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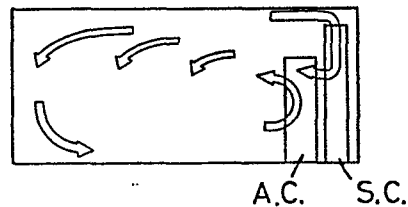
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64 Room air circulating apparatus.

67 A room air circulating apparatus has a case (1) with an inlet (3') at its lower end and possibly another inlet (3) at its upper end, an outlet (6) in its upper region but below the upper inlet, and a fan (8) for impelling air from the inlet (3') or a chosen one of two inlets (3,3') to the outlet (6).

By joint employment with a package air conditioner presently widely used or various types of stoves, room air can largely circulate without being stagnant near floor or ceiling then present little temperature variation among different parts of a room with pleasant and highly healthy environment zone created and energy saving realized.

Fig.4B



ROOM AIR CIRCULATING APPARATUS

Background of Invention

This invention relates to a package air conditioner which is generally used as an air conditioner for homes and every kind of offices, and it relates to a room air circulating apparatus for compulsorily circulating room air to be a temperature control medium in a room when it is used jointly with a stove provided fuels such as petroleum and gas.

Conventionally, a package air conditioner, though computerized control such as a use of IC contributes greatly to improving the quality, whether a hanging type or floor type, is employed by a single circulate route form in which room air is inhaled from particular level and either heated or cooled through a heat exchange, the heated or cooled air thereafter is exhaled into a room from a particular level which does not obstruct said air to be inhaled. Moreover, most apparatuses are provided with a thermistor sensor being equipped with an inhale gate for controlling room temperature.

Therefore, generally speaking, above-mentioned package air conditioner being widely used at present causes great variation of temperature in different parts of a room if it is solely employed for heating or cooling,

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although there is slight variance due to a setting type of an apparatus and a direction of heated or cooled air to be exhaled.

The variation of temperature between the upper and
5 lower level of a room is tens to 20 degrees Celsius in winter and 5 to 10 degrees even in summer due to a draft effect causing warm air to mass near a ceiling level and cool air to stagnate around floor, and room air stays because of obstacles such as desks, charis, and counters.
10 These conditions are unfavorable for health as well as unpleasant. Furthermore, temperature to be determined is set higher or lower than necessary for providing pleasant temperature in a dwelling zone, which generates a great loss of energy leading to a rise in running cost.

15 The problems caused by a conventional package air conditioner (shown by A.C. in a drawing) solely employed for heating and cooling will hereinafter be described specifically based on the results of an experiment conducted by an inventor.

20 I. In case of heating (specification of a heating apparatus: 9,900 Kcal/h, 25m³/min)

(1) Floor type and blast air is exhaled horizontally.

Referring to Fig. 18 of a temperature distribution diagram, the temperature at the upper level in a room
25 reaches 30°C or higher, while that of the floor level is

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aproximately 20°C, presenting the large temperature variation. The above-mentioned state results from that heated air ascends while cool air descends, wherein air constantly circulates at the higher level than the middle
5 in the room and cool air in the lower level stagnates without flowing. In addition to that, various obstacles in the room typically such as desks and chairs cause the above tendency to grow further in a real case.

(2) Floor type and blast air is exhaled downward
10 30° angle to a horizontal plane.

Referring to Fig. 19 of a temperature distribution diagram, blast air blown to the floor results in less variation of temperature between the upper and the lower levels than said case(1) due to less air stagnation to
15 rise temperature of the lower level. On the contrary, referring to Fig. 20 of a temperature distribution diagram at the level 1m from the floor, a high temperature zone is partially produced at the center of the room, which moreover is the level of a head when a man sits on
20 a chair. Therefore, blast air at high temperature directly blown gives an unpleasant feeling or blows off papers on a desk as well as produces unfavorable condition for health.

(3) Hanging type and blast air is exhaled
25 horizontally.

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Referring to Fig. 21 of a temperature distribution diagram, such large temperature variation as approximately 20°C between the upper and the lower levels in the room, more particularly the temperature variation is larger
5 than said I(1) due to hot air zone at ceiling and cold air zone on floor.

(4) Hanging type and blast air is exhaled downward 50° angle to a horizontal plane.

Referring to Fig. 22 of a temperature distribution
10 diagram, an air current of 0.5m/sec or haster which gives an unpleasant feeling is generated at the central part of a dwelling zone, about 1.5m high from the floor.

In the manner as stated above, in case of heating, whether an apparatus is a floor type or a hanging type,
15 the variation of temperature between the upper and the lower levels in the room is so great as to cause a chill near feet of a person. When blast air is exhaled downward to improve the conditions slightly, a high temperature zone is produced partially, and inevitably
20 problems are generated such as a person in a room to be exposed to hot air with high velocity feels unpleasant as well as the health is impaired.

II In case of cooling

(1) Floor type

25 Compared with Fig. 24 A of a temperature distribution

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diagram at the time of exhaling upward 30° angle and Fig. 24 B of a temperature distribution diagram at the time of horizontally exhaling, the latter produces a better effect in uniformizing room temperature. When
5 exhaling direction is excessively downward, however, cool air stagnates near the floor, thereafter further stagnant air lowers temperature near feet of a person even to the unusual extent. In addition to that, extremely cool air is prone to hit a human body, resulting in a further
10 vicious impact on health than a case of heating. It is especially unfavorable for women.

(2) Hanging type

Referring to Fig. 25 of a plane figure of an object room(R) and a cooling apparatus (A.C.) of a hanging type
15 to be set so that air is exhaled horizontally, the distribution of room temperature is measured at each cross sections of X-X, Y-Y, and Z-Z with distribution diagrams shown by Fig. 26 A,B, and C. In this case, both gates of inhaling room air and exhaling blast air being located
20 near the ceiling permit high temperature air at the upper level to be cooled by heat exchange, which results in a draft effect due to which exhaled cool air descends naturally. Therefore, the temperature variation in the room is as ideal as approximately 1°C at any part. The
25 downward direction for exhaling air, however, is desirable

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to promote a cooling effect in a dwelling zone where blast air (cool air) directly hits. Therefore, the temperature variation and a cooling effect in a dwelling zone contradict each other.

5 In the manner as stated above, in case of cooling, blast air is blown either horizontally or upward to cool from the upper level, which results in more uniformized distribution of room temperature. A disadvantage, however, in respect of health caused by lower half of a body to be
10 cooled too much hinders a quick cooling and improvement of a cooling effect in a dwelling zone.

The above-mentioned problem caused by the prior art of heating and cooling are hereinafter summarized:

(a) Temperature variation between the upper and the
15 lower levels in a room is too great, especially in case of heating.

(b) Blast air which is extremely hot or cool directly hits a human body then may give unpleasant feeling and injure health.

20 (c) Blast air, passing a human body with high velocity, further increases unpleasant feeling and vicious impact on health.

In case of heating by means of a stove which is another heating apparatus, according to partial heating
25 of a room due to heat radiation and natural convection,

a whole room is not heated up easily while it is sufficiently warm around a stove.

Although there is another type of a stove exhaling warm air into a room such as a warm air heater with forced
5 blowing system or a fan heater, temperature cannot rise high enough in the corner of a room because of generally insufficient amount of air, which results in inferior distribution of temperature in a room compared with that of said package air conditioner and far from pleasant
10 heating.

Summary of the Invention

The invention is intended to provide a room air circulating apparatus which can realize pleasant and healthy heating and cooling by means of uniformized
15 and suitable room temperature even when it is employed jointly with various types of stove as well as with said package air conditioner.

A room air circulating apparatus according to this invention to be developed in order to attain the object
20 mentioned above is so constructed as to inhale room air and exhale said inhaled air into a room, and the room air circulating apparatus comprising a hollow case in a box shape provided with an inhale gate for room air at least at a lower end of either an upper end or a lower
25 end of the hollow case, a spout gate provided at an

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upper part of said hollow case in a box shape for exhaling inhaled air to a room, and a fan built in said hollow case in a box shape for inhaling and exhaling air.

A room air circulating apparatus according to this invention which is characterized in the manner mentioned above provides hereinafter operations.

1. Since a room air circulating apparatus is used jointly with a conventional package air conditioner, cool or heated air to be inhaled and generated through the air conditioner is exhaled as conventionally, while either hot room air stagnating near the ceiling which is higher than an exhaling zone at the time of cooling or cool room air stagnating near the floor which is lower than an inhaling zone of said package air conditioner at the time of heating can be inhaled positively along a horizontal or nearly a horizontal plane and then be mixed with cool or hot air exhaled from said air conditioner. Hereby, overcooling or overheating of cool or hot air exhaled from the package air conditioner is avoided even when the time passes by. Additionally, room air including hot air at the upper level and cool air at the lower level can largely circulate and flow.

2. In either case of heating or cooling, the angles of exhaling cool or hot air from the package air conditioner and of exhaling room air from the circulating

apparatus are set slightly upward from a horizontal plane, so that mixed air is situated at the level higher than a dwelling zone, resulting in flowing at high velocity. Hot air, being involved, generates lenient return air to
5 be inhaled into this circulating apparatus.

3. In spring and autumn without any necessity of heating or cooling, the circulating apparatus, if used solely, can provide pleasant coolness in accordance with the relations between circulated air and effective
10 temperature.

4. At the time of heating by a stove, combustion gas per se or heated gas ascends to the ceiling and stagnates, causing greater temperature variation than the time of the employment of an air conditioner. This
15 circulating apparatus, if employed additionally, inhales then exhales cooled air near the floor, mixing with hot air near the ceiling so taht the mixed air can largely circulate in the room.

As it is apparent in the manner as stated above,
20 the invention presents many advantages hereinafter;

(1) The large part of room air to be circulated efficiently and largely gives extremely little temperature variation in a room regardless of a type and form of a main air conditioner so that a pleasant environment zone
25 ia created by uniformalized and suitable room temperature.

