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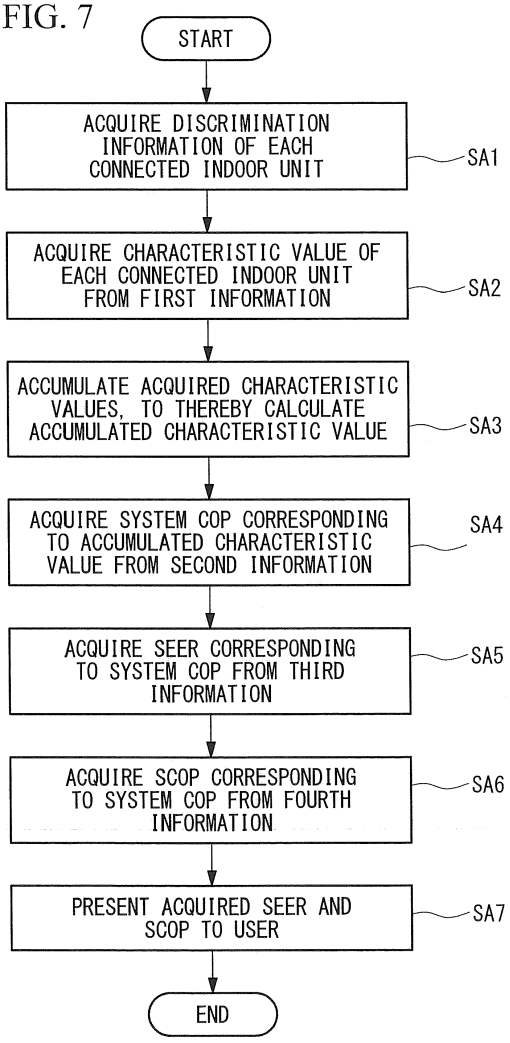
(54) Evaluation supporting apparatus, method, and program for air conditioning system

(57) If discrimination information of each connected indoor unit connected to an outdoor unit is inputted from an input unit (Step SA1), a characteristic value concerning a heat exchanger of each connected indoor unit is acquired from first information (Step SA2), and the acquired characteristic values are accumulated, whereby an accumulated characteristic value is calculated (Step SA3). Subsequently, a coefficient of system performance corresponding to the accumulated characteristic value is acquired from second information (Step SA4), and a SEER and a SCOP corresponding to the coefficient of system performance are respectively acquired from third information and fourth information (Steps SA5 and SA6). The SEER and the SCOP acquired in this way are displayed on a display screen or the like to be thereby presented to a user (Step SA7). Accordingly, a burden and time of an operator in evaluating the SEER and the SCOP can be reduced.

FIG. 7



EP 2 908 066 A2

Description

{Technical Field}

[0001] The present invention relates to an evaluation supporting apparatus, method, and program for an air conditioning system, and, more particularly, to an evaluation supporting apparatus, method, and program for an air conditioning system for making evaluations concerning energy saving.

{Background Art}

[0002] Up to now, in Japan, an annual performance factor (APF) has been used as one of energy saving evaluation standards for air conditioning systems, and systems for calculating this evaluation value have been proposed (see, for example, PTL 1).

[0003] In Europe, a seasonal energy efficiency ratio (SEER) and a seasonal coefficient of performance (SCOP) have become popular as energy saving evaluation standards, instead of an energy efficiency ratio (EER) and a coefficient of performance (COP) that are conventionally used.

{Citation List}

{Patent Literature}

[0004] {PTL 1} Japanese Unexamined Patent Application, Publication No. 9-79650

{Summary of Invention}

{Technical Problem}

[0005] An indoor unit is connected to an outdoor unit in various patterns. In recent years, pluralities of different types (for example, a ceiling cassette type and a wall type) of indoor units are connected to a common outdoor unit in many cases. In the case where such different types of indoor units are connected to a common outdoor unit, calculation of a SEER and a SCOP becomes more complicated, and a burden on an operator increases.

