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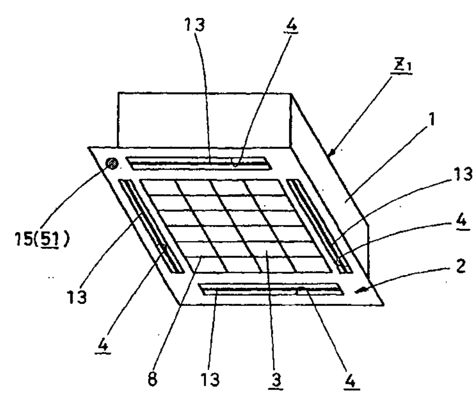
(54) AIR CONDITIONER

(57) An indoor unit **(Z_1)** has a casing **(1)** which is embedded or suspended in/from a ceiling **(50),** and an indoor panel **(2)** which is provided on a lower side of the casing **(1)** and installed in an indoor exposed state. The indoor panel (**2**) is provided with an air inlet (**3**), a plurality of air outlets (**4**) which surround the air inlet (**3**) in a rectangular shape and have a rectangular shape. An infrared sensor (**15**) is provided on an exposed portion of the indoor panel **(2).** The indoor unit **(Z_1)** further has an airflow changing unit **(52)** for changing characteristics of airflow blown out from each of the air outlets **(4),** and a control unit (**53**) for controlling the airflow changing unit (**52**) based on output information of the infrared sensor (**15**).

Fig. 1



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Description

TECHNICAL FIELD

[0001] The present invention relates to an air conditioner installed in a state that it is embedded in a ceiling or it is suspended from the ceiling.

BACKGROUND ART

[0002] Conventionally, in the case where air is conditioned in a building having a comparatively wide air conditioning space such as a store, a restaurant or an office, a ceiling-embedded type or a ceiling suspended type indoor unit is generally installed on a ceiling side of the air conditioning space.

[0003] However, in the case where air is conditioned in the wide air conditioning space by the ceiling-embedded type or ceiling-suspended type indoor unit, there arises the following problem. Namely, an airflow is conventionally blown uniformly from air outlets of the indoor unit without considering air conditioning conditions such as a heat load distribution or a people distribution. For this reason, an indoor temperature has irregularity and an area with inferior comfortability where people feel a sense of draft occasionally exists. Moreover, since air is conditioned similarly in an area where people exist and in an area where people do not exist, energy saving characteristics are occasionally deteriorated. Further, even though the heat load distribution changes with time due to conditions such as seasons, time and a number of people in the room, there are many cases that an operation is always performed under a single condition. As a result, the energy-saving characteristics are deteriorated by useless air conditioning.

[0004] In order to improve such conventional problems, there suggests a technique for detecting, for example, the indoor heat load distribution, people distribution and the like and adjusting characteristics of a blowout airflow from air outlets of an indoor unit based on the detected information. For example, there suggests a technique for suitably controlling a blowout air capacity, a blowout temperature, a blowout speed, a blowout direction and the like so as to always condition air comfortably and with energy saving characteristics (for example, see Japanese Patent Application Laid-Open Nos. 5-203244 (1993) and 5-306829 (1993)). Moreover, as detecting means of a heat load distribution or the like, a technique using an infrared sensor (for example, Japanese Patent Application Publication No. 5-20659 (1993) or the like is suggested.

[0005] However, the above conventional techniques are considered to fulfill a required function academically and produce a predetermined effect, but their technical contents are not concrete nor realistic, and thus actually they have not been yet put into a practical use. For this reason, these techniques are strongly demanded to be established and actualized early.

DISCLOSURE OF THE INVENTION

[0006] Therefore, in order to reconcile comfortability with energy saving characteristics, an object of the present invention is to suggest an air conditioner having a detecting unit of a heat load or the like, an airflow changing unit for changing characteristics of blowout airflow and a control unit of the airflow changing unit in a concrete and realistic form and facilitate its practical use.

[0007] A first air conditioner includes: a casing embedded or suspended in/from a ceiling; an indoor panel provided on a lower side of the casing, the indoor panel being provided with an air inlet and a plurality of air outlets, the air outlets surrounding a rectangular periphery of the air inlet and each having a rectangular shape, the indoor panel being installed in a state of being exposed to a room; an infrared sensor provided on an exposed portion of the indoor panel; an airflow changing unit for changing characteristics of an airflow blown out from each of the air outlets; and a control unit for controlling the airflow changing unit based on output information from infrared sensor.

[0008] In a second air conditioner according to the first air conditioner, the infrared sensor is provided between the air outlets.

[0009] In a third air conditioner according to the first air conditioner, the infrared sensor is provided on a periphery edge of the air outlet.

[0010] A fourth air conditioner according to the first air conditioner includes a scanning mechanism for scanning the infrared sensor.

[0011] In a fifth air conditioner according to the first air conditioner, a plurality of the infrared sensors are provided correspondingly to the air outlets, the infrared sensors are non-scanning type infrared sensors for detecting their respective constant ranges as an object to be detected.

[0012] In a sixth air conditioner according to the first air conditioner, a plurality of temperature sensors or temperature/humidity sensors are provided in vicinities of the air outlets on the indoor panel or in an inside portion of the air inlet in the casing.

[0013] A seventh air conditioner according to the sixth air conditioner includes: a scanning mechanism for scanning the infrared sensor; a judging unit for calculating a heat load based on output information from the temperature sensors or temperature/humidity sensors and judging whether the heat load is not less than a predetermined load for each of the temperature sensors or temperature/humidity sensors; and a stopping unit for, when the judgment is made that the heat load is not less than the predetermined load in a not less than predetermined proportion of the temperature sensors or temperature/humidity sensors, stopping an operation of the scanning mechanism.

[0014] An eighth air conditioner according to the sixth air conditioner includes a correcting unit for anticipating a temperature of an object in a blowout direction of an airflow from the air outlets based on the output information from the temperature sensors or temperature/humidity sensors and correcting a detected temperature of the infrared sensor based on the anticipated object temperature.

[0015] In a ninth air conditioner according to the sixth air conditioner, the infrared sensor detects a position of a person in a room and the temperature sensors or temperature/humidity sensors detect a temperature of a sucked air from the room.

[0016] In a tenth air conditioner according to the first air conditioner, the airflow changing unit includes: an air capacity distributing mechanism for changing a distributing ratio of a blowout air capacity between the air outlets; first flaps for changing a blowout direction of an airflow in a direction of a long side of each air outlet; a second flap for changing a blowout direction of an airflow in a direction of a short side of each air outlet; and driving mechanisms for driving said air capacity distributing mechanism, the first flaps and the second flap independently at each air outlet.

[0017] In an eleventh air conditioner according to the first air conditioner, the airflow changing unit includes: an air capacity distributing mechanism for changing a distributing ratio of a blowout air capacity between the air outlets; first flaps for changing a blowout direction of an airflow in a direction of a long side of each air outlet; a second flap for changing a blowout direction of an airflow in a direction of a short side of each air outlet; driving mechanisms for driving the air capacity distributing mechanism and the first flaps independently at each air outlet; and a driving mechanism for driving the second flaps of the air outlets in an interlocking manner.

[0018] In a twelfth air conditioner according to the first air conditioner, a plurality of blowout passages continued to each air outlet are provided in the casing, the airflow changing unit includes: an air capacity distributing mechanism provided on each blowout passage for changing a distributing ratio of a blowout air capacity between the air outlets; first flaps provided on each blowout passage for changing a blowout direction of an airflow in a direction of a long side of each air outlet; a driving mechanism provided on one end of the direction of the long side of each air outlet in each blowout passage, the driving mechanism for driving each air capacity distributing mechanism; and a driving mechanism for driving each first flap, which is provided on the other end of the direction of the long side of each air outlet in the blowout passage.

[0019] In a thirteenth air conditioner according to the first air conditioner, a plurality of blowout passages continued to each air outlet are provided in the casing, the airflow changing unit is provided in each blowout passage, and has an air capacity distributing mechanism for increasing/decreasing an opening area of each blowout passage so as to change a distributing ratio of a blowout air capacity between the air outlets, and the air capacity distributing mechanism includes: a pair of shutters provided on both sides of a direction of a short side of each air outlet in each blowout passage, the shutters being freely tilted simultaneously with a movement to an upper stream side of an airflow direction of the blowout passage; and a driving mechanism for moving the shutters to both ends of the blowout passage at the time of an operation for enlarging the opening area of the blowout passage, and moving the shutters to the upper stream side of the blowout passage at the time of an operation for reducing the opening area of the blowout passage.

[0020] Therefore, according to the first air conditioner, since the infrared sensor is arranged on the portion of the indoor panel exposed to the room, a visual field of the infrared sensor is secured sufficiently and the object temperature can be detected with high accuracy. As a result, the accuracy in the control of the airflow changing unit based on the detected information is improved, and thus comfortability and energy-saving characteristics of air conditioning are improved. Moreover, in a maintenance work of the infrared sensor, attachment/detachment of a suction grill is not required unlike the case for example, the infrared sensor is arranged inside a suction grill (namely, a portion which is not exposed to the room). Therefore, a check and the attachment/detachment of the infrared sensor can be carried out easily, thereby realizing high maintenance characteristics.

[0021] According to the second air conditioner, the following effect can be further obtained. Namely, in this air conditioner, since the infrared sensor is arranged between the air outlets on the indoor panel, the infrared sensor is not exposed directly to a suction airflow from the air inlet or a blowout airflow from the air outlets. As a result, problems, such as a problem which arises when the infrared sensor is arranged at the air inlet side, namely, a problem that dirt or the like in the suction airflow adheres to the infrared sensor and a detecting ability of the infrared sensor is inhibited, a problem which arises when the infrared sensor is arranged at the air outlet, namely, a problem that the infrared sensor is exposed to a cool blown airflow at the time of a cooling operation so that moisture is generated on its surface and thus the detecting ability is inhibited, are avoided. Therefore, the high-level detecting ability is maintained for a long time.

[0022] According to the third air conditioner, the following effect can be further obtained. Namely, in this air conditioner, since the infrared sensor is arranged on the peripheral edge of the air outlet on the indoor panel, it can detect a temperature of an object existing in a blowout direction of the airflow with high accuracy. When, for example, the infrared sensor is arranged, the infrared sensor is arranged at each air outlet, and the detecting object directions of the infrared sensors may correspond to the blowout direction of the air outlets at which the infrared sensors are provided. As a result, a corresponding relationship between the detected information of the infrared sensors and indoor detecting object area becomes clear, thereby facilitating control of the airflow changing unit based on the detected information of the infrared sensors.

[0023] According to the fourth air conditioner, the following effect can be further obtained. Namely, in this air conditioner, since the scanning mechanism for scanning the infrared sensor is provided, for example, a scanning range of the scanning sensor can be enlarged by driving control of the scanning mechanism. For this reason, when the scanning object range is enlarged, a number of the infrared sensors to be installed can be reduced, and a number of the infrared sensors can be one. As a result, a number of the infrared sensors to be installed are reduced, thereby accelerating low cost of the air conditioner, and a process on the detected information of the infrared sensor becomes easy and also its control can be simplified.

[0024] In addition, indoor temperature distribution and people distribution can be detected accurately by controlling the infrared sensor using the scanning mechanism, so that further improvement in the comfortability and energy-saving characteristics of air conditioning can be anticipated.

[0025] According to the fifth air conditioner, the following effect can be further obtained. Namely, in this air conditioner, a plurality of infrared sensors are provided correspondingly to the air outlets. Therefore, the temperature distribution and people distribution in the entire area of the room can be always detected simultaneously by using the plural infrared sensors. As a result, the airflow changing unit can be controlled with higher accuracy based on the detected information, so that the improvement in the comfortability and energy-saving characteristics of air conditioning can be anticipated.

[0026] According to the sixth air conditioner, the following effect can be further obtained. Namely, in this air conditioner, since the temperature sensor or temperature/humidity sensor is arranged at the air inlet correspondingly to each air outlet, a suction airflow temperature by means of the temperature sensor or the temperature/humidity sensor, namely, an indoor heat load is detected directly, and the indoor heat load as well as the detected information of the infrared sensor can be reflected to the control of the airflow changing unit. In comparison with the case where the airflow changing unit is controlled based only on the detected information of the infrared sensor, the airflow changing unit can be controlled with higher accuracy.

[0027] According to the seventh air conditioner, the following effect can be further obtained. Namely, in this air conditioner, when a judgment is made that the heat load is large in a not less than predetermined proportion of detecting directions of the temperature sensors or temperature/humidity sensors, namely, when the judgment is made that the heat load is high in nearly entire area of the room and necessity of detecting the temperature distribution or the like by means of the infrared sensor is less, the operation of the scanning mechanism is stopped. For this reason, during the operation of the air conditioner, wear of a driving section of the scanning mechanism is further suppressed due to a reduction in the operating time in comparison with the case where the scanning mechanism is operated continuously, thereby improving its durability. Therefore, this can contribute to lowering of operating cost of the air conditioner.

