transportation, and further it is unnecessary to pay attention to supplement of water. Furthermore, since a dehumidifying coil is not necessitated as is the case with the prior art, mechanisms and operations for removing ice or frost adhered to the dehumidifying coil, also become unnecessary.

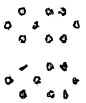
Furthermore, if the solid adsorptive material is formed as a fixed bed as shown in the first preferred embodiment, then dehumidification or humidification of the inside of a container becomes possible by alternately circulating inside air and outside air through the fixed bed.

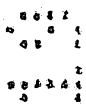
Still further, if the humidity-regulating apparatus including the solid adsorptive material formed as a fixed bed is disposed in multiple as shown in the second preferred embodiment, then it becomes possible to continuously carry out dehumidification or humidification of the inside of a container by alternately circulating inside air and outside air through the solid adsorptive materials in the respective humidity-regulating apparatus.

Yet further, as shown in the third preferred embodiment, by forming the solid adsorptive material in a cylindrical shape and disposing it in a rotatable manner, and by partitioning the air circulation route into an inside air circulation zone and an outside air circulation zone and simultaneously circulating inside air and outside air, it becomes possible to continuously carry out dehumidification or humidification of the inside of a container.

While a principle of the present invention has been described above in connection to preferred embodiments of the invention, it is a matter of course that many

apparently widely different embodiments of the present invention could be made without departing from the spirit of the present invention.





~~WHAT IS CLAIMED IS:~~ THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A refrigerating and humidity-regulating system for a container, the system comprising a refrigerating unit having a humidity-regulating apparatus assembled therein, which humidity-regulating apparatus includes a solid adsorptive material, air heating means and air blowing means, and is provided with an air circulation route for circulating inside air and outside air through said air heating means and then said solid adsorptive material. ~~in that sequence.~~

2. A refrigerating and humidity-regulating system for a container as claimed in Claim 1, wherein said solid adsorptive material is formed as a fixed bed, and inside air and outside air are alternately circulated through said fixed bed, whereby dehumidification or humidification of the inside of said container can be achieved.

3. A refrigerating and humidity-regulating system for a container as claimed in Claim 1, wherein said humidity-regulating apparatus is assembled in multiple in said refrigerating unit, in each said humidity-regulating apparatus said solid adsorptive material is formed as a fixed bed, and inside air and outside air are alternately circulated through said fixed bed in each humidity-regulating apparatus, whereby dehumidification

or humidification of the inside of said container can be achieved continuously.

4. A refrigerating and humidity regulating system for a container as claimed in Claim 1, wherein said solid adsorptive material is formed in a cylindrical shape and disposed rotatably about its own axis, said air circulation route is partitioned into an inside air circulation zone and an outside air circulation zone in such manner that the cylindrical solid adsorptive material may alternately pass through said inside air circulation zone and said outside air circulation zone during its one revolution, and inside air and outside air are simultaneously and continuously circulated through the respective air circulation zones in the air circulation route.

5. A refrigeration and humidity-regulating system substantially as hereinbefore described with reference to any one embodiment as shown in the accompanying drawings.

Dated this 19th day of October, 1988

MITSUBISHI JUKOGYO KABUSHIKI KAISHA, KABUSHIKI KAISHA KOBE SEIKO SHO AND MITSUI O.S.K. LINES, LTD.
By their Patent Attorney
GRIFFITH HACK & CO.

Fig. 1

第1図

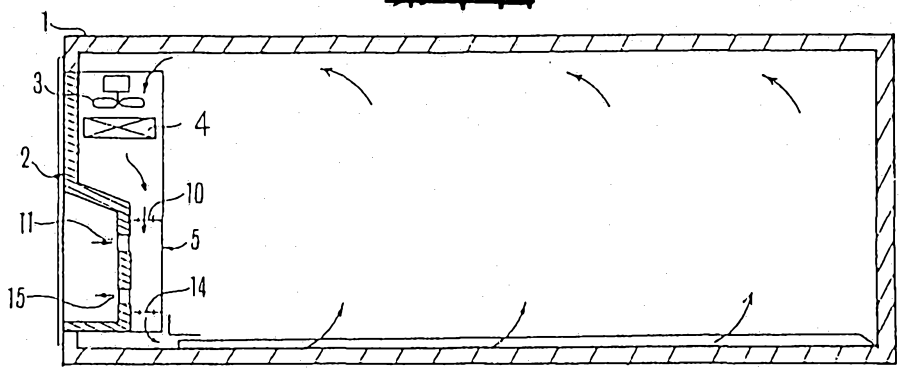


Fig. 2 (A)