[0006] The present invention, which has been made in view of the above-mentioned circumstances, has an object to provide an evaluation supporting apparatus, method, and program for an air conditioning system capable of reducing a burden and time of an operator in evaluating a SEER and a SCOP.

{Solution to Problem}

[0007] According to a first aspect of the present invention, an evaluation supporting apparatus for an air conditioning system includes: an input means for inputting discrimination information for identifying each connected indoor unit connected to an outdoor unit; first information in which the discrimination information of each indoor unit connectable to the outdoor unit and a characteristic value concerning a heat exchanger of the indoor unit are associated with each other; an accumulation means for acquiring the characteristic value corresponding to each connected indoor unit from the first information and accumulating the acquired characteristic values, to thereby calculate an accumulated characteristic value; second information in which the accumulated characteristic value and a coefficient of system performance are associated with each other; a coefficient-of-system-performance acquiring means for acquiring the coefficient of system performance corresponding to the accumulated characteristic value calculated by the accumulation means, from the second information; third information in which the coefficient of system performance and a seasonal energy efficiency ratio are associated with each other; and a seasonal energy efficiency ratio acquiring means for acquiring the seasonal energy efficiency ratio corresponding to the coefficient of system performance acquired by the coefficient-of-system-performance acquiring means, from the third information.

[0008] According to the above-mentioned configuration, if the discrimination information of each connected indoor unit connected to the outdoor unit is inputted from the input means, the characteristic value concerning the heat exchanger of each connected indoor unit is acquired from the first information, and the acquired characteristic values are accumulated, whereby the accumulated characteristic value is calculated. Subsequently, the coefficient of system performance corresponding to the accumulated characteristic value is acquired from the second information, and the seasonal energy efficiency ratio corresponding to the coefficient of system performance is acquired from the third information. The seasonal energy efficiency ratio (SEER) acquired in this way is, for example, outputted to an output means such as a display screen to be thereby presented to a user.

[0009] According to the above-mentioned configuration, the seasonal energy efficiency ratio can be obtained through simple work of inputting the discrimination information for identifying each indoor unit connected to the outdoor unit. Accordingly, efforts and time of the user can be reduced.

[0010] According to a second aspect of the present invention, an evaluation supporting apparatus for an air conditioning system includes: an input means for inputting discrimination information for identifying each connected indoor unit connected to an outdoor unit; first information in which the discrimination information of each indoor unit connectable to the outdoor unit and a characteristic value concerning a heat exchanger of the indoor unit are associated with each other; an accumulation means for acquiring the characteristic value corresponding to each connected indoor unit from the first information and accumulating the acquired characteristic values, to thereby calculate an accumulated characteristic value; second information in which the accumulated characteristic value and a coefficient of system performance are associated with each other; a coefficient-of-system-performance acquiring means for acquiring the coefficient of system performance corresponding to the accumulated characteristic value calculated by the accumulation means, from the second information; fourth information in which the coefficient of system performance and a seasonal coefficient of performance are associated with each other; and a seasonal coefficient-of-performance acquiring means for acquiring the seasonal coefficient of performance corresponding to the coefficient of system performance acquired by the coefficient-of-system-performance acquiring means, from the fourth information.

[0011] According to the above-mentioned configuration, if the discrimination information of each connected indoor unit connected to the outdoor unit is inputted from the input means, the characteristic value concerning the heat exchanger of each connected indoor unit is acquired from the first information, and the acquired characteristic values are accumulated, whereby the accumulated characteristic value is calculated. Subsequently, the coefficient of system performance corresponding to the accumulated characteristic value is acquired from the second information, and the seasonal coefficient of performance corresponding to the coefficient of system performance is acquired from the fourth information. The seasonal coefficient of performance (SCOP) acquired in this way is, for example, outputted to an output means such as a display screen to be thereby presented to a user.