[0028] According to the eighth air conditioner, the following effect can be further obtained. Namely, in this air conditioner, an average object temperature in the detecting direction of the temperature sensors or temperature/humidity sensors is anticipated from the detected information of the temperature sensors or temperature/humidity sensors, and the detected temperature of the infrared sensor is corrected based on the object temperature. For example, in the case where the object temperature detected by the infrared sensor has a transnormal value with respect to the average object temperature anticipated from the detected information of the temperature sensors or the temperature/humidity sensors (for example, not a radiation heat from an indoor wall surface, a floor surface or a human body as an originally determined detecting object but a radiation heat from a metal surface as a low radiation portion or a heater, a window glass surface or the like as a high radiation portion is detected), this detected temperature is corrected by the average object temperature, so that a detecting error due to a difference of the detecting object in the infrared sensor from an originally determined object is solved as much as possible, and the accuracy in the control of the airflow changing unit can be secured. As a result, the comfortability and energy-saving characteristics of air conditioning are further improved.

[0029] According to the ninth air conditioner, the following effect can be further obtained. Namely, in this air conditioner, since the infrared sensor detects a position of a person in the room and the temperature sensor or the temperature/humidity sensor detects a suction air temperature from the room, the infrared sensor may detect only the position of a person. The process on the detected information of the infrared sensor becomes easier in comparison with the case, for example, where the infrared sensor detects both the positions of a person and the indoor temperature distribution. For this reason, a control system is simplified. Moreover, as for the detection of the indoor temperature distribution, required accuracy can be secured by the temperature sensor or temperature/humidity sensor which is more inexpensive than the infrared sensor. As a multiplier effect, the securing of the accuracy in the detected information is reconciled with the lowering of the cost.

[0030] According to the tenth air conditioner, the following effect can be further obtained. Namely, in this air conditioner, characteristics of the blowout airflow can be finely controlled at each air outlet, and the comfortability and the energy saving characteristics of air conditioning can be further improved.

[0031] According to the eleventh air conditioner, the following effect can be further obtained. Namely, in this air conditioner, since the characteristics of the blowout airflow can be finely controlled at each air outlet by the air capacity distributing mechanism and the first flaps, the comfortability and the energy saving characteristics of air conditioning can be improved in comparison with a structure that, for example, the air capacity distributing mechanism and the first flaps are operated in an interlocking manner between the air outlets. Moreover, since the second flaps provided at the air outlets, respectively, can be driven by a single driving source, the cost can be lowered and the structure can be simplified due to a reduction in a number of the driving sources to be installed in comparison with a case where, for example, the second flaps are driven by individual driving sources. Therefore, the improvement in the comfortability and the energy saving characteristics of air conditioning is reconciled with the acceleration of low cost.

[0032] According to the twelfth air conditioner, the following effect can be further obtained. Namely, in this air conditioner, the air capacity distributing mechanism, the first flaps and their driving mechanisms can be arranged compactly on the blowout passage where a space is restricted. As a result, the indoor panel can be thinned and miniaturized.

[0033] According to the thirteenth air conditioner, the following effect can be further obtained. Namely, in this air conditioner, at the time of the operation for enlarging the opening area of the blowout passage, namely, at the time of increasing the blowout air capacity, the shutters are positioned on portions of the blowout passage where a flow rate is slow, thereby reducing a ventilating resistance due to the shutters and surely securing the air capacity. Moreover, a blast sound is reduced. Meanwhile, at the time of the operation for reducing the opening area of the blowout passage, namely, at the time of reducing the blowout air capacity, the shutters are positioned on the upper stream side of the blowout passage, thereby suppressing disorder of the airflow at the air outlet portion positioned on a lower stream end of the blowout passage as much as possible. Therefore, moisture in a vicinity of the air outlet can be prevented, and dirt on the ceiling surface due to bump of disordered blowout airflow is prevented.

BRIEF DESCRIPTION OF THE DRAWINGS

[0034]

Fig. **1** is a perspective view of an indoor unit from an indoor side according to a first embodiment of the present invention.

Fig. **2** is a main section enlarged sectional view of the indoor unit shown in Fig. **1**.

Fig. **3** is a cross sectional view showing a first structure example of an air capacity distributing mechanism provided to a air outlet of the indoor unit.

Fig. **4** is a perspective view taken along line IV-IV in Fig. **3.**

Fig. **5** is a cross sectional view showing a second structure example of the air capacity distributing mechanism provided to the air outlet of the indoor unit.

Fig. **6** is a cross sectional view showing a third structure example of the air capacity distributing mechanism provided to the air outlet of the indoor unit.

Fig. **7** is an explanatory diagram of a first driving system of a second flap provided to the air outlet of the indoor unit.

Fig. **8** is an explanatory diagram of a second driving system of the second flap provided to the air outlet of the indoor unit.

Fig. **9** is a perspective view of the indoor unit from the indoor side according to a second embodiment of the present invention.

Fig. **10** is a main section enlarged sectional view of the indoor unit shown in Fig. **9**.

Fig. **11** is a perspective view of the indoor unit from the indoor side according to a third embodiment of the present invention.

Fig. **12** is a main section enlarged sectional view of the indoor unit shown in Fig. **11**.

Fig. **13** is a flowchart of a correcting method of a radiation temperature.

Fig. **14** is a perspective view of the indoor unit from the indoor side according to a fourth embodiment of the present invention.

Fig. **15** is a main section enlarged sectional view of the indoor unit shown in Fig. **14**.

BEST MODES FOR CARRYING OUT THE INVENTION

[0035] There will be explained below embodiments of the present invention with reference to the drawings.

EMBODIMENT 1

[0036] Figs. **1** and **2** show an indoor unit $\mathbf{Z_1}$ of a separate type air conditioner according to the first embodiment of the present invention. The indoor unit $\mathbf{Z_1}$ is a ceiling embedding type indoor unit which is embedded into a ceiling **50** in a room. The indoor unit $\mathbf{Z_1}$ is provided with a rectangular box shaped casing **1** embedded into an upper side of the ceiling **50,** and a rectangular flat plate type indoor panel **2** mounted from an indoor side to a lower end opening of the casing **1.** A rectangular opening type air inlet **3** is provided on a center portion of the indoor panel **2,** four air outlets **4, 4,** ... are provided outside the air inlet **3** so as to surround the air inlet **3** in a rectangular shape. The air outlets **4** are rectangular openings and extend approximately parallel with a peripheral edge of the indoor panel **2**.

[0037] In addition, a centrifugal fan **6** is arranged concentrically with a center line of the air inlet **3** in the casing **1**, and a heat exchanger **5** is arranged on an outer periphery of the fan **6** so as to surround the fan **6**. Further, a bellmouth **7** is arranged on an air inlet side of the fan **6**, and a filter **9** and a suction grill **8** are mounted to the air inlet **3**.

[0038] Meanwhile, a blowout passage **14** having a rectangular section which extends upward continuously with the air outlet **4** is provided on an upper stream side of the air outlet **4** in an airflow direction. An air capacity distributing mechanism **10**, first flaps **12** and a second flap **13**, mentioned later, are arranged in the blowout passage **14**. Here, the air capacity distributing mechanism **10**, the first flaps **12** and the second flap **13** compose "an airflow changing unit **52"** of the present invention.

[0039] Further, an infrared sensor **15** as a temperature detecting unit **51** is arranged at one comer portion of a surface of the indoor panel **2** (namely, indoor exposed portion). Moreover, a control section **18** (corresponding to "a control unit **53"** of the present invention), which controls the air capacity distributing mechanism **10,** the first flaps **12,** the second flap **13** and the like upon reception of the detected information from the infrared sensor **15,** is arranged in a vicinity of the blowout passage **14** in the casing **1**.

[0040] Hereinafter, structures and the like of the respective components are explained concretely.

[0041] The air capacity distributing mechanism **10** adjusts an air capacity distributing ratio between the air outlets **4**, **4**, ... by increasing or decreasing an air capacity from each of the air outlet **4**. As shown in Figs. **2** through **4**, the air capacity distributing mechanism **10** is provide with a pair of distributing shutters **11**, **11** arranged on both sides of a long side of the blowout passage **14** close to walls, respectively. A concrete structure of the distributing shutters **11**, **11** are as shown in Fig. **3**. Namely, when one ends of the distributing shutters **11, 11** are engaged with guide grooves **25** which extend in an up-down direction along side walls of the blowout passage **14**, respectively, the shutters **11**, **11** freely move in the up-down direction along the guide grooves **25**. Meanwhile, as shown in Figs. **3** and **4**, the other ends of the distributing shutters **11**, **11** are coupled with ends of a pair of racks **27**, **27**, respectively. The racks **27**, **27** are geared to a gear **28** which is driven to be rotated by a motor **29** (corresponding to "a driving mechanism" of the present invention") from both sides of its radial direction.

[0042] Therefore, when the gear **28** is selectively rotated in both regular and reverse directions by the motor **29**, the paired racks **27**, **27** geared to the gear **28** move in opposite directions to each other. According to the movement of the racks **27**, **27** the distributing shutters **11**, **11** move in the up-down direction while their tilting angles are being changed. When an extending amount of the distributing shutter **11** to a center of the blowout passage **14** increases or decreases, an opening area of the blowout passage **14** increases or decreases.

[0043] Namely, in the air capacity distributing mechanism **10**, in a state that the opening area of the blowout passage **14** is enlarged (at the time of setting a large air capacity), the distributing shutters **11**, **11** are housed in the blowout passage **14** closer to the side walls so as to be in a nearly upstanding posture, and thus the extending amount to the center of the blowout passage **14** becomes small. Meanwhile, in a state that the opening area of the blowout passage **14** is reduced (at the time of setting a small air capacity), the distributing shutters **11**, **11** are in a nearly horizontal posture, and thus the extending amount to the center of the blowout passage **14** becomes large. As a result, entirely the distributing shutters **11**, **11** are positioned to be closer to the upper stream of the blowout passage **14**.

[0044] Here, the air capacity distributing mechanism **10** is provided correspondingly to the air outlets **4**, **4**, ... and the air capacity distributing mechanisms **10**, **10**, ... are controlled individually and independently. Moreover, the air capacity distributing mechanism **10** is controlled by the control section **18** arranged in the vicinity of the blowout passage **14** based on the detected information from the infrared sensor **15**.

[0045] As explained above, the air capacity distributing mechanism **10** has the following structural and functional characteristics. The air capacity distributing mechanism **10** is provided with the distributing shutters **11**, **11** which move in a passage direction of the blowout passage **14** and simultaneously tilt about one ends positioned on the blowout passage **14** close to the side wall, and when the opening area is enlarged, the distributing shutters **11**, **11** are positioned on the blowout passage **14** close to the side walls so as to largely open a center of the passage with high flow rate (in other words, the distributing shutters **11**, **11** are retreated towards the side wall of the blowout passage **14**). Meanwhile, when the opening area is reduced, the distributing shutters **11**, **11** are positioned on the upper stream side of the blowout passage **14**. As a result, a peculiar function is produced as mentioned later. Namely, the air capacity distributing mechanism **10** does not need to be limited to the above structure of the embodiment as long as it has the above structural and functional characteristics. Therefore, beside the above embodiment, for example, a structure shown in Fig. **5**, a structure shown in Fig. **6** or the like can be suitably adopted. These structures will be explained simply below.

[0046] The air capacity distributing mechanism **10** shown in Fig. **5** is structured so that the paired distributing shutters **11**, **11** freely advance or retreat in a direction of their short sides in the upper stream portion of the blowout passage **14**. Also in this air capacity distributing mechanism **10**, the structure that the distributing shutters **11**, **11** are driven by the motor **29** via the racks **27** and the gear **28** geared to the racks **27** is similar to the structure of the air capacity distributing mechanism **10** shown in Fig. **3**. Also in the air capacity distributing mechanism **10** shown in Fig. **5,** when the opening area is enlarged, the distributing shutters **11, 11** are positioned in the blowout passage **14** closer to the side walls so as to largely open the center of the passage with high flow rate, whereas when the opening area is reduced, the distributing shutters **11**, **11** are positioned on the upper stream side of the blowout passage **14**.

[0047] The air capacity distributing mechanism **10** shown in Fig. **6** has one distributing shutter **11**, and one end of the distributing shutter **11** is pivotally supported to the upper stream portion of the blowout passage **14** closer to the one side wall in a freely tilting manner, and the distributing shutter **11** is driven to be rotated by a motor **35** via gears **33** and **34** which are geared to each other. The air capacity distributing mechanism **10** can selectively adopt an opening area enlarged posture shown by a solid line in Fig. **6** and an opening area reduced posture shown by a chain line. Also in the air capacity distributing mechanism **10** shown in Fig. **6**, when the opening area is enlarged, the distributing shutter **11** is positioned in the blowout passage **14** closer to the side wall so as to largely open the center of the passage with high flow rate, whereas when the opening area is reduced, the distributing shutter **11** is positioned on the upper stream side of the blowout passage **14**.