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More particularly, it is effective for air conditioning the palce with obstacles such as desks, chairs, and counters.

(2) Since extremely high or low temperature zone is
5 not partially created in a dwelling zone, the space in a room can be optimized.

(3) Cool or warm air to be exhaled from the package conditioner at the time of joint employment does not directly hit a human body, eliminating unpleasant
10 feeling and presenting effectiveness in respect of health. More particularly, it is of advantage for women's health at the time of cooling.

(4) Uniformalized and suitable room temperature results in saving energy and reduction of running cost.

15 (5) Even pleasantness can be provided in spring and autumn.

Another object of this invention is to make a whole apparatus thin and small.

A further object of this invention is to provide
20 suitably humidifying effect at the time of heating for more pleasant air conditioning.

Still a further object of this invention is so constructed to be fixed and used by minimizing both the occupancy within effective space and the injure of the
25 fine appearance of a room.

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Other objects and advantages of the invention will become apparent from the following description.

Brief Description of the Invention

Fig. 1 is a perspective view of a whole appearance
5 of a room air circulating apparatus according to this invention;

Fig. 2 is a vertically sectional side view;

Fig. 3 is a vertically sectional rear elevation taken
on line III - III of Fig. 2;

10 Fig. 4 A is a schematic side elevational view illustrating the flow of room air when an apparatus according to the invention is employed for heating;

Fig. 4 B is a schematic side elevational view illustrating the flow of room air when an apparatus
15 according to the invention is employed for cooling;

Fig. 5 is a plan view of an experiment room where a room air circulating apparatus according to the invention is employed;

Figs. 6 to 13 inclusive are graphs showing temperature
20 variation of each parts of the room to be measured at each experiment;

Figs. 14 A,B and 15 A,B are temperature distribution views of longitudinal section of the experiment room;

Figs. 15 A,B and 17 A,B are plan views illustrating
25 an air current of the experiment room;

Figs. 18 to 20 inclusive are temperature distribution views when a floor type of a package air conditioner is solely employed for heating;

5 Figs. 21 and 22 are temperature distribution views when a hanging type of a package air conditioner is solely employed for heating;

Fig. 23 is a view of an air current in a condition the same as above;

10 Figs. 24 A,B are temperature distribution views when a floor type of a package air conditioner is solely employed for cooling;

Fig. 25 is a plan view of the experiment room when a hanging type of a package air conditioner is solely used for cooling;

15 Figs. 26 A,B, and C are temperature distribution views of longitudinal section of the experiment room for cooling in a condition the same as above;

20 Figs. 27 to 29 inclusive are all schematic vertically sectional side views according to another embodiments respectively;

Fig. 30 is a block diagram illustrating the control of the room air circulating apparatus in Fig. 29;

Fig. 31 is a schematic elevational view illustrating the employment of the apparatus shown in Fig. 29; and
25 Figs. 32 and 33 are schematic vertically sectional side

views of employment according to another embodiments respectively.

Detailed Description of the Preferred Embodiment

Preferred embodiments of this invention will be hereinafter described.

Referring to Figs. 1 to 3 inclusive, (1) is a hollow case in a box shape approximately 1,900 (mm) in whole height, about 600 (mm) in width, and about 250 (mm) in depth so constructed as to stand by itself on the floor.

At the upper and the lower ends of a front plate(2) of the case(1), suction gates (3), (3') are formed which may inhale room air both at the upper and the lower parts near ceiling and floor respectively in a room along a horizontal or nearly a horizontal plane. Rotary dampers (4),(4')are provided with said suction gates (3), (3') at both levels respectively which are so constructed as to open or close alternatively by means of opening and closing of the rotary dampers (4), (4'). At nearly upper end of the front plate(2) of the case(1), a spout gate (7) of room air is formed with blades(5) and (6) for changing air directions in respects of length and width. A fan (8) for inhaling and exhaling to be built in the case(1) comprises two multiblade fans(8A),(8B)laid at the upper and the lower ends of the case(1) respectively.

An inhale flue(9) is so formed at the rear of the inside

of the case (1) as to connect said two suction gates (3),
(3') at both ends and inhale gates (8a), (8b) at the
center of the rotation of said two multiblade fans (8A),
(8B). Exhale gates(10A),(10B) are so formed as to connect
5 spout gates (8a'), (8b') of said two multiblade fans
(8A),(8B) and said spout gate(7) alternately by means of
a diaphragm(11). Electric motors (12A), (12B) for driving
said two multiblade fans (8A),(8B) are so connected with
a controller as to stop operation automatically and
10 reversibly when the temperature of room air to be inhaled
from said gate (3)or (3') reaches the determined value.
Since the electric motors are constructed in a very
generally matter to omit the description thereof. (13)
illustrates an operation switch.

15 A general embodiment of a room air circulating
apparatus (shown as S.C. in Figures) being constructed
in the manner mentioned above is employed standing by
itself either at the side or the rear of a floor type
package air conditioner (shown as A.C. in Figures)
20 according to Figs. 4A, B in either case of heating or
cooling.

In case of heating by means of the multiblade fans
(8A),(8B) being employed in synchronism with the package
air conditioner (A.C.) to be employed with the upper
25 end damper (4) to be closed and the lower end damper(4')

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to be open, room air at the lower zone than the intake zone of the package air conditioner (A.C.) is inhaled from the suction gate(3') along a horizontal or nearly a horizontal plane, and the inhaled room air is blown to
5 a room from said spout gate(7) slightly upward according to solid lines in Fig. 2 and double lines in Fig. 4A. In case of cooling, by means of the employment in the same manner as mentioned above with the upper end damper(4) to be open and the lower end damper(4') to be closed,
10 room air at the higher zone than the cool air exhale zone from the package air conditioner (A.C.) is inhaled from the suction gate(3) along a horizontal or nearly a horizontal plane, and the inhaled room air is exhaled to a room from said exhale gate(7) slightly upward
15 according to chain lines in Fig. 2 and double lines in Fig. 4B.

Both in heating and cooling cases, by means of setting the angle at which warm or cool air is exhaled from the package air conditioner(A.C.), the mixed air
20 to be generated by mixture of the warm or cool air exhaled from the package air conditioner (A.C.) and the air blown from the room air circulating apparatus can be largely circulated in a room, actualizing heating or cooling with little temperature variation.

25 Another embodiment will be hereinafter described in

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the manner to be employed together with stoves and the like mentioned before at the time of heating, though figures illustrating thereof are omitted. In this embodiment, the mixed air to be generated by mixture of
5 inhaled cool air near the floor to be blown at stagnant hot air near the ceiling can be largely circulated in a room in the same manner as mentioned above, actualizing temperature increase in a whole room.

A further embodiment will be hereinafter described
10 by means of the sole employment of the circulating apparatus in spring and autumn when there is no need of heating and cooling, generating proper amount of a current around a human body so as to give a pleasant feeling suitably.

15 In the above-mentioned embodiment, since two multiblade fans(8A),(8B) used at the both ends as a fan(8) for inhaling and exhaling provide such advantages as to narrow the width in the direction of the shaft line of the fan compared with the use of a single fan used for
20 supplying the necessary quantity fo inhaled or exhaled air (the quantity of the air to be bolwn), thereby a thinner and smaller apparatus as a whole is constructed leading to preventing the increase of the occupancy space due to the joint employment with a conventional
25 package air conditioner. Referring to Fig. 27 illustrating

a modified embodiment by means of two fans, in the above-mentioned embodiment, it may be so constructed that the room air may be inhaled from the suction gate(3') at the lower end and exhaled into a room from the spout gate(7) by omitting the suction gate(3) at the upper end. This embodiment is particularly aimed at a high-ceiled room, where hot air stagnating further higher level than the dwelling zone does not influence a cooling effect very much so that air is left without being circulated.

10 The second embodiment to be hereinafter described structurally differentiates from the first embodiment in respects to be described hereinafter, but it is almost identical in its function. The explanation of the identical parts of the two embodiments are omitted by 15 that the identical symbols being used.

Referring to Fig. 28, the second embodiment differentiates from the first embodiment in that a single fan(8) for inhaling and exhaling is equipped inside the case(1) at the immediate rear of the spout 20 gate (7) and that a humidifying device(16) which is surrounded by an endless belt made of the material with such properties as waterproof and permeability with unrestrictedly driving rotation through a motor(24) and a transmission belt(25) at the position between a water 25 tank(14) as which the absence of said case(1) is so

constructed and an inahle flue(9) of the air from said suction gate(3') at the lower end.

The second embodiment is employed through almost the same circualtion illustrated by solid and chain lines
5 at the time of heating and cooling as the operation of the first embodiment. Flowing through the endless belt (15), the room air inhaled from said gate(3') is humidified by absorbing moisture kept at the endless belt(15) then additionally the humidified air being
10 exhaled into a room and diffused by the circulation of the mixed air presents such advantages as to maintain the humidity of the room appropriately and produce a heating effect more pleasantly.

Referring to Figs. 29 and 30 illustrating the third
15 embodiment presenting the almost same construction as the second embodiment, comprises a sensor(17) for detecting the temperature of the room air to be inahled from said sauction gate (3) and a controller(19) for automatically controlling the revolving speed of a single fan(8) and
20 the electric motor(12) corresponding to the temperature detected by the sensor(17) so taht the temperature of the room air can be maintained in the determined range to be set by a device(18) for determining temperature. According to the third embodiment, pleasantly heating
25 by uniformalized and suitable room temperature realizes

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pleasant heating as expected , while electric power loss can be reduced by means of elimianting unnecessary room air circualtion.

Rererring to Fig. illustrating the third embodiment,
5 the floor type of package air conditioner (A.C.) to be employed jointly comprises mechanism of both a fan motor (20) and a compressor(21) to be electrically connected with said controller(19) of the apparatus (S.C.) so taht this apparatus (S.C.) and the package air conditioner
10 are controlled synchronously, as a result of which the room temperature can be uniformalized more effectively. (26) of Fig. 31 shows a device for opening and closing electromagnetically.