[0012] According to the above-mentioned configuration, the seasonal coefficient of performance can be obtained through simple work of inputting the discrimination information for identifying each indoor unit connected to the outdoor unit. Accordingly, efforts and time of the user can be reduced.

[0013] In the above-mentioned evaluation supporting apparatus for the air conditioning system, the characteristic value in the first information may be set assuming one of a refrigerant circulation amount and a compressor frequency depending on a capacity of each indoor unit. Accordingly, the characteristic value can be calculated in consideration of one of the refrigerant circulation amount and the compressor frequency.

[0014] The above-mentioned evaluation supporting apparatus for the air conditioning system may further include: fifth information in which a total capacity of the connected indoor units and a first correction value are associated with each other; and a first correction means for acquiring the first correction value corresponding to the total capacity of the connected indoor units from the fifth information and correcting the accumulated characteristic value using the acquired first correction value. The coefficient-of-system-performance acquiring means may acquire the coefficient of system performance corresponding to the corrected accumulated characteristic value from the second information.

[0015] According to the above-mentioned configuration, the first correction value depending on the total capacity of the connected indoor units is acquired, and the accumulated characteristic value is corrected using the acquired first correction value. Accordingly, the accumulated characteristic value can be calculated in consideration of the total capacity of the connected indoor units. Therefore, the calculation accuracy of the accumulated characteristic value can be improved, and the calculation accuracy of the seasonal energy efficiency ratio and the seasonal coefficient of performance can be improved eventually.

[0016] For example, the first correction value is set to 1 in a case where the total capacity of the connected indoor units is coincident with an indoor unit capacity at a rated capacity of the outdoor unit, and is set to a value that becomes smaller than 1 as the total capacity of the connected indoor units becomes higher than the indoor unit capacity at a rated capacity of the outdoor unit.

[0017] In the above-mentioned evaluation supporting apparatus for the air conditioning system, the second information may be provided for each of an air cooling operation and an air heating operation. Because the pieces of information corresponding to both the air cooling operation and the air heating operation are held, the seasonal energy efficiency ratio and the seasonal coefficient of performance can be obtained using an appropriate coefficient of system performance.

[0018] In the above-mentioned evaluation supporting apparatus for the air conditioning system, in a case where the characteristic value is a degree of effectiveness of the heat exchanger, the evaluation supporting apparatus may include: sixth information in which the accumulated characteristic value and an indoor heat exchange amount are associated with each other; and seventh information in which the accumulated characteristic value and a sum of inverter power consumption and compressor power consumption are associated with each other, instead of the second information, and the coefficient-of-system-performance acquiring means may respectively acquire the indoor heat exchange amount and the sum of the inverter power consumption and the compressor power consumption corresponding to the accumulated

characteristic value, from the sixth information and the seventh information, and may apply: the acquired indoor heat exchange amount; the acquired sum of the inverter power consumption and the compressor power consumption; an input of an indoor fan motor; and power consumption of indoor and outdoor fan motors, to a predetermined arithmetic expression set in advance, to thereby calculate the coefficient of system performance.

[0019] The above-mentioned evaluation supporting apparatus for the air conditioning system may further include: eighth information in which a standby power and a second correction value are associated with each other; and a second correction means for acquiring the second correction value corresponding to the standby power of each connected indoor unit from the eighth information and correcting the seasonal energy efficiency ratio acquired by the seasonal energy efficiency ratio acquiring means, using the second correction value.

[0020] Because the seasonal energy efficiency ratio is corrected using the second correction value concerning the standby power as described above, the seasonal energy efficiency ratio can be calculated also in consideration of the standby power.