[0048] The first flap **12** changes to adjust a blowout direction of an airflow blown out from the air outlet **4** via the blowout passage **14** into a room in a lateral direction (in other words, a direction of a long side of the air outlet **4**). As shown in Fig. **2**, the first flap **12** is composed of a plate body having an outer shape along a passage section shape from the blowout passage **14** to the air outlet **4**, and is supported to the side wall of the long side of the blowout passage **14** by a supporting shaft **23** in a freely oscillating manner. As shown in Fig. **4,** a plurality of the first flaps **12** are arranged in the blowout passage **14** in the direction of its long side with predetermined gaps. The first flaps **12** are connected with a motor **30** (corresponding to "the driving mechanism" of the present invention) via a link bar **24** for coupling the first flaps **12,** and are driven by the motor **30** in the oscillating direction so that their tilt angles are changed. The blowout direction of the blowout airflow from the air outlet **4** in the lateral direction is changed to be adjusted by changing the tilt angles. Moreover, the first flaps **12, 12,** ... are arranged at the air outlets **4,** but their control is made individually and independently by the control section **18.**

[0049] Here, the first flaps **12, 12,** ... are arranged in the blowout passage **14,** but the motor **30** is arranged on an end of the short side of the blowout passage **14** so that the area of the blowout passage **14** is not narrowed by the arrangement of the motor **30**.

[0050] As shown in Fig. **2**, the second flap **13** is composed of a band plate material having a curved section shape. The second flap **13** is arranged on a portion adjacent to the air outlet **4** on an lower stream side of the blowout passage **14**. When the second flap **13** tilts about its upper edge side, the blowout direction of the blowout airflow in a lengthwise direction (in other words, the direction of the short side of the air outlet **4**) is changed to be adjusted.

[0051] The second flap **13** is arranged at each of the air outlets **4, 4,** ... but an interlocking system and an individual system are considered as a driving system of the second flaps **13, 13,** .... As shown in Fig. **7,** the interlocking system is such that the second flaps **13**, **13**, ... provided correspondingly to the air outlets **4**, **4**, ... are connected with each other by interlocking members **32, 32,** ... so as to be driven by a single motor **31.** On the contrary, as shown in Fig. **8**, the individual system is such that the second flaps **13**, **13**, ... provided correspondingly to the air outlets **4**, **4**, ... are driven individually by special motors **31**, respectively. In the former interlocking system of these systems, since the second flaps **13**, **13**, ... can be driven by the single motor **31**, this system has an advantage that a structure of a driving section is simple and cost can be lowered. On the contrary, the latter individual system has an advantage that the blowout directions of the blowout airflow in the longitudinal direction can be adjusted individually and finely at the air outlets **4, 4,** ....

[0052] The infrared sensor **15** detects a temperature of a detecting object (object temperature) based on a radiated heat from the object such as a wall surface, a floor surface or a human body in a room in a state that the indoor unit $\mathbf{Z_1}$ is installed on the ceiling **50**, and outputs the detected temperature as detected information relating to a current indoor temperature to the control section **18**. As shown in Figs. **1** and **2**, the infrared sensor **15** is arranged on one of four comers on the outer periphery of the indoor panel **2**, namely, one of four inter-opening portions between the air outlets **4**, **4**. In the present embodiment, the infrared sensor **15** is mounted thereto via a scanning mechanism **20**, and this single infrared sensor **15** detects the temperatures of objects in the entire area of a room. Here, the scanning mechanism **20** oscillates the infrared sensor **15** in a reciprocating manner using a first motor **21** having a horizontal shaft and revolves it using a second motor **22** having a vertical shaft. The infrared sensor **15** is supported to the casing **1** in a state that it is inserted into a sensor mounting hole **19** provide on the indoor panel **2**.

[0053] Here, preferable examples of the infrared sensor **15** are a single element type sensor for integrally detecting an entire area of a detecting object range, a one-dimensional array element type sensor for dividing the detecting object range in one direction so as to detect the respective divided areas, and a two-dimensional array element type sensor for dividing the detecting object range in two directions intersecting perpendicularly to each other so as to detect the respective divided areas.

[0054] The detected information relating to the object temperature detected by the infrared sensor **15** is input into the control section **18** and is used as a control factor of the airflow changing unit **52** by mean of the control section **18.**

[0055] As mentioned above, the control section **18** exercises control of the air capacity distributing mechanism **10**, the first flaps **12** and the second flap **13** correlatively based on the detected information detected by the infrared sensor **15**. Moreover, the control section **18** simultaneously exercises this control and control of an air conditioning ability and a temperature so as to optimize air conditioning, thereby improving comfortability or energy saving characteristics of the air conditioning. For example, the characteristics of the blowout airflow blown out from the air outlets **4, 4,** ... of the indoor unit $\mathbf{Z_1}$ are not always set equally between the air outlets **4** but are adjusted according to indoor temperature distribution (heat load distribution) and people distribution. For example, at cooling time, the air capacity is controlled so that the blowout air capacity is increased in an area with high temperature or in an area with a lot of people, whereas the blowout air capacity is decreased in an area with low temperature or in an area with no people. Moreover, the direction of the blowout airflow is controlled in the area with people so as to avoid direct blowing of the blowout airflow to the people, thereby controlling a wind direction or the like so as to reduce a sense of drafting.

[0056] Here, the operation and the function of the indoor unit $\mathbf{Z_1}$ will be explained below. It is an object of the indoor unit $\mathbf{Z_1}$ of the present embodiment to realize the optimization of air condition as explained above and heighten its comfortability or energy saving characteristics, and in order to achieve this object, it is important to secure sufficient accuracy in control of the airflow changing unit **52** or the like by means of the control section **18**. Accordingly, it is important to heighten detecting accuracy of the infrared sensor **15** which is a base for controlling the control section **18** and secure reliability of the detected information. A device obtained by concretizing a technical concept based on this viewpoint for each component of the indoor unit is the indoor unit $\mathbf{Z_1}$ of this embodiment. Therefore, in the indoor unit $\mathbf{Z_1}$ of this embodiment, the respective components fulfill their predetermined functions based on their peculiar structures, so that the improvement in the comfortability or energy saving characteristics which is an ultimate problem can be realized by optimizing the air conditioning. This will be explained below concretely.

[0057] In the indoor unit $\mathbf{Z_1}$ of this embodiment, air-conditioning air which has passed through the heat exchanger **5** so as to be heat-exchanged is blown out from the air outlets **4** into a room. At this time, when the blowout airflow flows through the blowout passage **14**, its air capacity is adjusted by the air capacity distributing mechanism **10** at each of the air outlets **4, 4**, ... Namely, the blowout air capacity is distributed between the air outlets **4**, **4**, ... In addition, the blowout direction adjusting function in the lateral direction by means of the first flap **12** and the blowout direction adjusting function in the longitudinal direction by means of the second flap **13** are carried out simultaneously. Moreover, another control such as the air conditioning ability control and the temperature control is exercised at the same time. The optimization of the air conditioning is realized as their multiplier effect.

[0058] Here, as explained above, the optimization of the air conditioning is realized by inputting the accurate detected information from the infrared sensor **15** into the control section **18.** In the indoor unit $\mathbf{Z_1}$ of this embodiment, the infrared sensor **15** adopts the following structure so that the accurate detected information can be obtained.

[0059] Firstly, in this embodiment, the infrared sensor **15** is arranged on the inter-opening portion of the air outlets **4, 4,** ... on the indoor panel **2,** namely, an indoor exposed portion. With this structure, a visual field of the infrared sensor **15** is sufficiently secured, and as a result, the object temperature can be detected with high accuracy by the infrared sensor **15**.

[0060] Secondly, since the infrared sensor **15** is arranged on the inter-opening portion of the air outlets **4, 4**, ... on the indoor panel **2,** the infrared sensor **15** is not exposed directly to a suction airflow from the air inlet **3** and the blowout airflow from the air outlet **4**. As a result, for example, unlike a case where the infrared sensor **15** is arranged on a side of the air inlet **3**, there does not arise a problem that dust or the like in the suction airflow adheres to the infrared sensor **15** and its detecting ability is inhibited. Moreover, unlike a case where the infrared sensor **15** is arranged at the air outlet **4**, a problem such that the infrared sensor **15** is exposed to a cool blowout airflow and moisture adheres to its surface so that the detecting ability is inhibited is prevented securely from arising. For this reason, the high level detecting ability is maintained for a long time.

[0061] Thirdly, the infrared sensor **15** is structured so as to be capable of scanning detection using the scanning mechanism **20**. When the scanning mechanism **20** is controlled, the indoor temperature distribution and people distribution can be detected accurately by the infrared sensor **15**. Moreover, since the one infrared sensor **15** detects the object temperature, the detected information is easily processed and its reliability is improved.

[0062] As their multiplier effect, the detected information with high accuracy and reliability by the infrared sensor **15** is captured into the control section **18**, so that the comfortability and energy saving characteristics of the air conditioning by means of the indoor unit $\mathbf{Z_1}$ can be further improved.

[0063] On the other hand, the comfortability and the energy saving characteristics of the air conditioning are improved also by the characteristic structure on the airflow changing unit **52.**

[0064] Namely, firstly in this embodiment, since the air capacity distributing mechanism **10,** the first flaps **12** and the second flap **13** can be operated individually and independently between the air outlets **4**, **4**, ..., the characteristics of the blowout airflow at each of the air outlets **4 , 4,** ... can be controlled more finely according to the indoor temperature distribution and people distribution.

[0065] On the contrary, the structure may be such that the air capacity distributing mechanisms **10** and the first flaps **12** can be operated independently and individually at the air outlets **4, 4, ...,** whereas the second flaps **13** are operated in an interlocking manner at the air outlets **4, 4,** .... In this case, the air capacity distributing mechanism **10** and the first flaps **12** can finely control the characteristics of the blowout airflow at each of the air outlets **4, 4,** ....

[0066] Secondary, in this embodiment, the air capacity distributing mechanism **10** is composed of the paired distributing shutters **11**, **11**, and when the opening area of the blowout passage **14** is enlarged, the distributing shutters **11** are positioned on the long sides of the blowout passage **14**, and the opening area is reduced, they are positioned on the upper stream side of the blowout passage **14**. At the time of the operation for enlarging the opening area of the blowout passage **14**, namely, when the blowout airflow increases, since the distributing shutters **11**, **11** are positioned on the portions of the blowout passage **14** with slow flow rate, ventilating resistance due to the distributing shutters **11**, **11** is reduced, thereby ensuring the securing of the blowout airflow and reducing a blast sound.

[0067] As their multiplier effect, the blowout airflow characteristics are improved, and the comfortability and energy saving characteristics of the air conditioning are improved by the indoor unit $\mathbf{Z_1}$.

[0068] Further, there are following circumstantial effects.

[0069] Firstly in this embodiment, the air capacity distributing mechanism **10** and the first flap **12** are arranged on the upper stream portion of the blowout passage **14** which is continued with the air outlet **4**, and a driving mechanism **29** of the air capacity distributing mechanism **10** and a driving mechanism **30** of the first flap **12** are arranged on both ends in the direction of the long sides of the blowout passage **14**, respectively. With such a structure, the air capacity distributing mechanism **10** and the first flaps **12** and their driving mechanisms **29** and **30** can be arranged compactly at the blowout passage **14** with spacial restriction, and as a result, the indoor panel **2** can be thinned and miniaturized.

[0070] Secondly in this embodiment, the paired distributing shutters **11**, **11** are structured so as to be positioned on the upper stream side of the blowout passage **14** when the opening area of the blowout passage **14** is reduced (namely, the blowout airflow is reduced). With such a structure, disorder of airflow can be suppressed as much as possible at the air outlet **4** positioned on a lower stream end of the blowout passage **14**, so that moisture in the vicinity of air outlet **4** is prevented and dirt of the ceiling surface due to bump of disordered blowout airflow is prevented.

[0071] Thirdly in this embodiment, since the infrared sensor **15** is arranged on the indoor exposed portion of the indoor panel **2**, at the time of a maintenance work of the infrared sensor **15**, attachment/detachment of a suction grill is not necessary unlike, for example, the case where the infrared sensor **15** is arranged inside the suction grill (namely, a portion which is not exposed to the room). For this reason, a check or the attachment/detachment work of the infrared sensor **15** can be carried out easily, and thus high maintenance characteristics are realized.

[0072] Fourthly in this embodiment, since the second flaps **13** are operated in the interlocking manner at the air outlets **4**, **4**, ..., the second flaps **13**, **13**, ... can be driven by a single driving source. A number of the driving sources to be installed is reduced in comparison with the case where the second flaps **13**, **13**, ... are driven by individual driving sources, thereby lowering the cost and simplifying the structure.