Referring to Fig. 32 illustrating the fourth
15 embodiment, said hollow case in a box shape is so constructed as to be fixed outside of a wall(21) of a building outdoors therein pipes(3A),(3A'), and(7A) are laid continuously in the wall(21) and permitting said suction gates(3), (3')of both ends and said spout gate(7)
20 to be open in a room in above-mentioned condition. Though the embodiment of a single fan(8) is shown, two fans can be employed.

The fourth embodiment presents practical effects by offsetting such disadvantages as deteriorating the
25 space utilization rate or injuring the fine appearance of

the room by means of the case(1) to be employed outdoors. In the fourth embodiment, a gate(23) for inhaling outside air provided with a damper(22) for opening and closing can be formed near the position of the intake gate(8a) of the fan(8) on the rear wall of the case(1) as shown in Fig. 33. In this case, by means of taking in fresh air at the time of air circulation when the necessity rises, ventilation is executed at the same time which permits the apparatus to be effectively employed for the exclusive use of ventilation in spring and autumn.

The case (1) can be so constructed as to be built in though no drawing is shown thereof.

In the fourth embodiment, the case(1) can be so constructed as to stand by itself at a veranda or on the ground.

While different embodiments of this invention have been described, the result of an experiment actually conducted by an inventor by means of employing the room air circulating apparatus as shown by the first embodiment will be hereinafter reported.

(1) Method of the Experiment

a. an object room of the experiment

Referring to Fig. 5 in a room of plane shape about 10.5m x 10.5m x 2.9m in length x width x height respectively (floor area 110.25m², capacity 319.7m³) where office

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desks(d), counters(c), cabinets(k), a set of a table and chairs for reception(s), and chairs(ch) are arranged as illustrated, room temperatures at the points of A to G inclusive are measured in a condition of actual business performances.

5

b. specification of a package air conditioner

total input: 3.3/10KW

compressor: 5.5KW

blowing apparatus: two Sirrocco fans

10

air quantity: 62/70m³/minute

height: 1,335 depth: 505 width: 1,300

height of suction gate: 800

height of spout gate: 1,800(mm)

c. the points of temperature recording

15

recorder to be employed: digital temperature

recorder Model 3874 manufactured by Yokogawa

Electric Works, Ltd.

points to be measured

Table 1

20

NO.	point to be measured
00	outside air
01	top of A (2.5m higher than the floor level)
02	middle of A (1.5m higher than the floor level)
03	bottom of A (0.2m higher than the floor level)
04	top of A (2.5m higher than the floor level)

25

	NO	points to be measured
	05	middle of B (1.5m higher than the floor level)
	06	bottom of B (0.2m higher than the floor level)
	07	top of C (2.5m higher than the floor level)
5	08	middle of C (1.5m higher than the floor level)
	09	bottom of C (0.2m higher than the floor level)
	10	top of D (2.5m higher than the floor level)
	11	middle of D (1.5m higher than the floor level)
	12	bottom of D (0.2m higher than the floor level)
10	13	top of E (2.5m higher than the floor level)
	14	middle of E (1.5m higher than the floor level)
	15	bottom of E (0.2m higher than the floor level)
	16	middle of F (1.5m higher than the floor level)
	17	bottom of F (0.2m higher than the floor level)
15	18	middle of G (1.5m higher than the floor level)
	19	bottom of G (0.2m higher than the floor level)
	20	spout gate of the apparatus (2.0m higher than the floor level)
	21	spout gate of the air conditioner (1.3m higher than the floor level)
20	22	suction gate of the air conditioner (0.3m higher than the floor level)
	23	spout gate of the apparatus (0.3m higher than the floor level)
25	methods of record measurement	

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8:20 - 11:50 The air conditioner is solely used.

11:53 - 18:00 The apparatus is used jointly.

a. measurement of the velocity

The velocity and the direction of air at the points
5 00 to 21 inclusive in the above Table I

(2) Result of the Experiment

a. Figs. 7 to 13 inclusive show the room
temperature variation at the measured points A to G, and
Fig. 6 shows the temperature variation of outside air, the
10 suction gate and the spout gate of the air conditioner
(A.C.) and the apparatus (S.C.) respectively, resulting
hereinafter;

Since after the joint employment, the temperature
at the suction gate of the air conditioner drops about
15 10°C, and slight increase as a whole after fluctuation
is shown at the spout gate.

Since after the joint employment, the temperature
at the high and middle part of the points A to D inclusive
reduces about 2°C to 4°C while the temperature at the
20 low part increases 3°C to 9°C. At the points F and G
near the air conditioner, the temperature variation at
the middle part is modest and about 4°C increase is shown
at the low part. The remarkable decrease and increase
of temperature are shown at the top part and the bottom
25 part respectively at the points A, C, C, D, which are farther

from the air conditioner.

b. Referring to Figs. 14 A,B of views of sectional temperature distribution at the points C-D, and referring to Figs. 15 A,B of views of sectional temperature
5 distribution at the measured points B-F-G-D, when the air conditioner is solely employed and the apparatus is jointly used respectively, the result thereof is that room temperature near the floor at the almost whole frontage is 20°C or higher in case of joint employment
10 with the increase of about 5°C to 10°C, while the temperature near the ceiling drops about 5°C compared with the sole employment.

c. Referring to Figs. 16A and 17A illustrating the currents at 1.5m and 2.5m higher than the floor level
15 respectively when the air conditioner is solely used, while referring to Figs. 16B and 17B illustrating the current respectively of the above-mentioned heights when the apparatus is jointly employed, which results in hereinafter;

20 The velocity at the time of joint employment is twice as much as the case of sole employment, resulting in the circulation of the air in large quantity.

The current at the left of the position of the air conditioner largely moves counterclockwise, while at
25 the right the air exhaled to the ceiling circulated

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with large velocity, which permits cool air in large quantity at the lower level to be inhaled into the suction gate at the lower end of the apparatus.

5 Though the velocity near the ceiling is high, at the level where the air touches a human body the velocity is relatively low and gives little impact by the blast air hitting directly.

10 As the results of the experiment have been described by a to c herein, the effect of presenting the little temperature variation between the upper and the lower levels of a room and a very pleasant heated space according to this invention is sufficiently supported.

15 In case of cooling, when the circulation is generated by means of inhaling and mixing the warm air near the ceiling with the blast air, it is clearly understood that room temperature can be effectively uniformized almost the same as the case of heating, although the detailed description of the results of the experimnts if herein omitted.

Claim for Patent:

1. A room air circulating apparatus for inhaling room air and exhaling the inhaled room air in a room comprising;
a hollow case in a box shape provided with an inhale
5 gate for room air at least at a lower end of either
an upper end or a lower end of the hollow case,
a spout gate provided at an upper part of said hollow
case in a box shape for exhaling inhaled air to a room,
and
10 a fan being built in said hollow case in a box shape
for inhaling and exhaling air.

2. The room air circulating apparatus as claimed in claim 1 wherein the inhale gates are formed at the both upper and lower ends of said case and the two inhale gates are constructed for opening and closing alternately.

3. The room air circulating apparatus as claimed in claim 1 wherein said fan is provided at the both upper and lower ends in said case.

4. The room air circulating apparatus as claimed in claim 1 further comprising a humidifying device built in said hollow case in a box shape near said inhaled gate.

5. The room air circulating apparatus as claimed in claim 1 further comprising a sensor for detecting temperature of room air inhaled from the inhale gate and a controller for controlling performance of said fan corresponding to temperature detected by the sensor for maintaining room air temperature in the determined range.

6. The room air circulating apparatus as claimed in claim 1 wherein said hollow case in a box shape is constructed for being located outside a building while communicating with the interior of the building.

5

7. A room air circulating apparatus comprising a box shaped hollow case having an air inlet at a lower end portion of the case, an air outlet at an upper region of the case, and a fan within the case to drive
10 air from the inlet to the outlet.

8. A room of a building having means for heating or cooling the room, and in addition thereto a room air circulating apparatus according to any one of the
15 preceding claims.