[0021] According to a third aspect of the present invention, an evaluation supporting method for an air conditioning system includes: a first step of acquiring discrimination information for identifying each connected indoor unit connected to an outdoor unit; a second step of acquiring, from first information in which the discrimination information of each indoor unit connectable to the outdoor unit and a characteristic value concerning a heat exchanger of the indoor unit are associated with each other, the characteristic value corresponding to each connected indoor unit and accumulating the acquired characteristic values, to thereby calculate an accumulated characteristic value; a third step of acquiring, from second information in which the accumulated characteristic value and a coefficient of system performance are associated with each other, the coefficient of system performance corresponding to the accumulated characteristic value calculated in the second step; and a fourth step of acquiring, from third information in which the coefficient of system performance and a seasonal energy efficiency ratio are associated with each other, the seasonal energy efficiency ratio corresponding to the coefficient of system performance acquired in the third step.

[0022] According to a fourth aspect of the present invention, an evaluation supporting method for an air conditioning system includes: a first step of acquiring discrimination information for identifying each connected indoor unit connected to an outdoor unit; a second step of acquiring, from first information in which the discrimination information of each indoor unit connectable to the outdoor unit and a characteristic value concerning a heat exchanger of the indoor unit are associated with each other, the characteristic value corresponding to each connected indoor unit and accumulating the acquired characteristic values, to thereby calculate an accumulated characteristic value; a third step of acquiring, from second information in which the accumulated characteristic value and a coefficient of system performance are associated with each other, the coefficient of system performance corresponding to the accumulated characteristic value calculated in the second step; and a fifth step of acquiring, from fourth information in which the coefficient of system performance and a seasonal coefficient of performance are associated with each other, the seasonal coefficient of performance corresponding to the coefficient of system performance acquired in the third step.

[0023] According to a fifth aspect of the present invention, an evaluation supporting program for an air conditioning system causes a computer to execute: a first process of acquiring discrimination information for identifying each connected indoor unit connected to an outdoor unit; a second process of acquiring, from first information in which the discrimination information of each indoor unit connectable to the outdoor unit and a characteristic value concerning a heat exchanger of the indoor unit are associated with each other, the characteristic value corresponding to each connected indoor unit and accumulating the acquired characteristic values, to thereby calculate an accumulated characteristic value; a third process of acquiring, from second information in which the accumulated characteristic value and a coefficient of system performance are associated with each other, the coefficient of system performance corresponding to the accumulated characteristic value calculated in the second process; and a fourth process of acquiring, from third information in which the coefficient of system performance and a seasonal energy efficiency ratio are associated with each other, the seasonal energy efficiency ratio corresponding to the coefficient of system performance acquired in the third process.

[0024] According to a sixth aspect of the present invention, an evaluation supporting program for an air conditioning system causes a computer to execute: a first process of acquiring discrimination information for identifying each connected indoor unit connected to an outdoor unit; a second process of acquiring, from first information in which the discrimination information of each indoor unit connectable to the outdoor unit and a characteristic value concerning a heat exchanger of the indoor unit are associated with each other, the characteristic value corresponding to each connected indoor unit and accumulating the acquired characteristic values, to thereby calculate an accumulated characteristic value; a third process of acquiring, from second information in which the accumulated characteristic value and a coefficient of system performance are associated with each other, the coefficient of system performance corresponding to the accumulated characteristic value calculated in the second process; and a fifth process of acquiring, from fourth information in which the coefficient of system performance and a seasonal coefficient of performance are associated with each other, the seasonal coefficient of performance corresponding to the coefficient of system performance acquired in the third process.

{Advantageous Effects of Invention}

[0025] The present invention produces an effect of reducing efforts and working time of a user in evaluating a SEER and a SCOP that are ones of energy saving evaluation standards.