EMBODIMENT 2

[0073] Figs. **9** and **10** show an indoor unit $\mathbf{Z_2}$ of the separate type air conditioner according to the second embodiment of the present invention. The indoor unit $\mathbf{Z_2}$ has the same basic structure as that of the indoor unit $\mathbf{Z_1}$ according to the first embodiment. A different point is only the structure of the infrared sensor **15.** Therefore, there will be detailed below only the structure of the infrared sensor **15** and its functions which are peculiar to this embodiment, and explanation of the other structures and functions will be omitted. In Figs. **9** and **10,** the components corresponding to those shown in Figs. **1** and **2** are designated by like numbers.

[0074] In the indoor unit $\mathbf{Z_2}$ of this embodiment, when the infrared sensor **15** is installed onto the indoor panel **2,** the three infrared sensors **15** are arranged on the peripheral edge portion of each air outlet **4** closer to the air inlet **3** and the direction of the long side of each air outlet **4** with predetermined gaps. Moreover, the infrared sensors **15**, **15**, ... are fixed directly to the peripheral edge portion. Detecting object ranges of the infrared sensors **15, 15,** ... provided correspondingly to the air outlets **4, 4,** ... are limited to constant ranges in the blowout directions of the air outlet **4, 4,** .... Moreover, the detecting object range of the three infrared sensors **15**, **15**, ... arranged along the long side of the air outlet **4** is also limited to a constant range. Therefore, in this embodiment, the infrared sensors **15** are non-scanning type infrared sensors which detect the respective constant ranges.

[0075] Namely, in this embodiment, as shown in Fig. **9**, the indoor space, namely, the detecting object range is divided virtually into four large areas **A1** through **A4** corresponding to the air outlets **4** with the indoor unit $\mathbf{Z_2}$ being centered in a plan view. Further, each of the large areas **A1** through **A4** is divided virtually into three small areas **SA**, **SB** and **SC** for each three infrared sensors **15** in which the large areas are the detecting object range. The detecting object rage of each infrared sensor **15** is one of the small areas **SA**, **SB** and **SC**. With this setting, when the detected information of the infrared sensors **15, 15, ...** is input into the control section **18,** a specification can be easily made as to which small area in which large area the detected information is about.

[0076] In this embodiment, since the infrared sensors **15**, **15**, ... are arranged on the surface of the indoor panel **2**, namely, the indoor exposed portion, the visual fields of the infrared sensors **15** are secured sufficiently, so that the object temperature is detected with high accuracy. As a result, the control accuracy for the airflow changing unit **52** by means of the control section **18** based on the detected information is improved, and thus the comfortability and energy saving characteristics of the air conditioning is improved. Moreover, at the time of the maintenance work of the infrared sensors **15**, **15**, ..., the attachment/detachment of the suction grill is not necessary unlike the case where, for example, the infrared sensors **15**, **15**, ... are arranged inside the suction grill (namely, the portion which is not exposed to the room), thereby easily carrying out the check or the attachment/detachment work of the infrared sensors **15**, **15**, ... and realizing the high maintenance characteristics.

[0077] In addition, the three infrared sensors **15**, **15**, ... are arranged at each of the air outlets **4**, **4**, ..., and the detecting object ranges of the infrared sensors **15**, **15**, ... are specified individually, thereby obtaining the following effect.

[0078] Namely, a corresponding relationship between the detected information of the infrared sensors **15**, **15**, ... and the indoor detecting object area is clarified, and the operational control of the airflow changing unit **52** of the air capacity distributing mechanism **10** based on the detected information of the infrared sensors **15, 15,** ... becomes easy.

[0079] In addition, in this embodiment, since the plural infrared sensors **15** are provided correspondingly to the air outlets **4**, **4**, ... and their detecting object ranges are set fixedly, the temperature distribution and the people distribution in the entire indoor area can be always detected by the infrared sensors **15**, **15**, ... simultaneously. As a result, the operational control of the air capacity distributing mechanism **10** or the like based on the detected information becomes more accurate, and thus the comfortability and the energy saving characteristics can be anticipated to be improved.

EMBODIMENT 3

[0080] Figs. **11** and **12** show an indoor unit $\mathbf{Z_3}$ of the separate type air conditioner according to the third embodiment of the present invention. The indoor unit $\mathbf{Z_3}$ is based on the structure of the indoor unit $\mathbf{Z_2}$ according to the second embodiment, and a temperature/humidity sensor **16,** mentioned later, is additionally provided. Therefore, there will be detailed below only a structure peculiar to this embodiment, namely, a structure of the temperature/humidity sensor **16** and a correlation between the temperature/humidity sensor **16** and the infrared sensor **15**, and explanation of the other structures and functions will be omitted. In Figs. **11** and **12**, components corresponding to those shown in Figs. **1** and **2** of the first embodiment and those shown in Figs. **9** and **10** of the second embodiment are designated by like numbers.

[0081] In the indoor unit $\mathbf{Z_3}$ of this embodiment, the infrared sensor **15** is arranged corresponding to each o the air outlets **4,4,** ...on the peripheral edge portions of each of the air outlets **4**, **4**, ... closer to the air inlet **3** on the indoor panel **2** in the direction of the long sides of the air outlets **4** with predetermined gaps. Additionally, the temperature/humidity sensor **16** (in another embodiment, a temperature sensor may be provided instead of the temperature/humidity sensor **16**) is arranged on the outer peripheral portion of the air inlet **3** corresponding to each of the air outlets **4**, **4**, ... in the direction of the long sides of each of the air outlets **4** with predetermined gaps (concretely, with the gaps corresponding to the infrared sensors **15**, **15**, ...). Therefore, the infrared sensors **15**, **15**, ... and the temperature/humidity sensors **16, 16,** ... corresponding to them have the same detecting object ranges (namely, the small areas **SA** through **SC** in the large areas **A1** through **A4).**

[0082] The temperature/humidity sensor **16** detects temperature and humidity of the suction airflow sucked from the area corresponding to this temperature/humidity sensor **16** to the air inlet **3**, and outputs the detected temperature and humidity as the detected information to the control section **18**. Thereafter, the detected information from the temperature/humidity sensor **16** is compared with the detected information of the infrared sensor **15** (namely, information about the indoor object temperature) in the control section **18**, so as to be utilized as a correcting standard of the detected information of the infrared sensor **15**.

[0083] Namely, the infrared sensor **15** originally detects a radiation temperature of an object such as a wall surface, a floor surface or people in the room as the object temperature, and the detected information of the infrared sensor **15** is utilized as a standard for control of the air capacity distributing mechanism **10** or the like of the airflow changing unit **52** in the control section **18**. However, in the room, for example, a window glass portion or a heater portion is a higher radiation portion than the other portions, and a metal surface or the like is a low radiation portion. For this reason, when the object temperature is simply detected by the infrared sensor **15**, if the detecting object range has the high radiation portion or the low radiation portion, a temperature having a transnormal value which is deviated from the actual indoor heat load distribution or the like is detected. Therefore, when this is used as the control standard in the control section **18**, for example, over-airflow is blown onto a particular portion in the room and this portion becomes "too cool" or "too warm", and thus there is a possibility that the comfortability is inhibited extremely.

[0084] Meanwhile, it is experientially known that a suction temperature of indoor air and a radiation temperature of a suction source area normally have a close value. For example, when the suction temperature is 25°C, the radiation temperature becomes about 23 to 27°C. Therefore, the radiation temperature of the object can be anticipated based on the air suction temperature.

[0085] Therefore, in the case where the object temperature (radiation temperature) detected by the infrared sensor **15** shows a transnormal value which is greatly deviated from the radiation temperature anticipated from the suction temperature, the detected temperature of the infrared sensor **15** is corrected based on the anticipated radiation temperature.

[0086] The detected temperature can be corrected by using various methods. For example, in a simple method, an area average radiation temperature (detected temperature after correction) T_S can be obtained by adding a predetermined temperature offset T_{OFS} to an anticipated radiation temperature T_p (this anticipated radiation temperature T_p is normally equal with the suction temperature. Here, anticipated radiation temperature T_p = suction temperature). Namely, the detected temperature can be corrected according to the following formula:

$$T_S = T_P + T_{OFS}$$

[0087] In addition, another correcting method is such that a threshold temperature T_{th}, mentioned later, is used so as to correct the radiation temperature. This correcting method is particularly effective to the case or the like where the detected temperature of the infrared sensor **15** is greatly deviated from the suction temperature. For example as shown in Fig. **13,** at steps S1, S2 and S3, after the radiation temperature is detected by the infrared sensor **15**, the average radiation temperature per area is calculated and the suction temperature per area is measured, a judgment is made at step S4 whether an absolute value of a temperature difference between the average radiation temperature and the suction temperature is larger than a predetermined value ΔT_1. When the absolute value is larger than the predetermined value ΔT_1, the following correction is carried out.

[0088] Incidentally, a window or the like is a surface portion with much outflux and influx of a heat to/from outside. In the case where the visual field of the infrared sensor **15** includes such a surface portion, or in the case where the detected temperature of the infrared sensor **15** is deviated from the suction temperature to a higher temperature side, it is considered that an air temperature in the vicinity of the surface portion is a temperature between the suction temperature and the detected temperature. Therefore, after a predetermined threshold value is initially set at step S5, when the absolute value of the difference between the suction temperature and the detected temperature is larger than the threshold value T_{th}, a temperature difference, which is obtained by multiplying the difference between the threshold value and the detected temperature and a coefficient η (η = about 0.3 to 0.7 and it is obtained experientially or experimentally) in which an average temperature distribution and radiation temperature are taken into consideration, is given as an offset (see step S6). Namely:

$$T_{OFS} = \eta\ (T_{th} - T_s)$$

The average radiation temperature is again calculated from a corrected radiation temperature Ts' obtained in such a manner (see step S7). Next, a judgment is made whether an absolute value of a difference between the average radiation temperature and the suction temperature is smaller than a predetermined value ε (see step S8). When the absolute value is smaller than the predetermined value ε, the correction is completed, and when not smaller, the threshold value is updated at step S9, so that steps S6 through S8 are repeated.

[0089] Here, the initial value of the threshold value at step S5 may be given suitably. As for steps S6 through S9, while the threshold value is being updated by dichotomy, the repeated process may be executed until the difference between the average radiation temperature and the suction temperature becomes sufficiently small.

[0090] The radiation temperature of a low radiant surface such as metal has less intraday fluctuation and deviation of such a kind of radiation temperature is a steady-state deviation to a low temperature side. Such a radiation temperature is considered to actually show an average temperature. For this reason, in such a case, a temperature of the radiation temperature area not more than the threshold value T_{th} is replaced by the suction temperature, and the threshold value is converged repeatedly from the initial value similarly to the above, so that a properly corrected radiation temperature can be obtained.

[0091] In addition, in an optical measuring method, as the sensor is used for a longer time, drift (deviation of a detected value) due to dirt or the like of the sensor occurs. However, from the viewpoint of making stable control for a long time, it is desirable that the long-time drift due to dirt or the like is compensated. Therefore, in a situation that a difference between respective radiation temperatures is small and a judgment is made that an influence of a transnormal radiation area is less, a slight difference between the suction temperature and the average radiation temperature is used as drift so that the detected value of the infrared sensor may be corrected. For example, in the case where the absolute value of the difference between the average radiation temperature and the suction temperature is smaller than a predetermined value ΔT_2 (see step S10) and the absolute value of the difference between the average radiation temperature and each radiation temperature is smaller than a predetermined value ΔT_3 (see step S11), T_{OFS} = suction temperature - average radiation temperature (step S12).

[0092] In such a manner, an error of the detected temperature due to a transnormal radiation section is corrected and the corrected temperature is used as the control standard of the airflow changing unit **52** in the control section **18**.

[0093] Here, the anticipation of the radiation temperature of an object and the correction of the detected temperature are carried out by the control section **18.** Therefore, "the correcting unit" of the present invention is composed of the control section **18.**

[0094] As mentioned above, in the indoor unit $\mathbf{Z_3}$ of this embodiment, in the case where the detected information of the infrared sensor **15** is transnormal, the detected information is corrected by the anticipated radiation temperature based on the suction temperature detected by the temperature/humidity sensor **16**, so that an error from an actual value is corrected. As a result, the airflow changing unit **52** is controlled to be suitably operated according to the actual indoor heat load distribution or the like, and thereby improving the comfortability or the energy saving characteristics of the air conditioning by means of the indoor unit $\mathbf{Z_3}$.

[0095] In the indoor unit $\mathbf{Z_3}$ of this embodiment, the infrared sensor **15** is of a fixed type without a scanning function, and a plurality of the infrared sensors **15** are provided correspondingly to the air outlets **4**, **4**, ..., respectively. However, in another embodiment, for example, the single or plural infrared sensor(s) **15** is(are) arranged and can be structured so as to have the scanning function by means of the scanning mechanism **20**.