Fig. 1

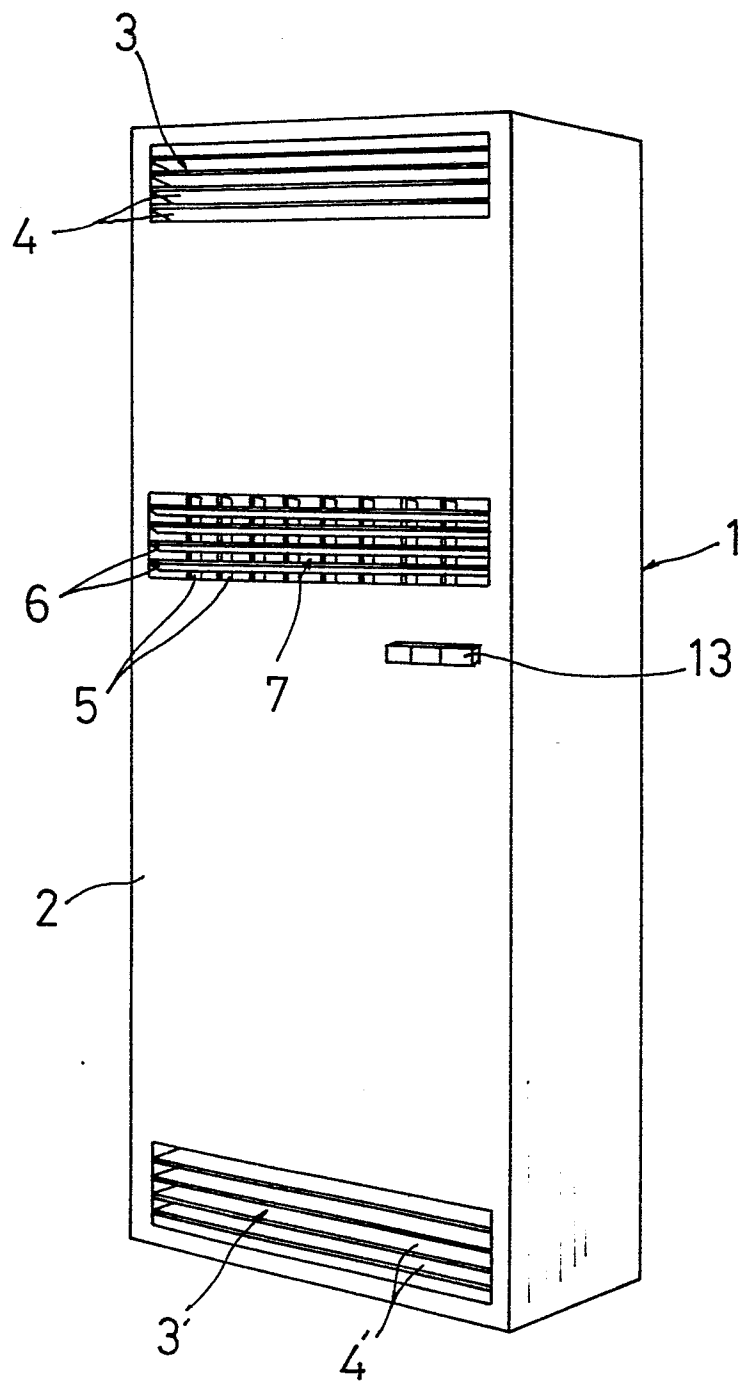


Fig. 2

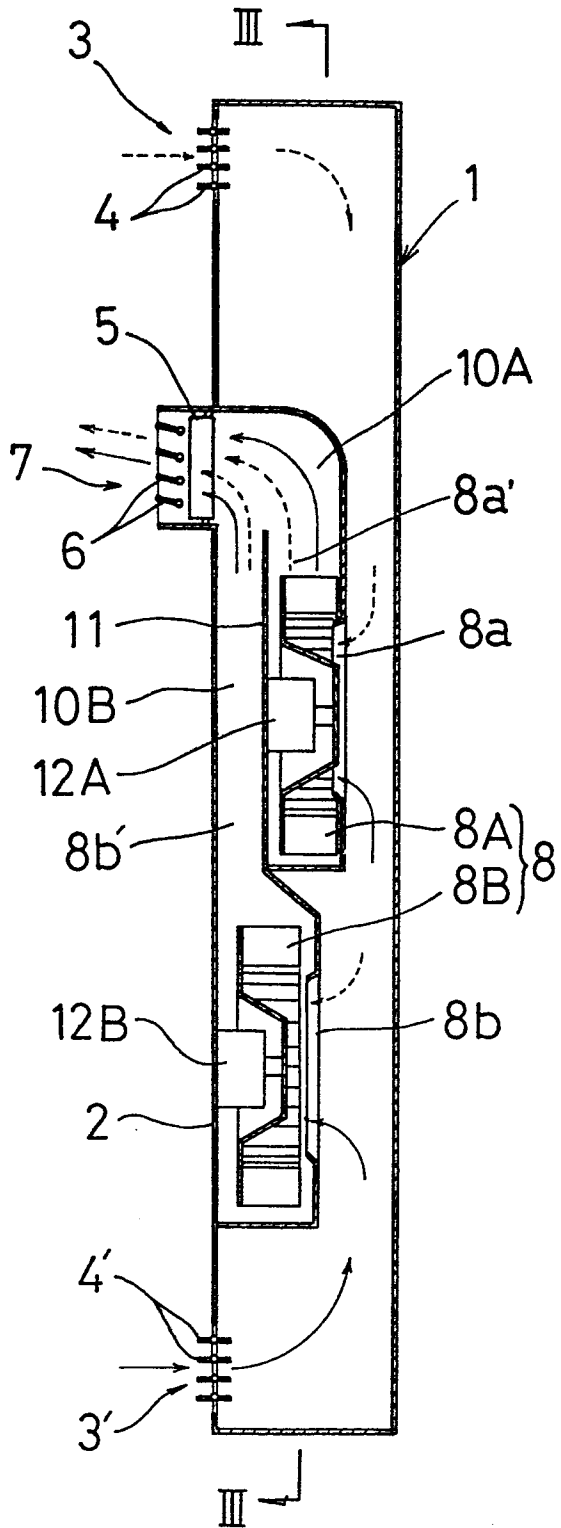


Fig. 3

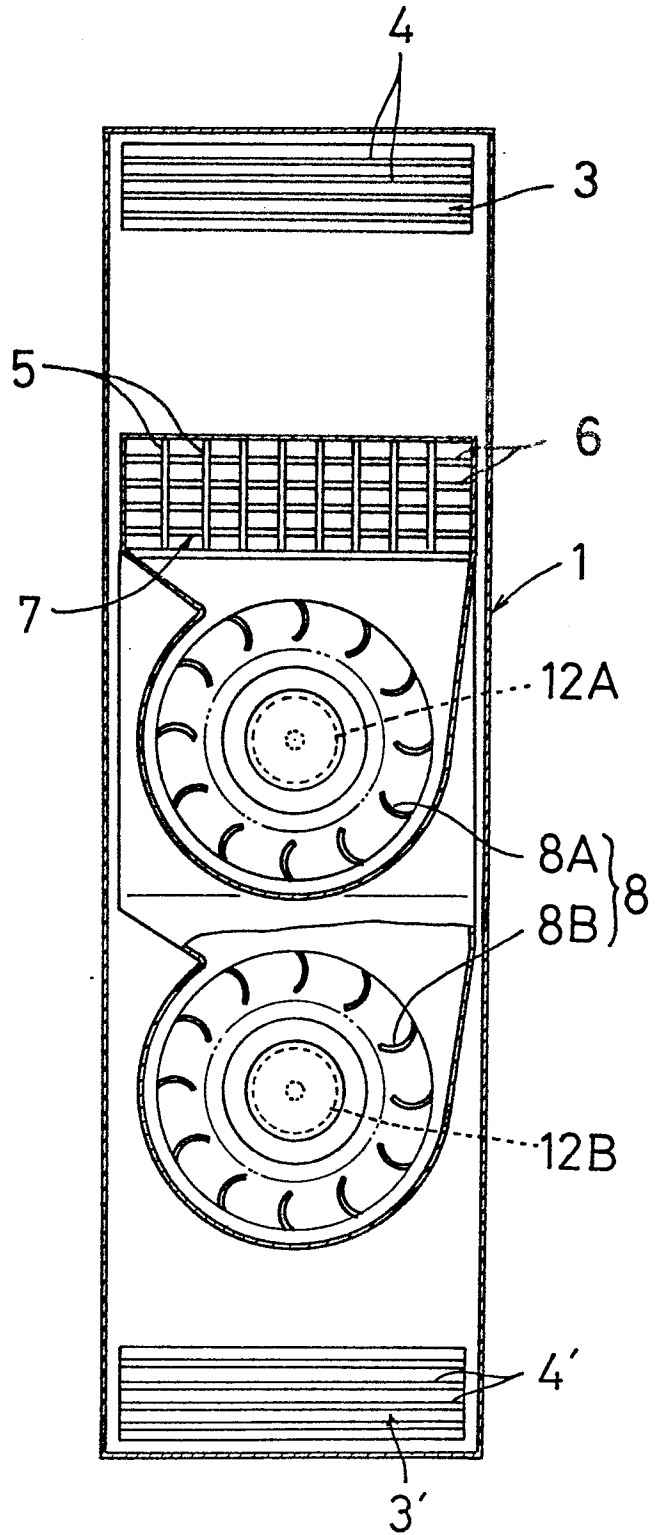


Fig. 6

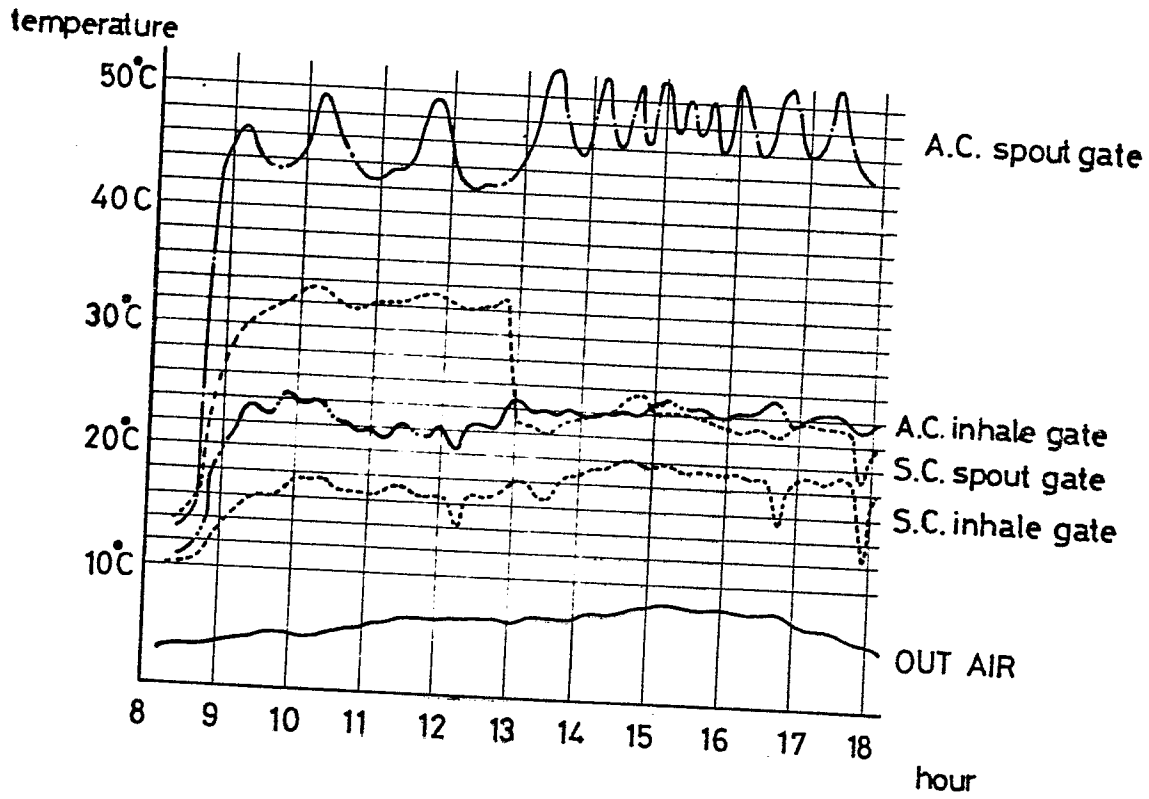


Fig. 7

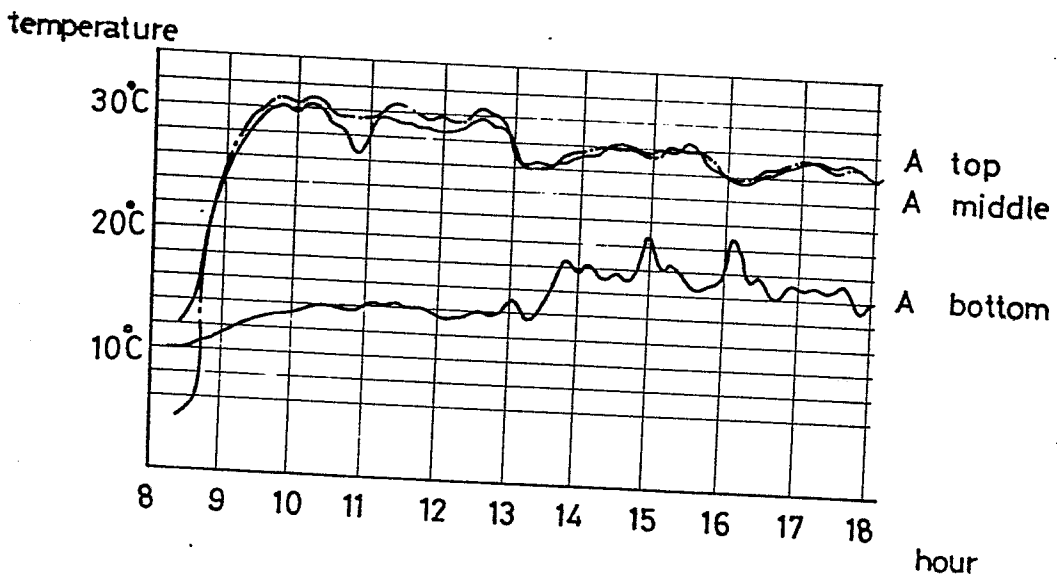


Fig. 8

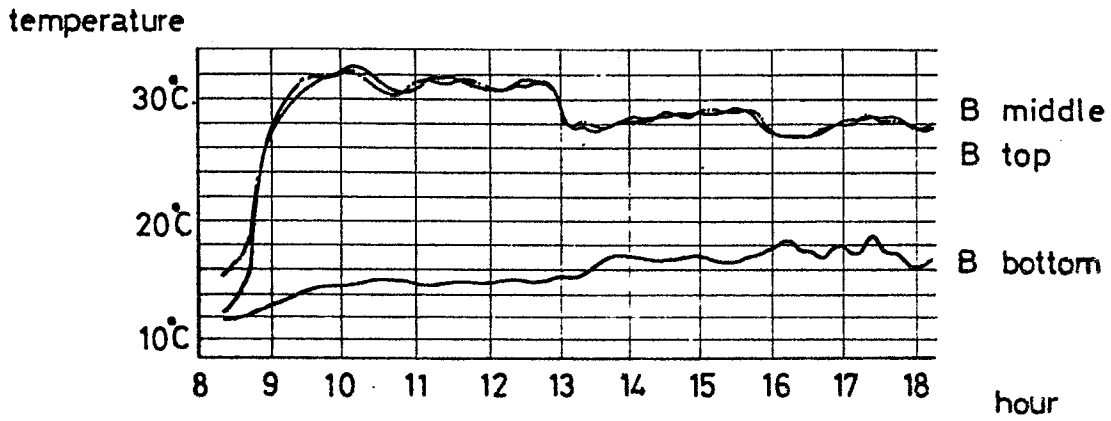


Fig. 9