{Brief Description of Drawings}

[0026]

{Fig. 1} Fig. 1 is a diagram for describing an evaluation supporting apparatus for an air conditioning system according to a first embodiment of the present invention.
{Fig. 2} Fig. 2 is a block diagram illustrating an example of a hardware configuration of the evaluation supporting apparatus according to the first embodiment of the present invention.
{Fig. 3} Fig. 3 is a functional block diagram illustrating, in a developed manner, functions provided to the evaluation supporting apparatus according to the first embodiment of the present invention.
{Fig. 4} Fig. 4 is a graph illustrating an example of second information in an air heating operation in the case of using an approximate curve.
{Fig. 5} Fig. 5 is a graph illustrating an example of third information.
{Fig. 6} Fig. 6 is a graph illustrating an example of fourth information.
{Fig. 7} Fig. 7 is a flowchart for describing procedures of processing performed by the evaluation supporting apparatus according to the first embodiment of the present invention.
{Fig. 8} Fig. 8 is a functional block diagram illustrating, in a developed manner, functions provided to an evaluation supporting apparatus according to a second embodiment of the present invention.
{Fig. 9} Fig. 9 is a graph illustrating the relation between a total capacity of connected indoor units and an accumulated characteristic value.
{Fig. 10} Fig. 10 is a graph illustrating an example of fifth information.
{Fig. 11} Fig. 11 is a graph illustrating the relation between the accumulated characteristic value and an indoor heat exchange amount.
{Fig. 12} Fig. 12 is a graph illustrating the relation between the accumulated characteristic value and machine power consumption.
{Fig. 13} Fig. 13 is a functional block diagram illustrating, in a developed manner, functions provided to an evaluation supporting apparatus according to a fourth embodiment of the present invention.
{Fig. 14} Fig. 14 is a graph illustrating an example of eighth information.

{Description of Embodiments}

(First Embodiment)

[0027] Hereinafter, an evaluation supporting apparatus, method, and program for an air conditioning system according to a first embodiment of the present invention are described with reference to the drawings.

[0028] Fig. 1 is a diagram for describing the evaluation supporting apparatus for the air conditioning system (hereinafter, referred to as "evaluation supporting apparatus") according to the present embodiment. An evaluation supporting apparatus 10a calculates a SEER and a SCOP that are evaluation values concerning energy saving of an air conditioning system 1 including one outdoor unit 2 and a plurality of indoor units 5 connected to the outdoor unit 2 (hereinafter, the indoor units connected to the outdoor unit 2 are referred to as "connected indoor units 5" in order to distinguish from other indoor units).

[0029] For convenience sake, the following description is given assuming that the evaluation supporting apparatus 10a and the outdoor unit 2 of the air conditioning system 1 as an evaluation target correspond one-to-one with each other, but, if the following function is prepared for various outdoor units, general versatility can be obtained.

[0030] Fig. 2 is a block diagram illustrating an example of a hardware configuration of the evaluation supporting apparatus 10a according to the present embodiment. As illustrated in Fig. 2, the evaluation supporting apparatus 10a includes, for example, a central processing unit (CPU) 11, a read only memory (ROM) 12 for storing programs to be executed by the CPU 11, a random access memory (RAM) 13 that functions as a work area at the time of executing each program, a hard disk drive (HDD) 14 as a high-capacity storage device, a communication interface 15 for connecting to a network, an access unit 17 to which an external storage device 16 is attached, an input unit 18 including a keyboard and a mouse, and an output unit 19 such as a liquid crystal display that provides information to a user. These units are connected to one another by a bus 20.

[0031] The ROM 12 stores various programs (for example, an evaluation supporting program), and the CPU 11 reads

the programs out of the ROM 12 onto the RAM 13 and executes the read programs to thereby perform various processes.

[0032] A storage medium for storing the programs to be executed by the CPU 11 may be, for example, other auxiliary storage devices such as a magnetic disk, a magneto-optical disk, and a semiconductor memory.

[0033] For example, the evaluation supporting apparatus 10a may exist as a system independent of the air conditioning system, and may be provided in an apparatus (for example, a central control unit) relating to the air conditioning system, as part of functions provided to the apparatus.