[0096] In the case where the infrared sensors **15** particularly having such an arrangement are combined with the temperature/humidity sensors **16**, **16**, ..., a useless operation of the scanning mechanism **20** is prevented based on the detected information of the temperature/humidity sensors **16, 16,** ..., so that durability of the scanning mechanism **20** can be improved and thus the energy saving characteristics of the indoor unit $\mathbf{Z_3}$ can be also improved. Namely, as for the temperature/humidity sensors **16, 16,** ..., since specified areas are the detecting object ranges as mentioned above, for example, in the case where all or most of the temperature/humidity sensors **16** (for example, a not less than predetermined proportion of the temperature/humidity sensors) detect that the radiation temperature of the object is high, namely, a detection is made that the heat load is not less than a predetermined load in the entire or most indoor area, there is less necessity anymore to scan the infrared sensor **15** so as to detect the indoor object temperature. Therefore, in this case, the operation of the scanning mechanism **20** is stopped. When the operation of the scanning mechanism **20** is stopped in such a manner, for example, in comparison with the case where the scanning mechanism **20** is operated continuously during the operation of the air conditioner, operating time of the scanning mechanism **20** is reduced further, thereby suppressing wear of a driving section. Therefore, the durability of the scanning mechanism **20** is improved, thereby contributing to reduction in operating cost of the air conditioner.

[0097] Here, the judgment as to whether the heat load is not less than the predetermined load in the entire or most indoor area is made by the control section **18**. The stopping control of the scanning mechanism **20** is also executed by the control section **18**. Therefore, "a judging unit" and "a stopping unit" of the present invention are structured by the control section **18**.

[0098] In addition, in this embodiment, the temperature/humidity sensor **16** is mounted to the suction grill **8** on the upper stream side above the filter on the outer periphery portion of the air inlet **3**, but in another embodiment, as designated by **16'** in Fig. **12**, the temperature/humidity sensor can be mounted to the bellmouth **7** section.

EMBODIMENT 4

[0099] Figs. **14** and **15** show an indoor unit $\mathbf{Z_4}$ of the separate type air conditioner according to the fourth embodiment of the present invention. This indoor unit $\mathbf{Z_4}$ is based on the structure of the indoor unit $\mathbf{Z_1}$of the first embodiment, and the arrangement structure of the temperature/humidity sensor **16** in the third embodiment is applied thereto. Therefore, there will be detailed below only a peculiar structure of this embodiment, namely, the structure of the temperature/humidity sensor **16** and a correlation between the temperature/humidity sensor **16** and the infrared sensor **15**, but explanation of the other structures and functions will be omitted. In Figs. **14** and **15**, the components corresponding to those shown in Figs. **1** and **2** of the first embodiment and shown in Figs. **11** and **12** of the third embodiment are designated by like numbers.

[0100] In the indoor unit $\mathbf{Z_4}$ of this embodiment, the infrared sensor **15** is arranged on the inter-opening portion of the two adjacent air outlets **4, 4** at the comer of the indoor panel **2** via the scanning mechanism **20**. Meanwhile, the three temperature/humidity sensors **16** are arranged on the air inlet **3** side on the indoor panel **2** correspondingly to each of the outlets **4**, **4**, ... in the direction of each long side of the air outlets **4** with predetermined gaps.

[0101] The indoor unit $\mathbf{Z_4}$ of this embodiment is different from the first and third embodiments in that an object to be detected by the infrared sensor **15** and an object to be detected by the temperature/humidity sensor **16** are independent. Namely, in the first embodiment, both a position of a person in the room and indoor temperature distribution are detected by the infrared sensor **15**. In the third embodiment, the temperature/humidity sensor **16** is utilized to correct the detected value of the infrared sensor **15**. On the contrary, in the fourth embodiment, the infrared sensor **15** is used only for detecting the position of a person in the room, and the temperature/humidity sensor **16** is used for detecting the indoor temperature distribution. In this embodiment, a control relationship between the infrared sensor **15** and the temperature/humidity sensor **16** is cut.

[0102] With such a structure, since the infrared sensor **15** may detect only a position of a person, in comparison with, for example, the case where both the position of a person and the indoor temperature distribution are detected, a process on the detected information by means of the infrared sensor **15** becomes easy, thereby simplifying a control system. At the same time, as to the detection of the indoor temperature distribution, required accuracy can be obtained by the temperature/humidity sensor **16** which is more inexpensive than the infrared sensor **15**, and as their multiplier effect, the securing of the accuracy in the detected information is compossible with lowering of the cost.

INDUSTRIAL APPLICABILITY

[0103] As mentioned above, the present invention is useful to the indoor unit of a room air conditioner, a package air conditioner, and the like.

Claims

1. An air conditioner comprising:

   a casing **(1)** embedded or suspended in/from a ceiling **(50);**
   an indoor panel **(2)** provided on a lower side of said casing **(1),** said indoor panel (**2**) being provided with an air inlet (**3**) and a plurality of air outlets (**4**), said air outlets (**4**) surrounding a rectangular periphery of said air inlet (**3**) and each having a rectangular shape, said indoor panel (**2**) being installed in an indoor exposed state;
   an infrared sensor (**15**) provided on an exposed portion of said indoor panel (**2**);
   an airflow changing unit (**52**) for changing characteristics of an airflow blown out from each or said air outlet (**4**); and
   a control unit (**53**) for controlling said airflow changing unit (**52**) based on output information from said infrared sensor (**15**).

2. The air conditioner according to claim 1, wherein said infrared sensor (**15**) is provided between said air outlets (**4**, **4**).

3. The air conditioner according to claim 1, wherein said infrared sensor **(15)** is provided on a peripheral edge of said air outlet (**4**).

4. The air conditioner according to claim 1, further comprising a scanning mechanism (**20**) for scanning said infrared sensor (**15**).

5. The air conditioner according to claim 1, wherein:

   a plurality of said infrared sensors **(15)** are provided correspondingly to said air outlets **(4, 4,** ...),
   said infrared sensors **(15)** are non-scanning type infrared sensors for detecting their respective constant ranges as an object to be detected.

6. The air conditioner according to claim 1, wherein a plurality of temperature sensors or temperature/humidity sensors (**16**) are provided in vicinities of said air outlets (**4**) in an inside portion of said air inlet (**3**) on the indoor panel (**12**) or in an inside portion of said air inlet (**3**) in said casing (**1**).

7. The air conditioner according to claim 6, further comprising:

   a scanning mechanism (**20**) for scanning said infrared sensor (**15**);
   a judging unit (**18**) for calculating a heat load based on output information from said temperature sensors or temperature/humidity sensors (**16**) and judging whether the heat load is not less than a predetermined load for each of said temperature sensors or temperature/humidity sensors (**16**); and
   a stopping unit (**18**) for, when the judgment is made that the heat load is not less than the predetermined load in a not less than predetermined proportion of said temperature sensors or temperature/humidity sensors (**16**), stopping an operation of said scanning mechanism (**20**).

8. The air conditioner according to claim 6, further comprising a correcting unit (**18**) for anticipating an object temperature in a blowout direction of an airflow from said air outlets (**4**) based on the output information from said temperature sensors or temperature/humidity sensors (**16**) and correcting a detected temperature of said infrared sensor (**15**) based on the anticipated object temperature.

9. The air conditioner according to claim 6, wherein said infrared sensor (**15**) detects a position of a person in a room and said temperature sensors or temperature/humidity sensors **(16)** detect a temperature of a sucked air from the room.

10. The air conditioner according to claim 1, wherein said airflow changing units (**52**) includes:

an air capacity distributing mechanism (**10**) for changing a distributing ratio of a blowout air capacity between said air outlets **(4, 4,** ...);
first flaps (**12**) for changing a blowout direction of an airflow in a direction of a long side of each of said outlets (**4**);
a second flap (**13**) for changing a blowout direction of an airflow in a direction of a short side of said each air outlet (**4**); and
driving mechanisms (**29**, **30**, **31**) for driving said air capacity distributing mechanism (**10**), said first flaps (**12**) and said second flap (**13**) independently at said each air outlet (**4**).

11. The air conditioner according to claim 1, wherein said airflow changing unit (**52**) includes:

an air capacity distributing mechanism **(10)** for changing a distributing ratio of a blowout air capacity between said air outlets **(4, 4,** ...);
first flaps **(12)** for changing a blowout direction of an airflow in a direction of a long side of said each air outlet (**4**);
a second flap (**13**) for changing a blowout direction of an airflow in a direction of a short side of said each air outlet (**4**);
driving mechanisms (**29**, **30**) for driving said air capacity distributing mechanism (**10**) and said first flaps (**12**) independently at said each air outlet (**4**); and
a driving mechanism **(31)** for driving said second flaps **(13, 13,** ...) of said air outlets **(4, 4,** ...) in an interlocking manner.

12. The air conditioner according to claim 1, wherein:

a plurality of blowout passages (**14**) each continued to said each air outlet (**4**) are provided in said casing (**1**),
said airflow changing unit (**52**) includes:

an air capacity distributing mechanism (**10**) provided on said each blowout passage (**14**) for changing a distributing ratio of a blowout air capacity between said air outlets **(4, 4,** ...);
first flaps (**12**) provided on said each blowout passage (**14**) for changing a blowout direction of an airflow in a direction of a long side of said each air outlet (**4**);
a driving mechanism (**29**) provided on one end of the direction of the long side of said each air outlet (**4**) in said each blowout passage (**14**), said driving mechanism (**29**) for driving said each air capacity distributing mechanism (**10**); and
a driving mechanism (**30**) provided on the other end of the direction of the long side of said each air outlet (**4**) in said blowout passage (**14**), said driving mechanism (**30**) for driving said each first flap (**12**).

13. The air conditioner according to claim 1, wherein:

a plurality of blowout passages (**14**) each continued to said each air outlet (**4**) are provided in said casing (**1**),
said airflow changing unit (**52**) is provided in said each blowout passage (**14**), and has an air capacity distributing mechanism (**10**) for increasing/decreasing an opening area of said each blowout passage (**14**) so as to change a distributing ratio of a blowout air capacity between said air outlets (**4**, **4**, ...),
said air capacity distributing mechanism (**10**) includes:

a pair of shutters (**11**, **11**) provided on both sides of a direction of a short side of said each air outlet (**4**) in said each blowout passage (**14**), said shutters (**11**, **11**) being freely tilted simultaneously with a movement to an upper stream side of an airflow direction of said blowout passage (**14**); and
a driving mechanism (**29**) for moving said shutters (**11**, **11**) to both ends of said blowout passage (**14**) at the time of an operation for enlarging the opening area of said blowout passage (**14**), and moving said shutters (**11**, **11**) to the upper stream side of said blowout passage (**14**) at the time of an operation for reducing the opening area of said blowout passage (**14**).