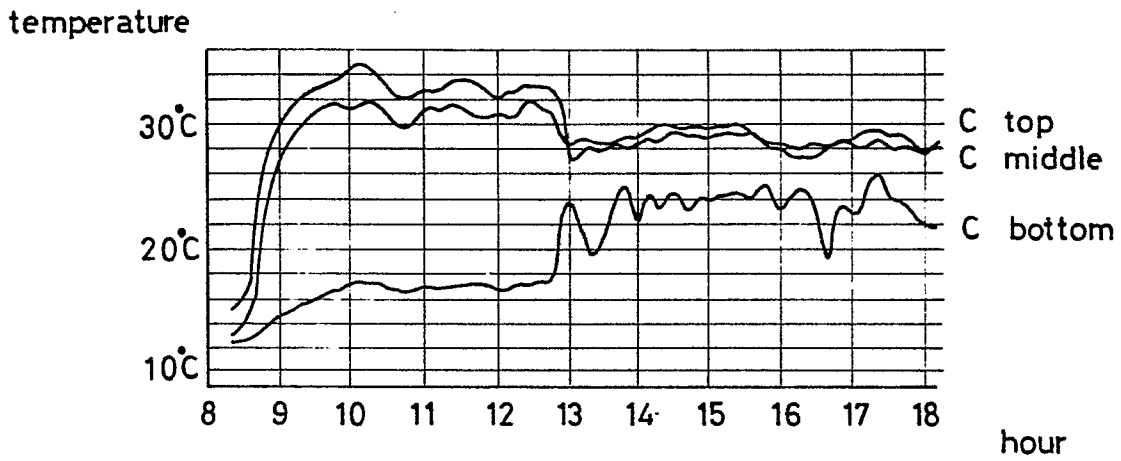


Fig. 10

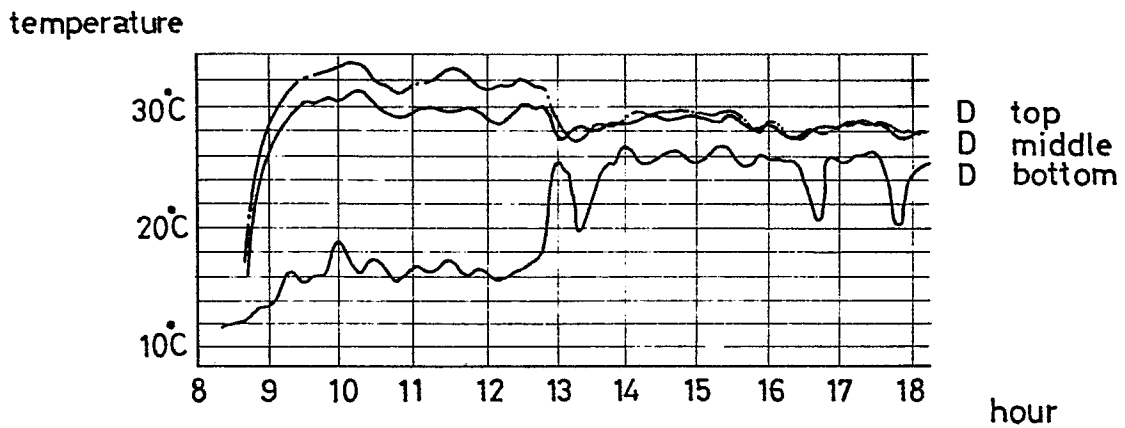


Fig. 11

temperature

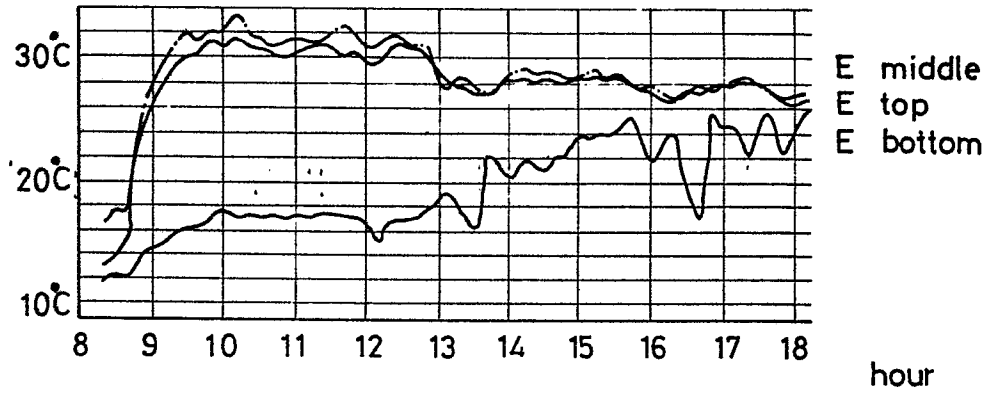


Fig. 12

temperature

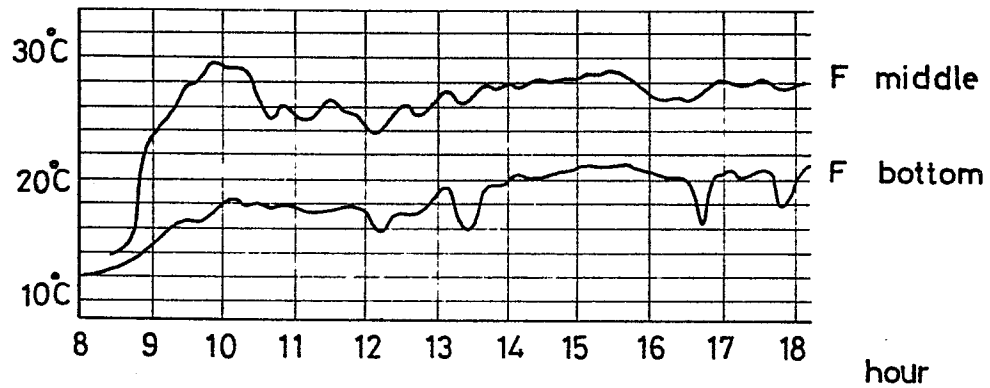


Fig. 13

temperature

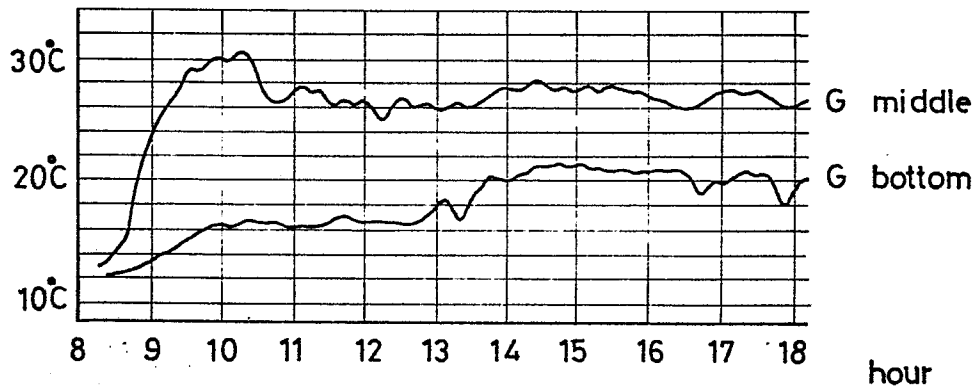


Fig. 14A

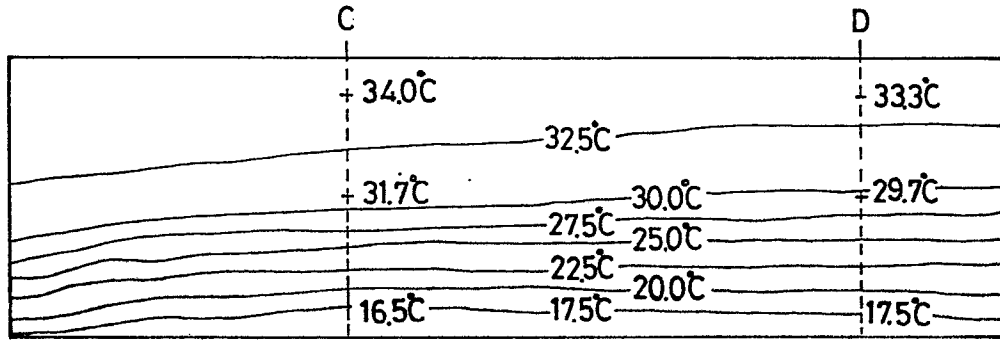