第2図

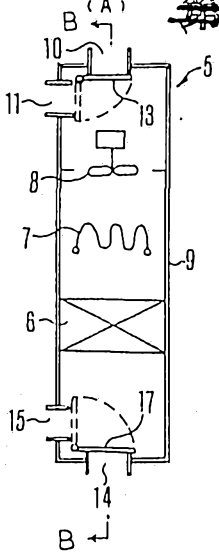
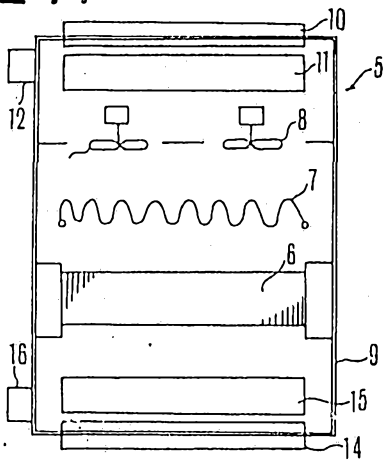


Fig. 2 (B)



第3図

Fig. 3(A)

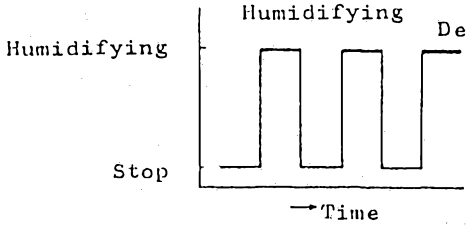
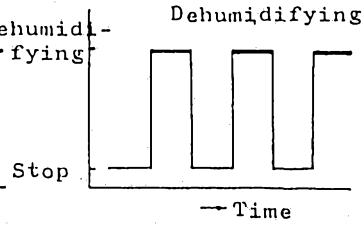


Fig. 3(B)



第4図

Fig. 4(A)

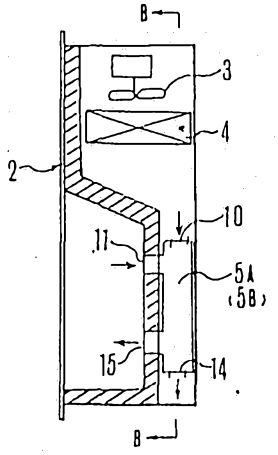
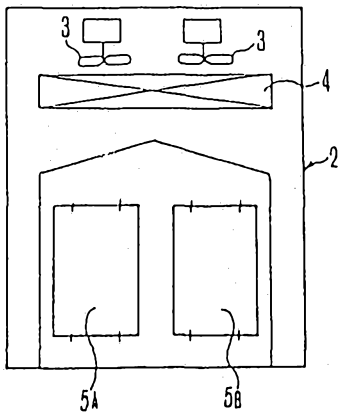


Fig. 4(B)



第5図

Fig. 5(A)

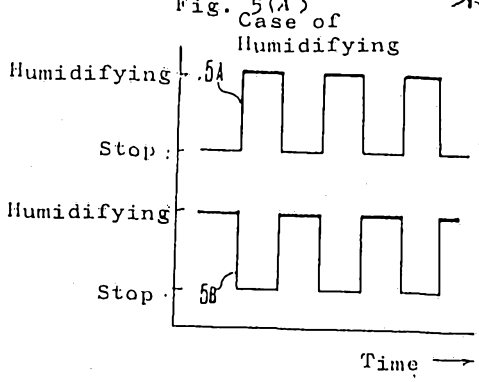


Fig. 5(B)