Fig. 1

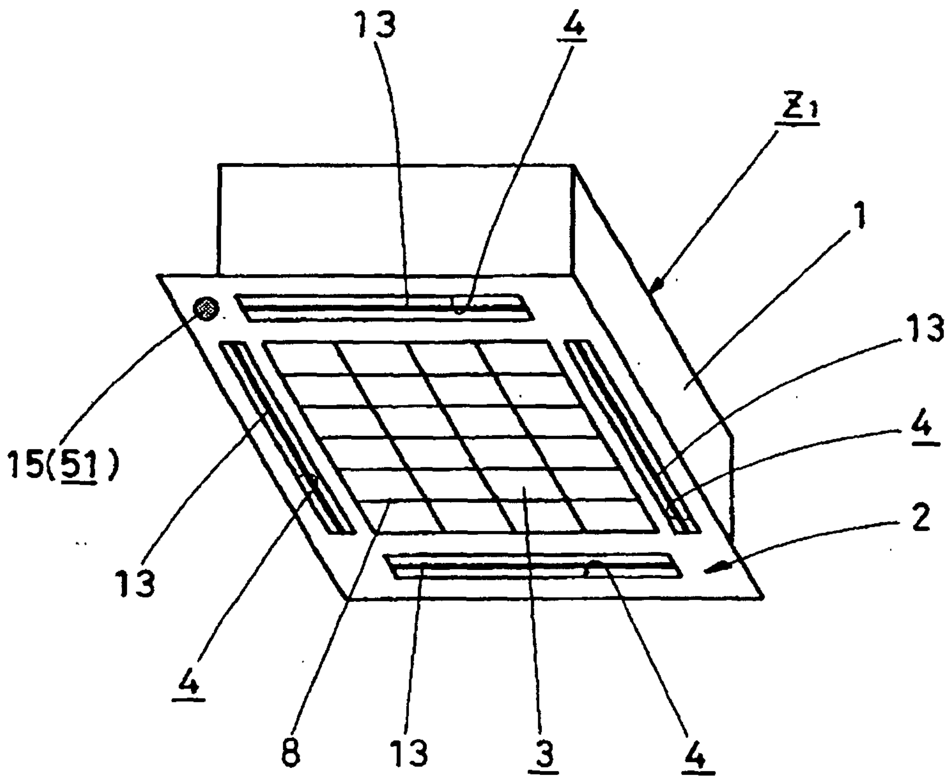


Fig. 2

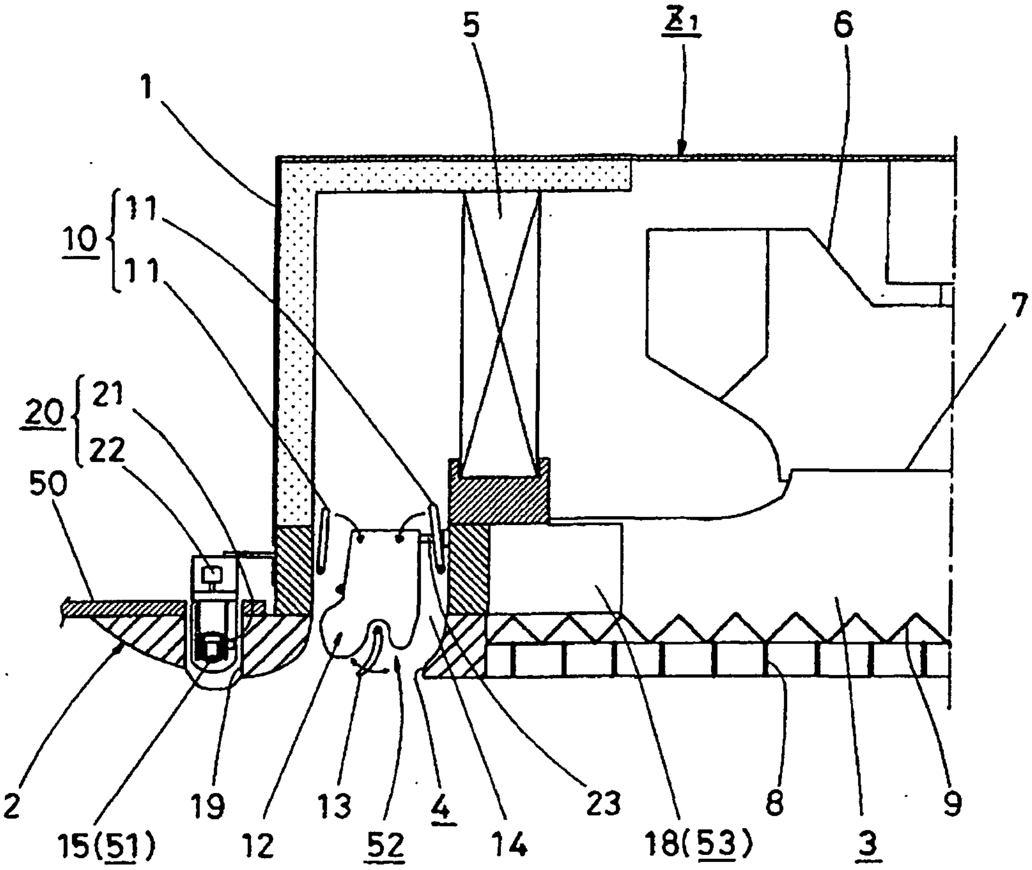
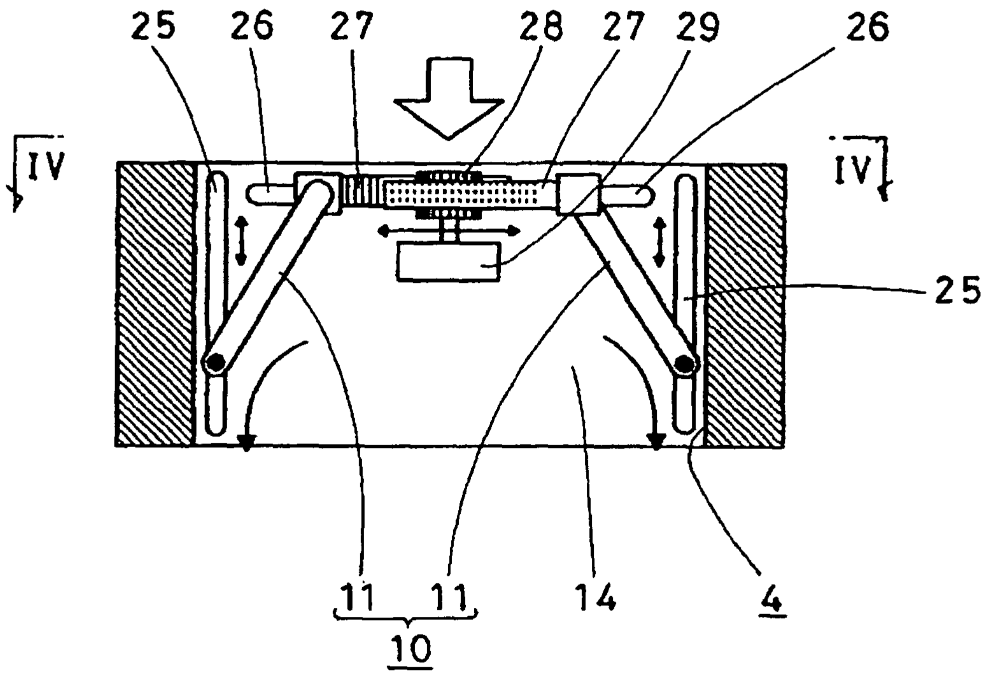


Fig. 3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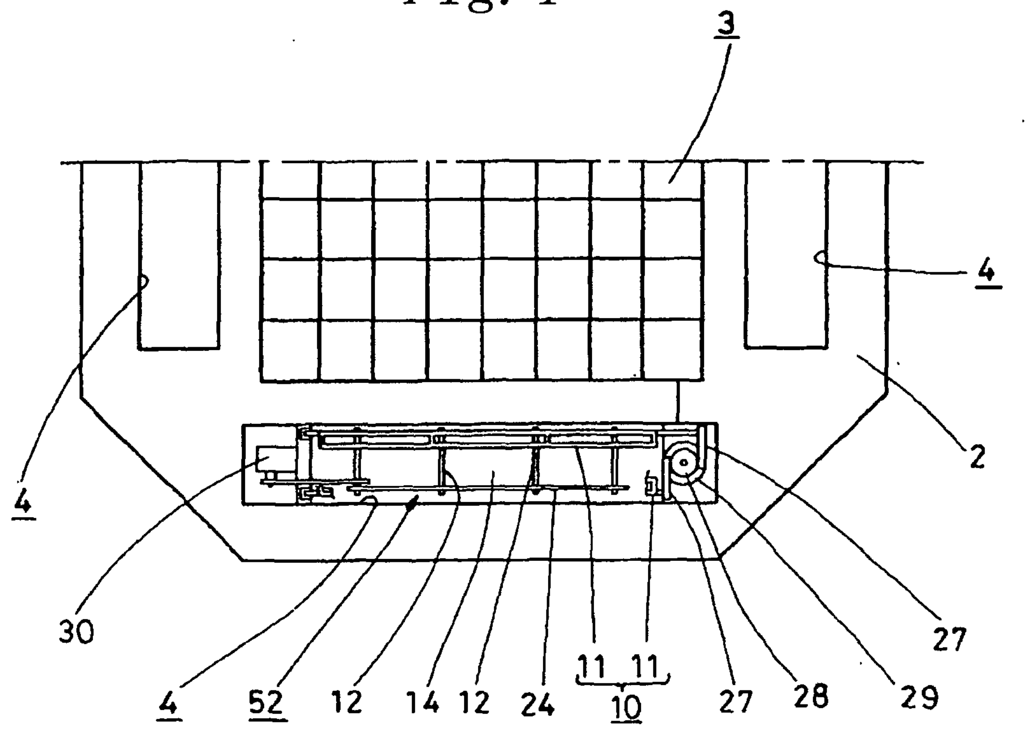
IV
IV
25
11
11
10
14
4

Fig. 4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52
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28
29