Fig. 14B

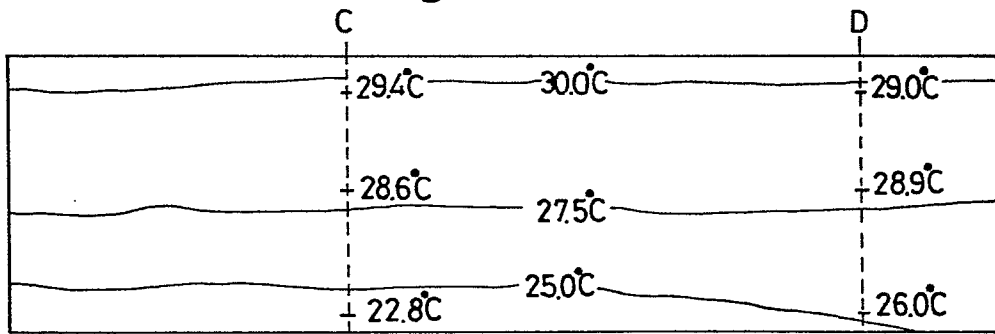


Fig. 15A

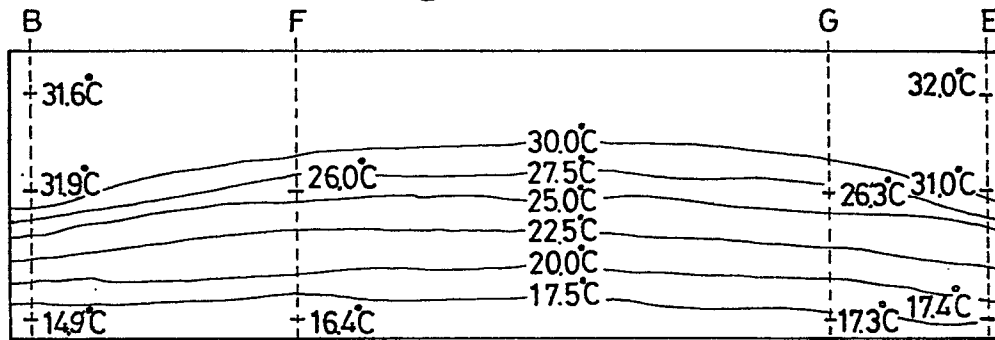


Fig. 15B

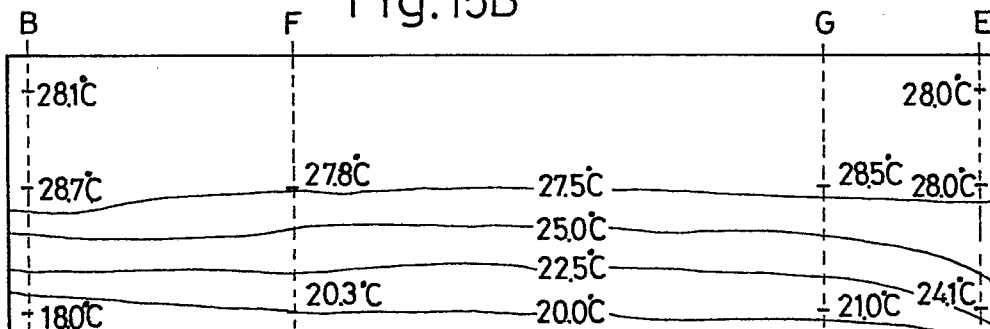


Fig. 18

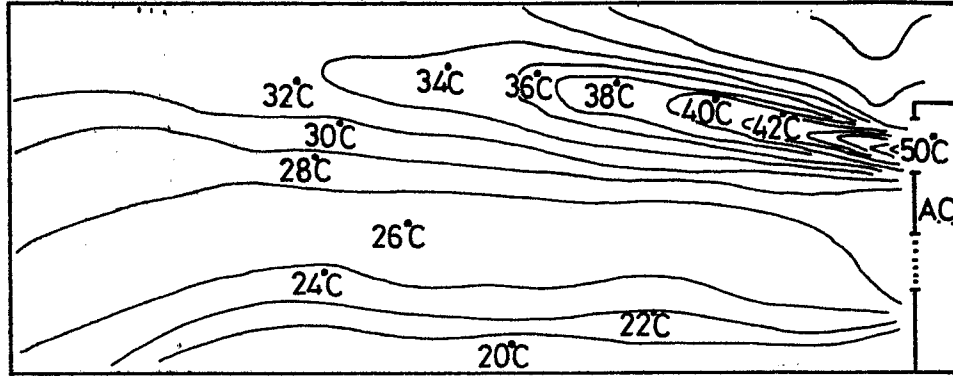


Fig. 19

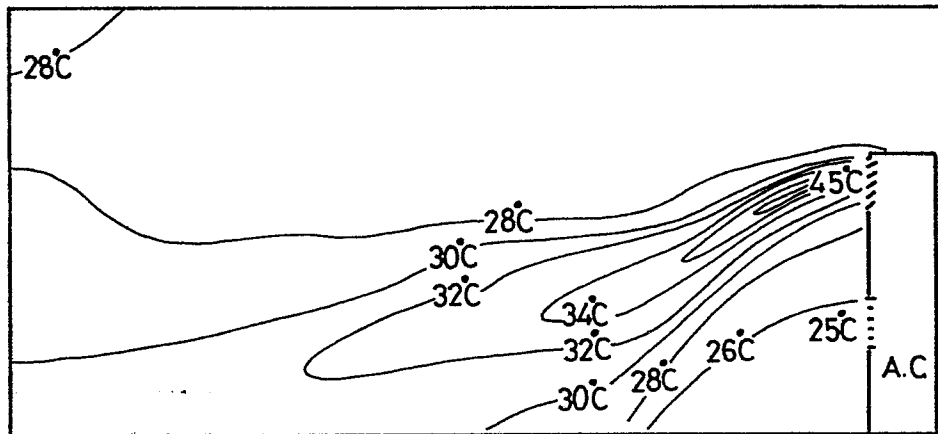


Fig. 20

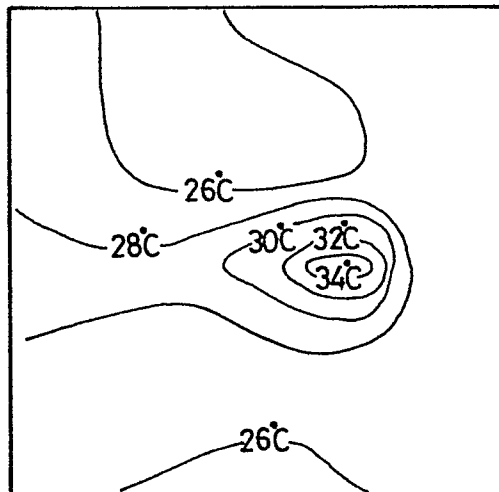


Fig. 21.