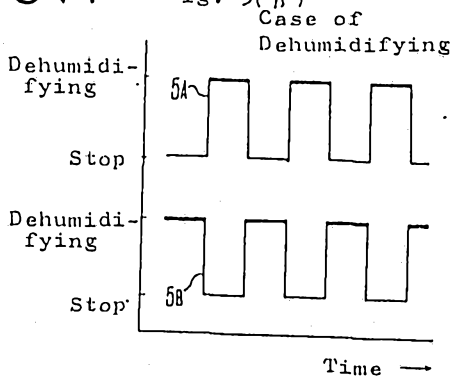


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Fig. 6

~~第6図~~

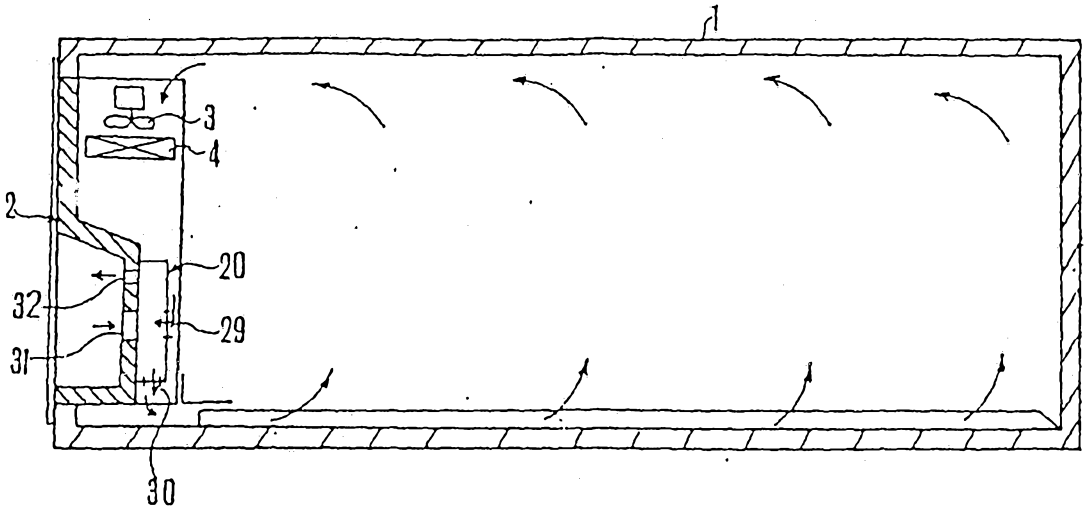

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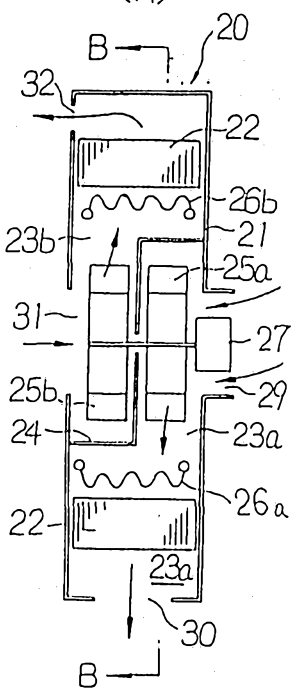
Fig. 7
(A)



第7図

Fig. 7
(B)

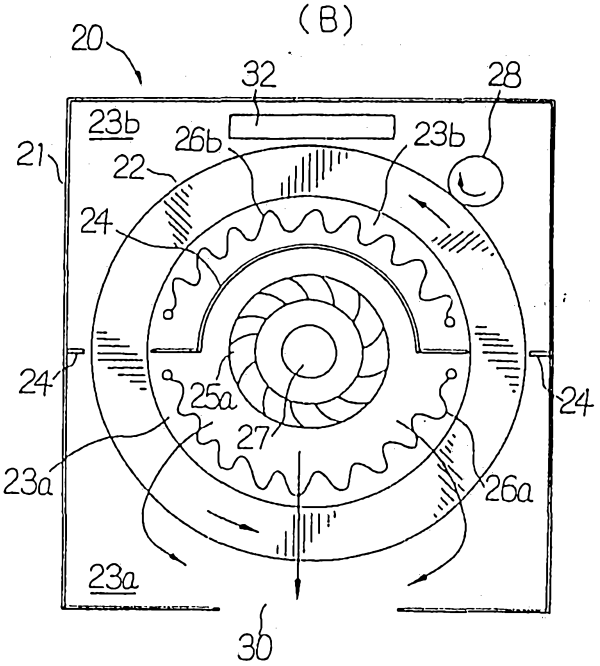


Fig. 8 (Prior Art)

第8图

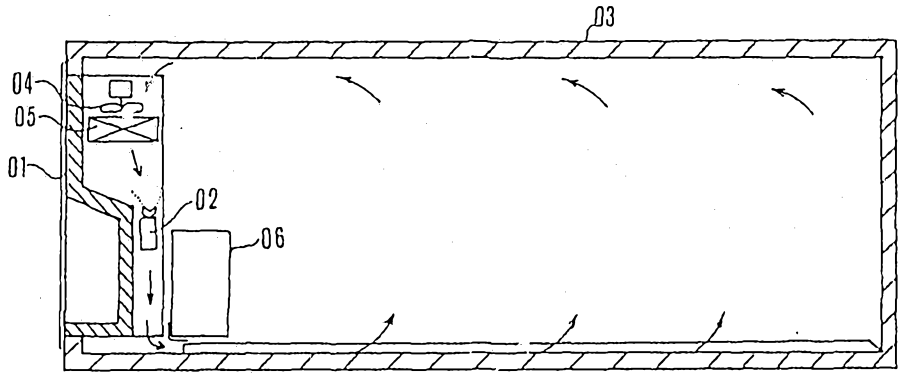


Fig. 9 (Prior Art)

第9图