Fig. 5

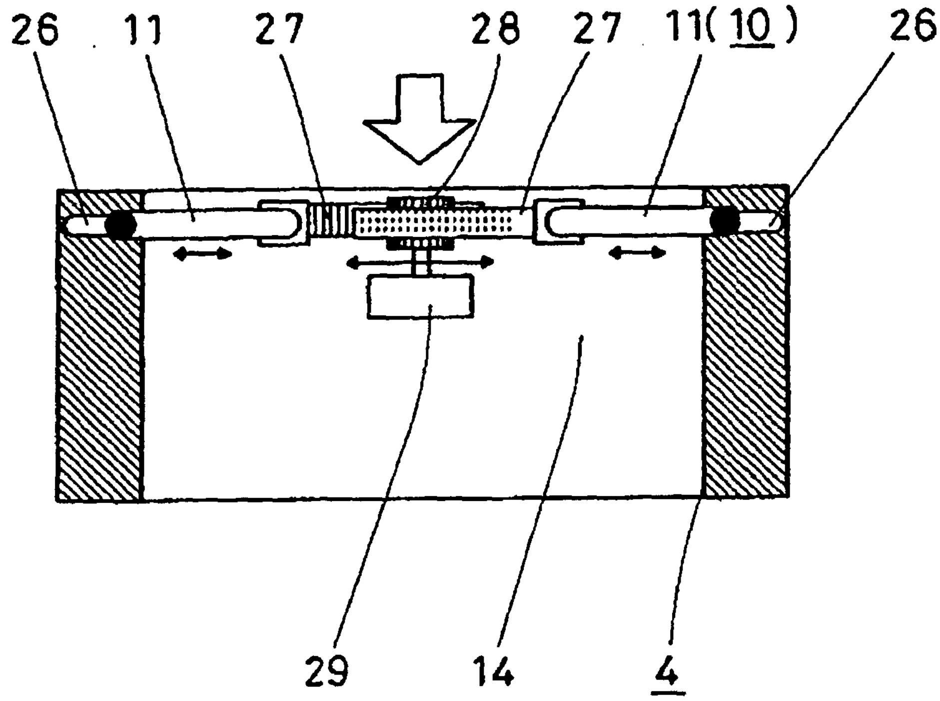


Fig. 6

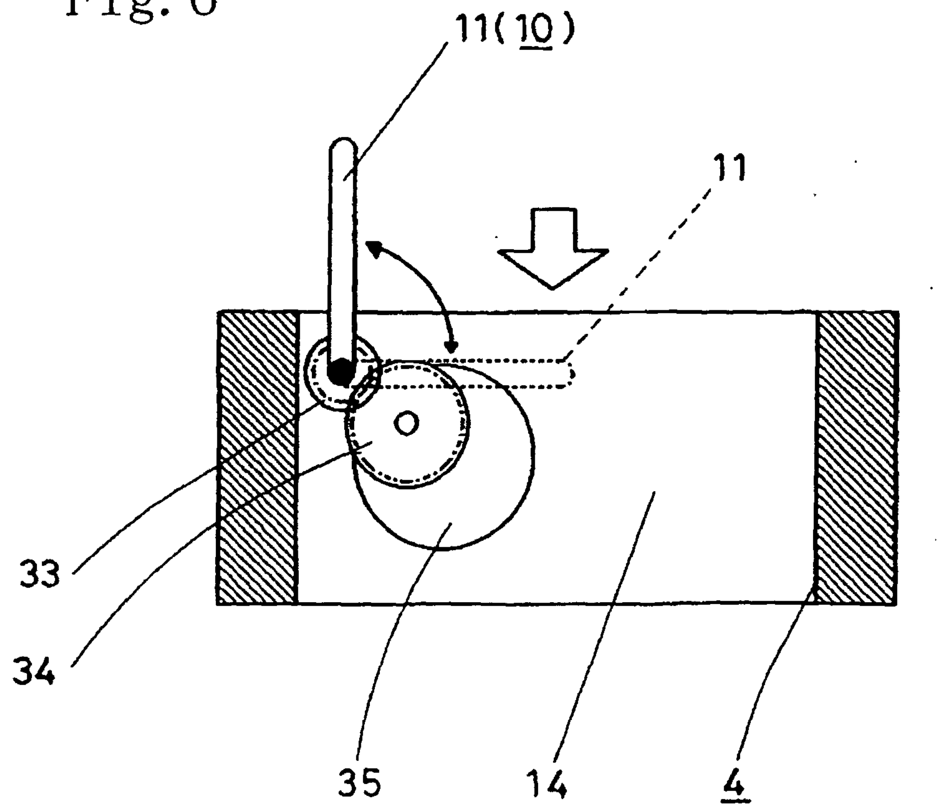


Fig. 7

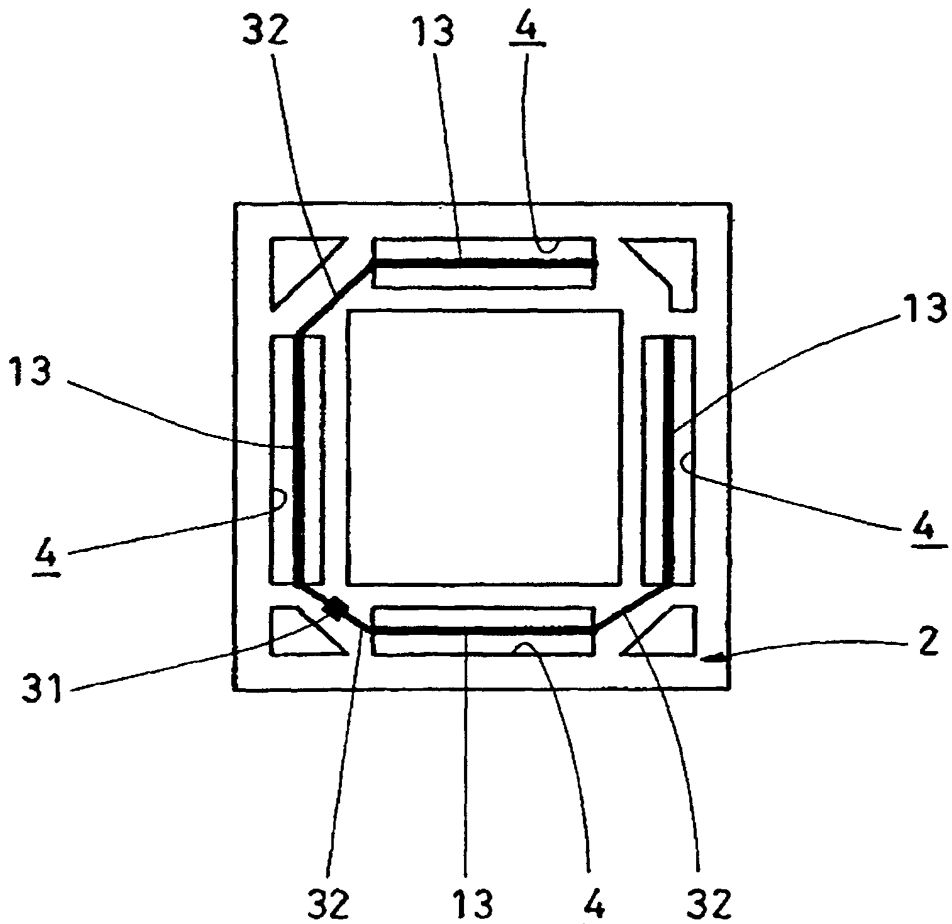


Fig. 8

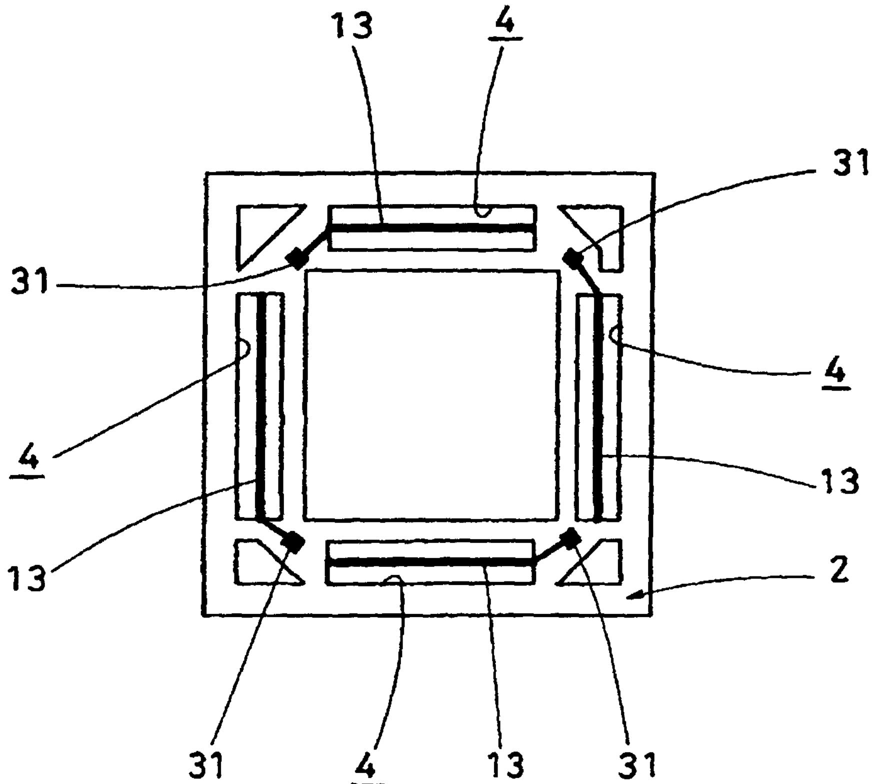
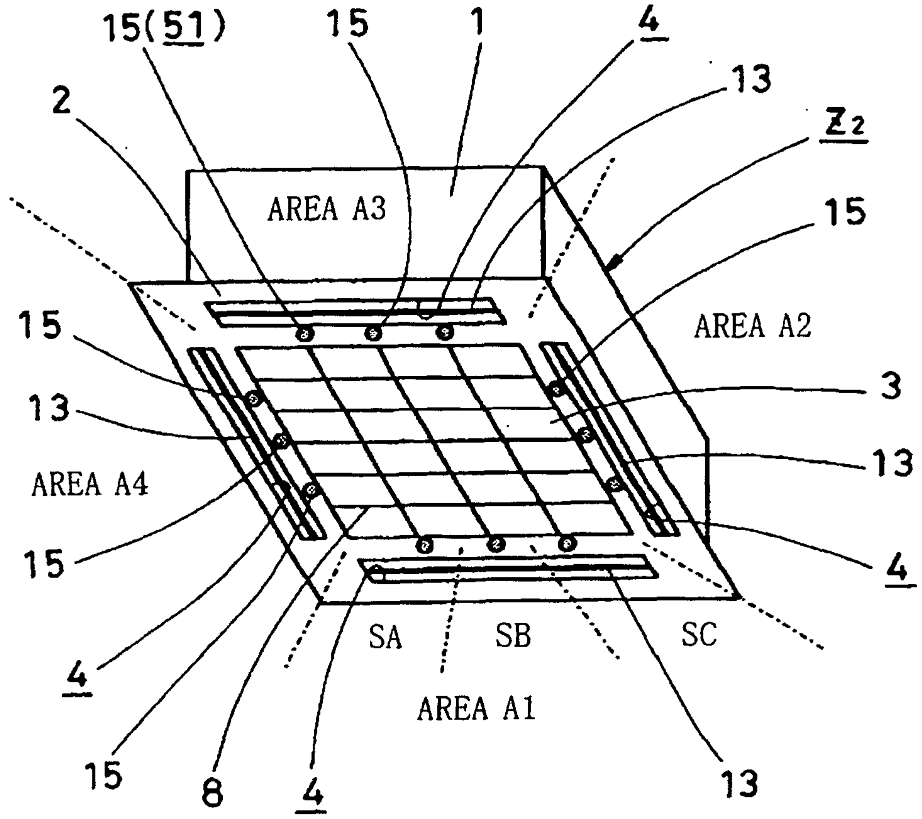


Fig. 9


15(51)
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1
4
13
2
Z2
15
AREA A3
AREA A2
15
3
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13
AREA A4
15
4
4
15
8
4
SA
SB
SC
AREA A1
13

Fig. 10

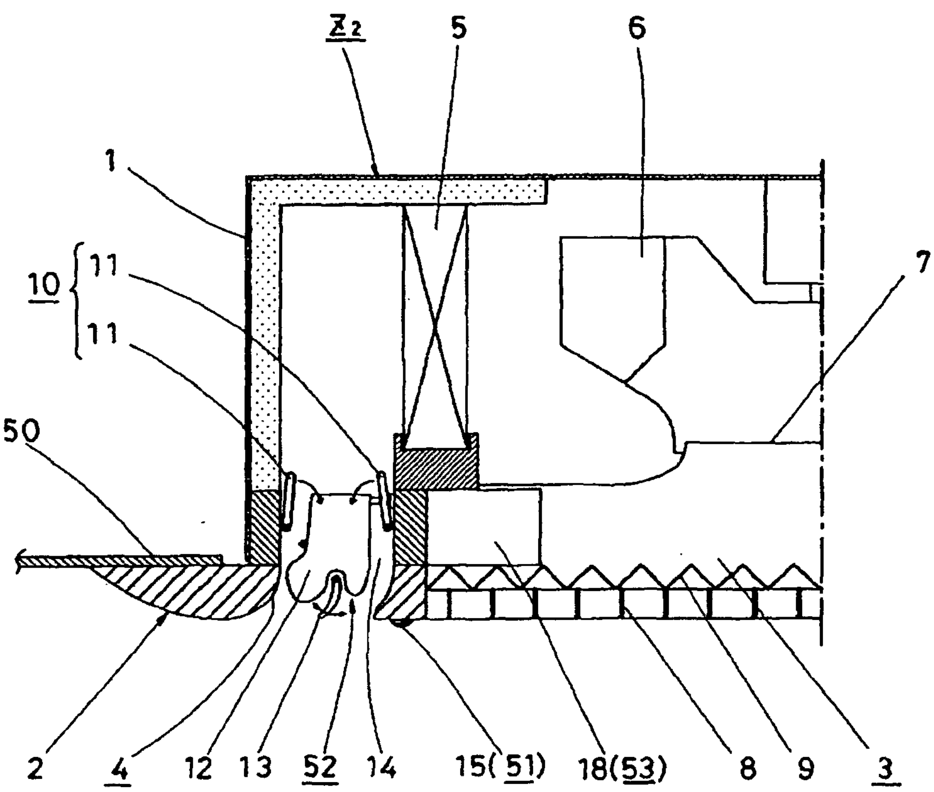
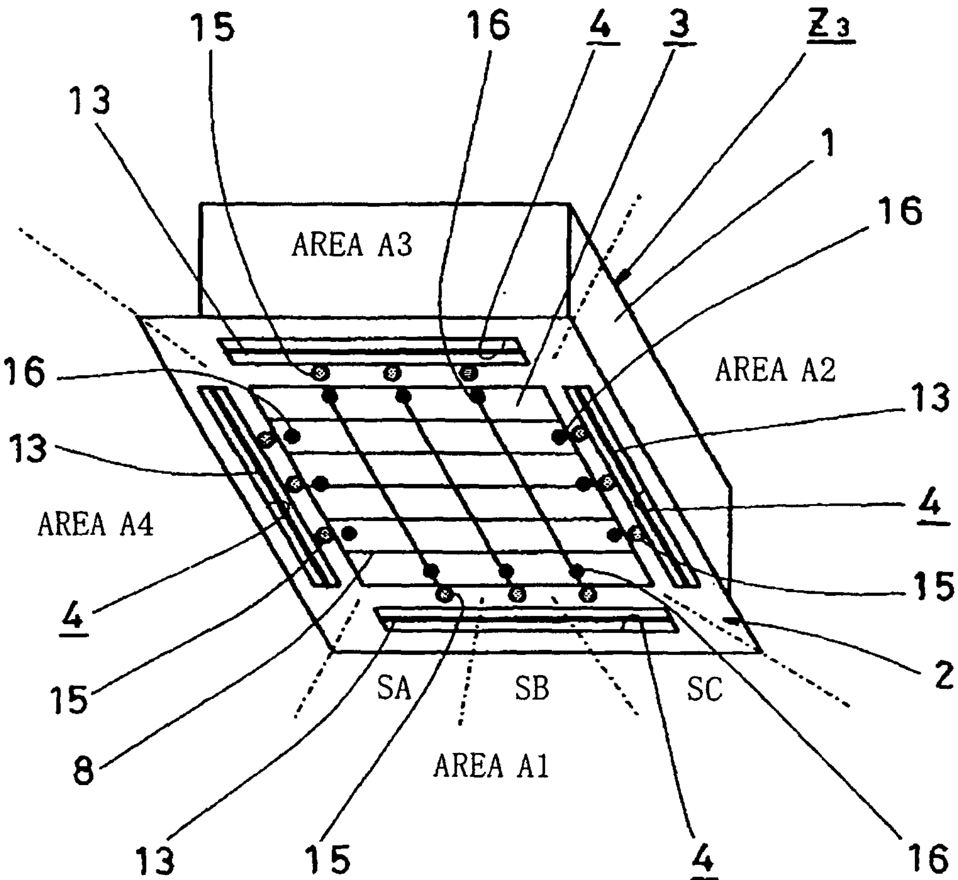


Fig. 11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AREA A2
16
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SB
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AREA A1
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Fig. 12