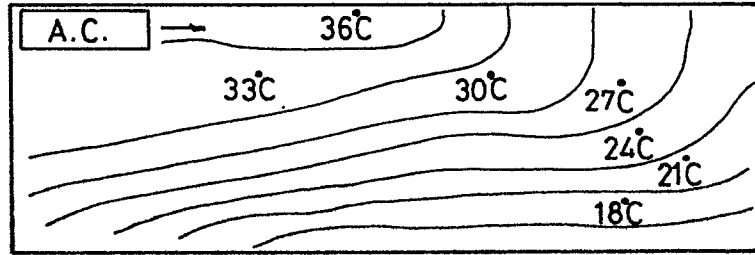


Fig. 22

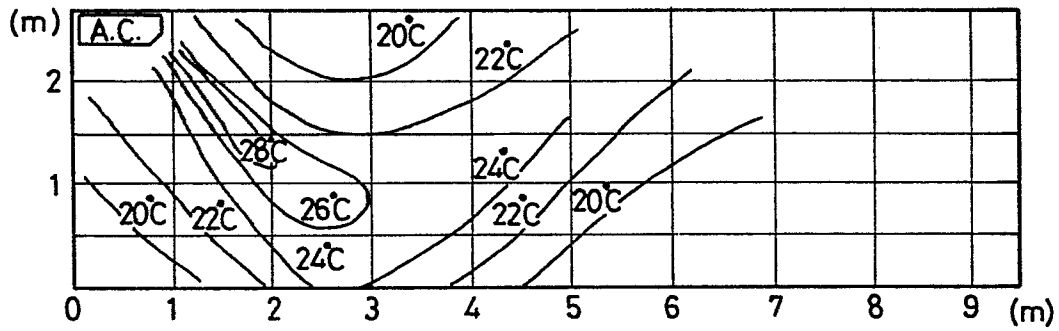


Fig. 23

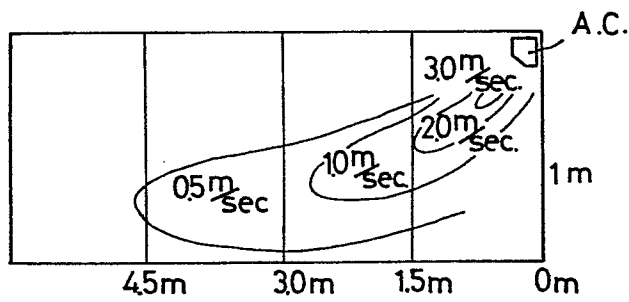


Fig. 24A

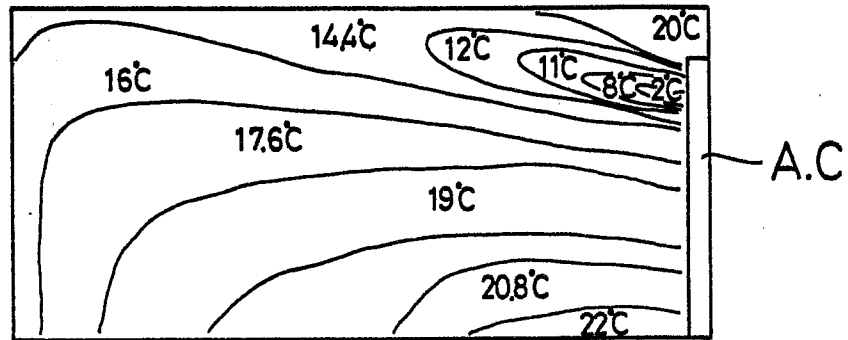


Fig. 24B

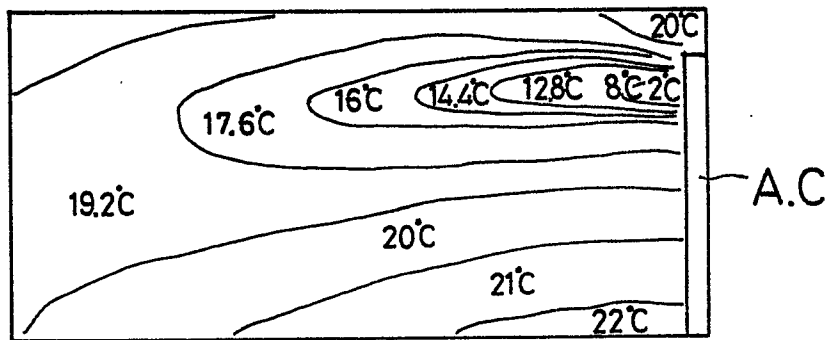


Fig. 25

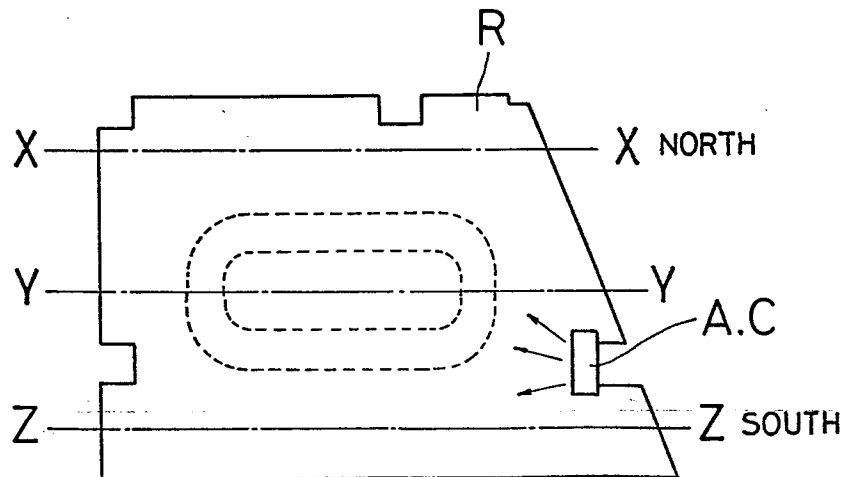


Fig. 26A

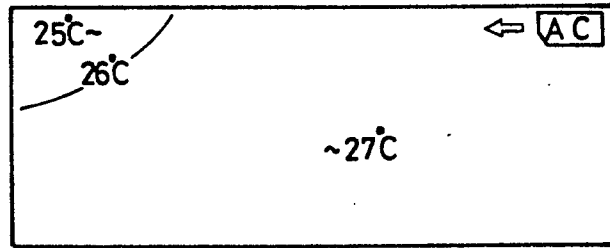


Fig. 26B

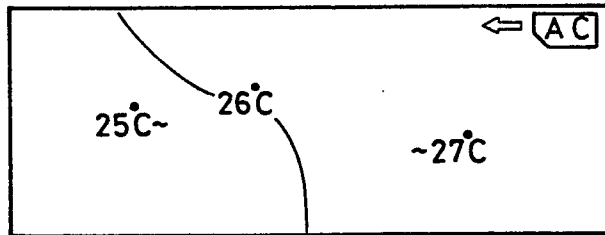