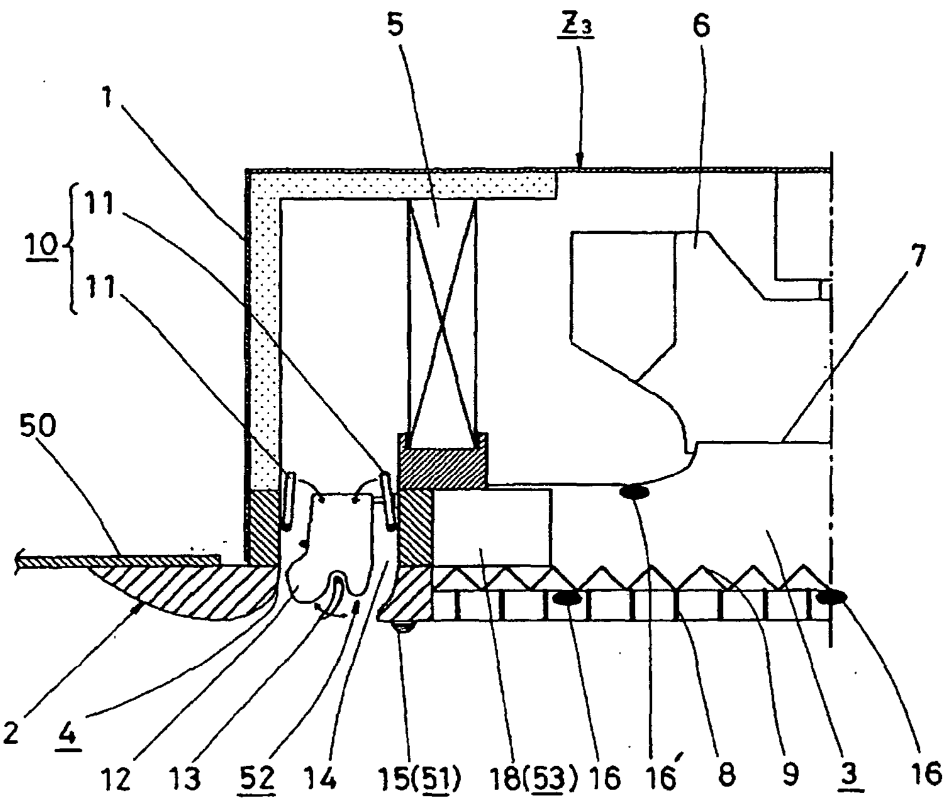


Fig. 13

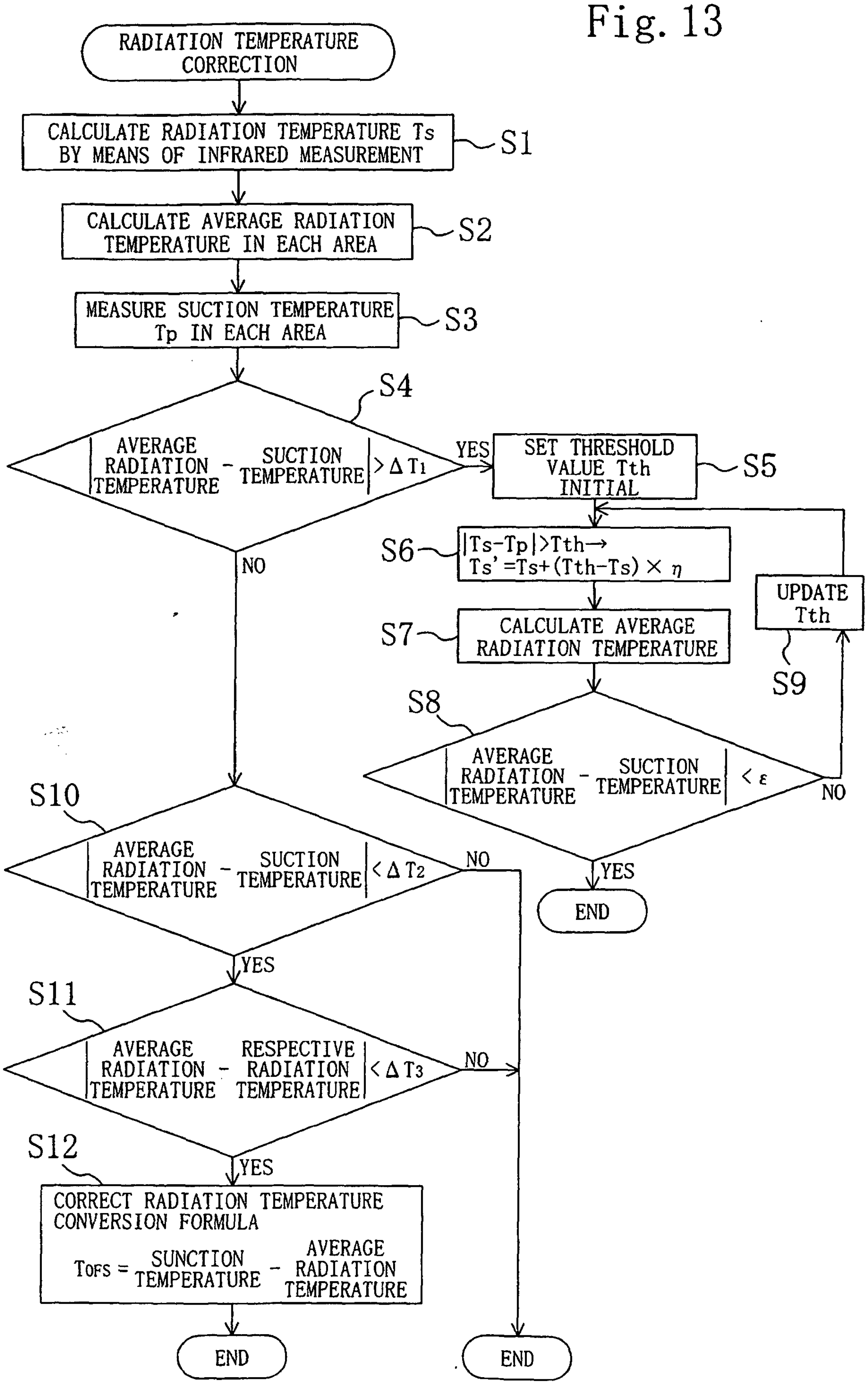
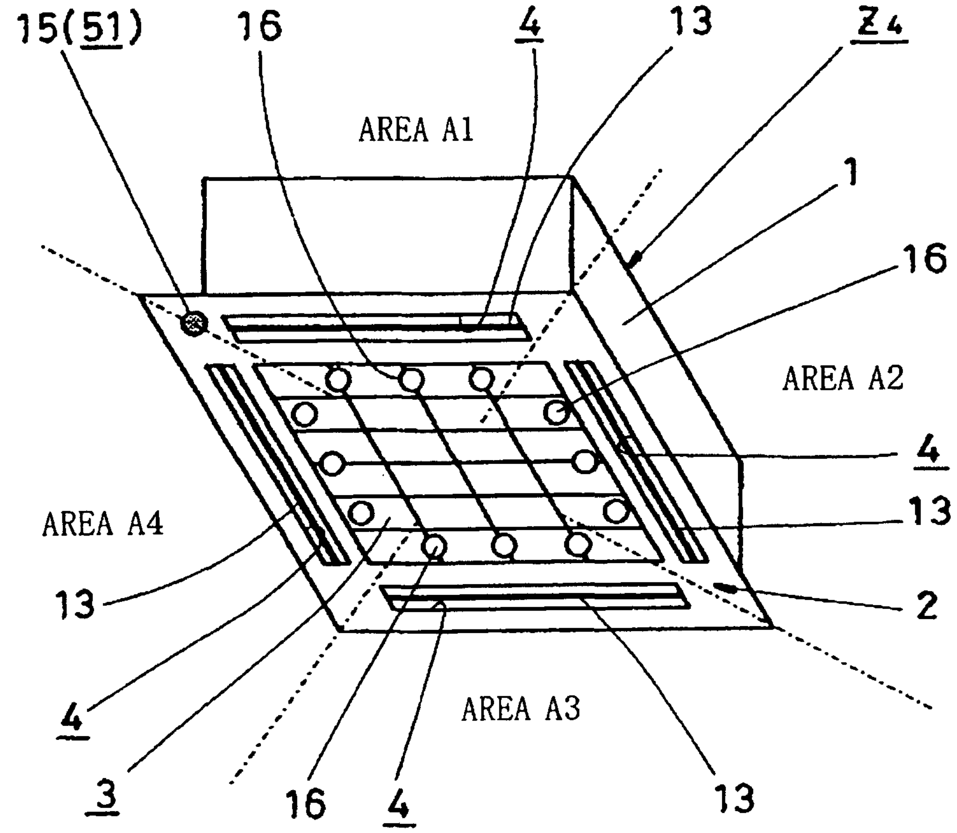

RADIATION TEMPERATURE CORRECTION
CALCULATE RADIATION TEMPERATURE Ts BY MEANS OF INFRARED MEASUREMENT
S1
CALCULATE AVERAGE RADIATION TEMPERATURE IN EACH AREA
S2
MEASURE SUCTION TEMPERATURE Tp IN EACH AREA
S3
S4
|AVERAGE RADIATION TEMPERATURE - SUCTION TEMPERATURE| > ΔT1
YES
NO
SET THRESHOLD VALUE Tth INITIAL
S5
S6
|Ts-Tp|>Tth→ Ts'=Ts+(Tth-Ts)×η
S7
CALCULATE AVERAGE RADIATION TEMPERATURE
UPDATE Tth
S9
S8
|AVERAGE RADIATION TEMPERATURE - SUCTION TEMPERATURE| < ε
NO
YES
END
S10
|AVERAGE RADIATION TEMPERATURE - SUCTION TEMPERATURE| < ΔT2
NO
YES
S11
|AVERAGE RADIATION TEMPERATURE - RESPECTIVE RADIATION TEMPERATURE| < ΔT3
NO
YES
S12
CORRECT RADIATION TEMPERATURE CONVERSION FORMULA
TOFS = SUNCTION TEMPERATURE - AVERAGE RADIATION TEMPERATURE
END
END

Fig. 14


15(51)
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Z4
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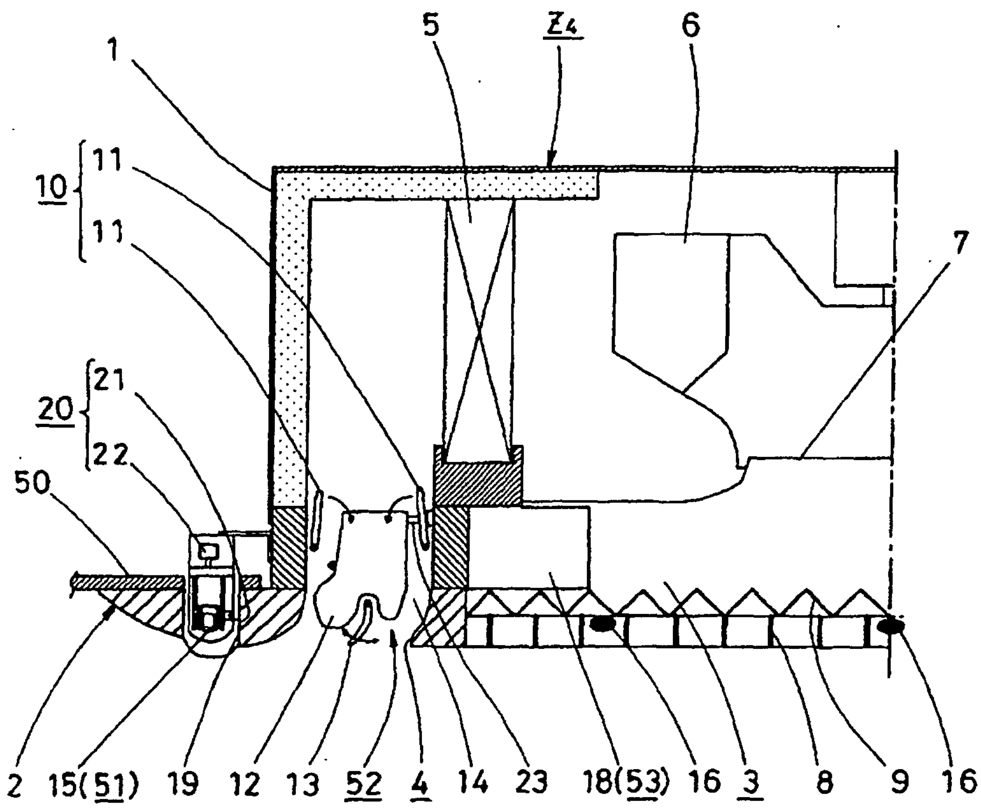
Fig. 15



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP02/11707

A. CLASSIFICATION OF SUBJECT MATTER
Int.Cl7 F24F11/02

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
Int.Cl7 F24F11/02

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Jitsuyo Shinan Koho	1926-1996	Toroku Jitsuyo Shinan Koho	1994-2002
Kokai Jitsuyo Shinan Koho	1971-2002	Jitsuyo Shinan Toroku Koho	1996-2002

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 3-77032 A (Matsushita Refrigeration Co.), 02 April, 1991 (02.04.91), Full text (Family: none)	1-13
Y	JP 3-260546 A (Daikin Industries, Ltd.), 20 November, 1991 (20.11.91), Full text (Family: none)	1-13
Y	JP 6-105236 A (Matsushita Electric Industrial Co., Ltd.), 15 April, 1994 (15.04.94), Full text (Family: none)	7

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:
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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
06 December, 2002 (06.12.02)	24 December, 2002 (24.12.02)
Name and mailing address of the ISA/ Japanese Patent Office	Authorized officer
Facsimile No.	Telephone No.

Form PCT/ISA/210 (second sheet) (July 1998)