Fig. 26C

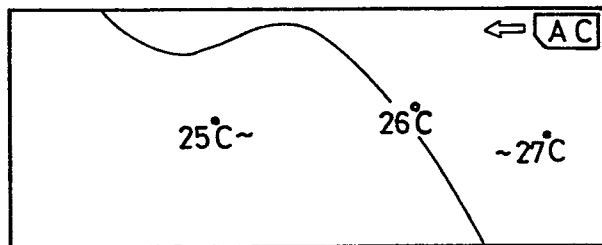


Fig. 27

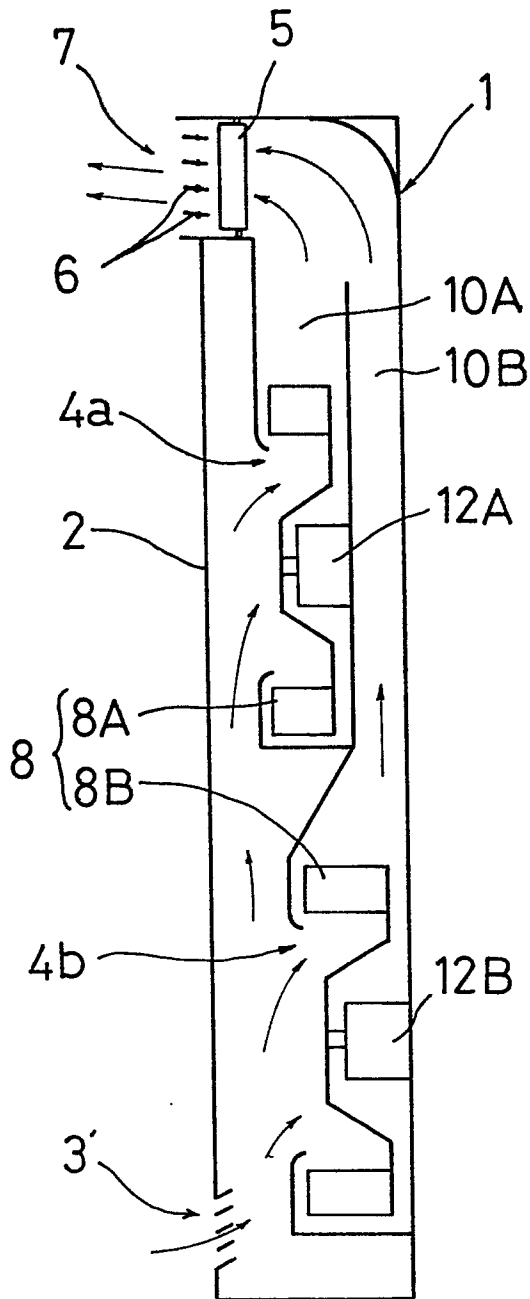


Fig. 28

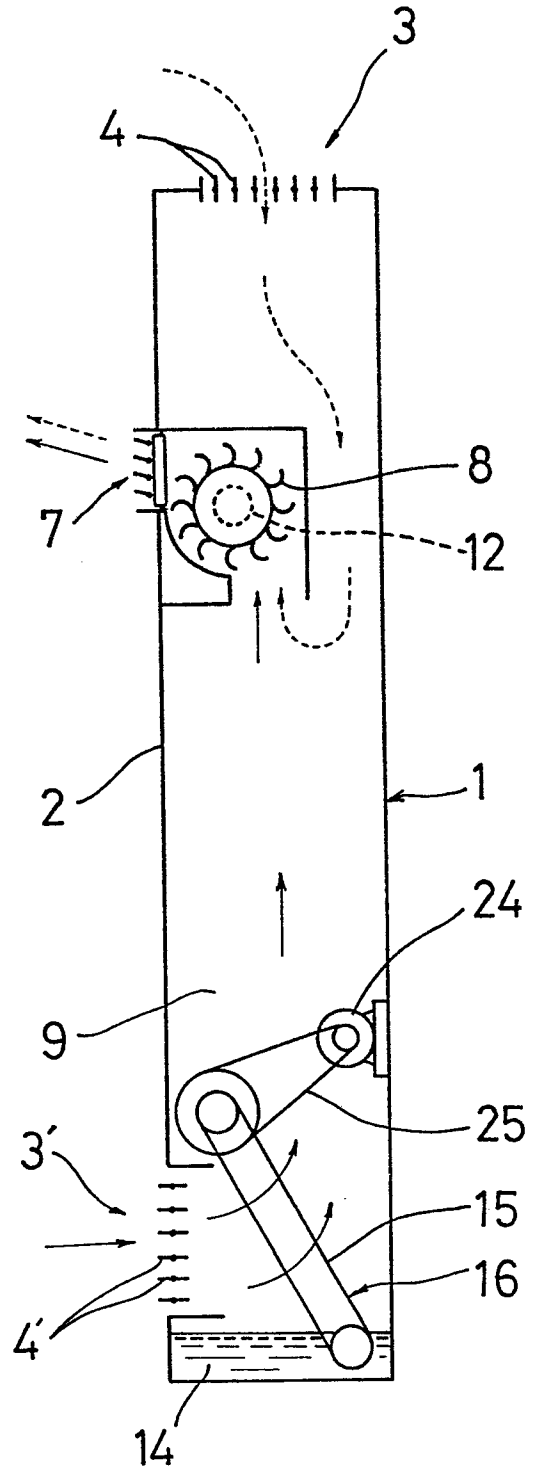


Fig. 29

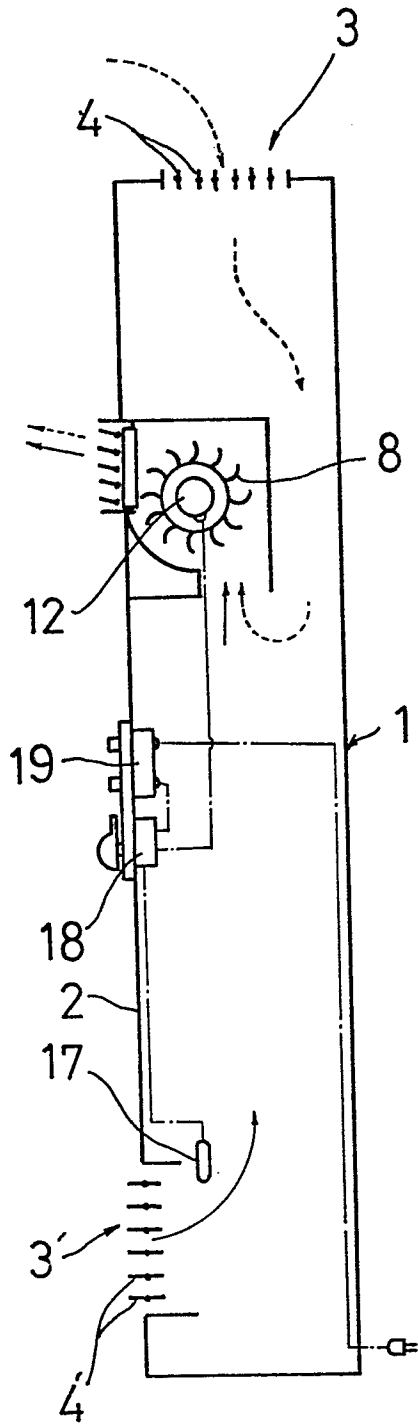


Fig. 30

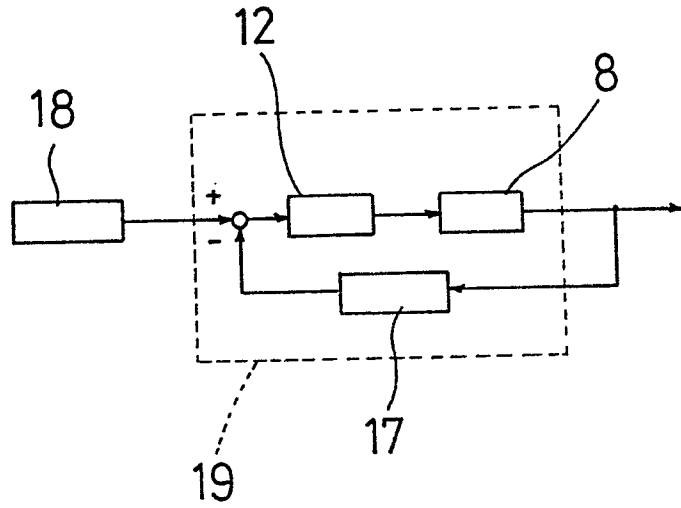


Fig. 31

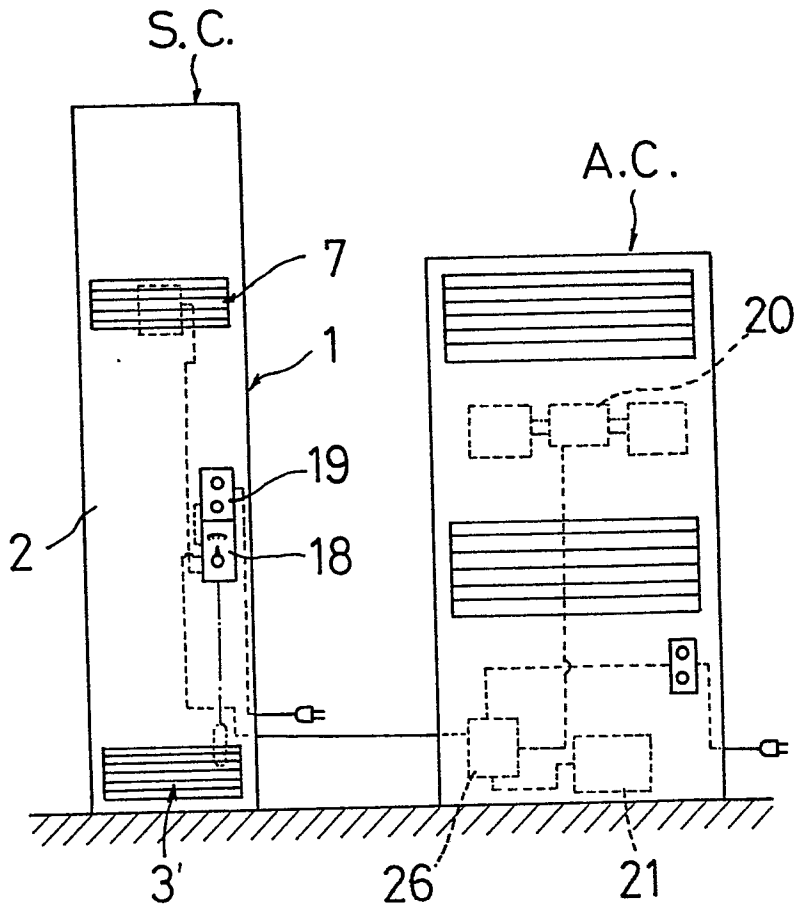


Fig. 32

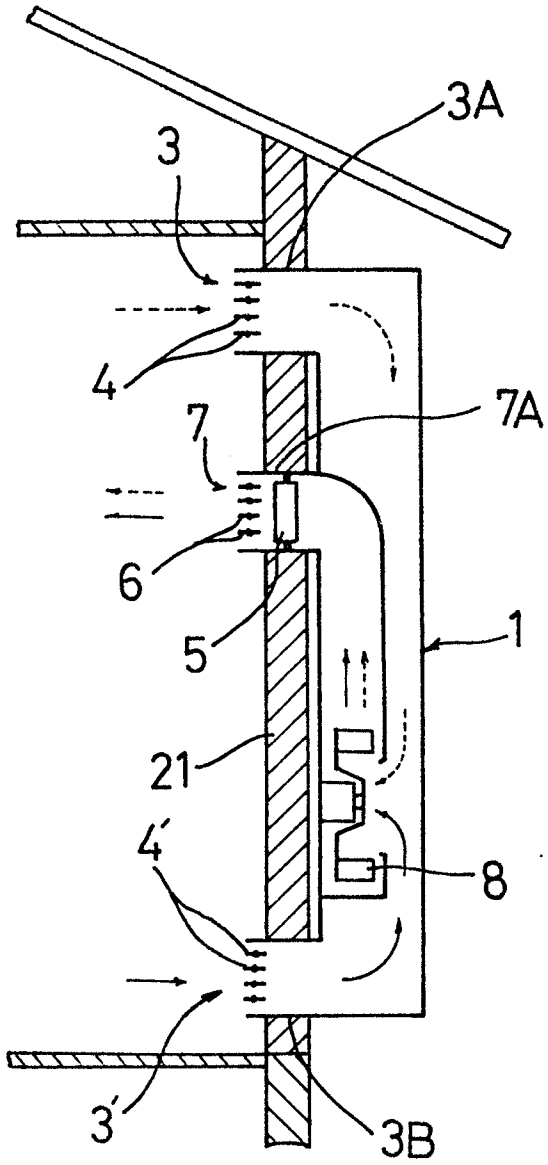


Fig. 33