[0034] For example, the evaluation supporting apparatus 10a may be installed in a manufacturer of the air conditioning system, and may be operated by an operator in the manufacturer. Alternatively, the evaluation supporting apparatus 10a may be installed in a facility of an owner of the air conditioning system, and may be operated by an operator in the facility of the owner. Still alternatively, a terminal of the owner and the evaluation supporting apparatus 10a installed in the manufacturer may be connected to each other via the network, the evaluation supporting apparatus 10a may calculate a SEER and a SCOP on the basis of input information inputted by the terminal of the owner, and the calculation results may be displayed on the terminal of the owner. In this way, how to use the air conditioning system is not particularly limited.

[0035] Fig. 3 is a functional block diagram illustrating, in a developed manner, functions provided to the evaluation supporting apparatus 10a. As illustrated in Fig. 3, the evaluation supporting apparatus 10a includes an input unit 21, a storage unit 22, an accumulation unit 23, a coefficient-of-system-performance acquiring unit (hereinafter, referred to as "system COP acquiring unit") 24, a seasonal energy efficiency ratio acquiring unit (hereinafter, referred to as "SEER acquiring unit") 25, and a seasonal coefficient-of-performance acquiring unit (hereinafter, referred to as "SCOP acquiring unit") 26, and an output unit 27.

[0036] The input unit 21 serves to input discrimination information for identifying each connected indoor unit 5 connected to the outdoor unit 2 of the air conditioning system 1 as the evaluation target. The discrimination information contains at least an indoor unit type (such as a wall type, a ceiling cassette type, and a duct type) and an indoor unit capacity.

[0037] According to an example of how to input the discrimination information of an indoor unit, types and capacities of all indoor units connectable to the outdoor unit of the air conditioning system are selectably displayed as a pull-down menu on a display screen, and the user selects a type and a capacity corresponding to the indoor unit from this menu and performs a confirmation operation. Specifically how to input the discrimination information is not particularly limited as long as the type and the capacity of the connected indoor unit 5 can be inputted.

[0038] The storage unit 22 stores: first information in which the discrimination information of each indoor unit connectable to the outdoor unit 2 and a characteristic value concerning a heat exchanger of the indoor unit are associated with each other; second information in which an accumulated characteristic value and a coefficient of system performance (system COP) are associated with each other; third information in which the system COP and a SEER are associated with each other; and fourth information in which the system COP and a SCOP are associated with each other.

[0039] The pieces of information stored in the storage unit 22 may be acquired by downloading from a predetermined server via a communication medium (for example, the Internet).

[0040] The first information to the fourth information are described in order.

[0041] First, the first information is described in detail.

[0042] A characteristic value C concerning the heat exchanger of each indoor unit in the first information is the degree of effectiveness of the heat exchanger, and is calculated using an arithmetic expression having a heat capacity flow rate Cmin and a heat exchange effectiveness rate ε as its main parameters, as shown in Expression (1) given below, for example. The heat exchange effectiveness rate ε is calculated using an arithmetic expression having a refrigerant circulation amount F as its main parameter, as shown in Expression (2) given below.

$$C = f(Cmin,\ \varepsilon) \qquad (1)$$

$$\varepsilon = f(F) \qquad (2)$$

[0043] Here, the refrigerant circulation amount F changes depending on the indoor unit capacity. For example, in the case of an indoor unit having a capacity of 28 kW, assuming that the maximum indoor unit capacity at the rated load of the outdoor unit is 112 kW, the refrigerant circulation amount $F_{(28)}$ is calculated using Expression (3) given below.

$$F_{(28)} = F_{tol} \times (28 / 112) \qquad (3)$$

[0044] In Expression (3), F_{tol} is the total circulation amount at the rated load, and is a value specific to the outdoor unit. Similarly, the maximum indoor unit capacity of 112 kW is a value specific to the outdoor unit. Note that, if the compressor frequency {Hz} at the rated load is used in Expression (3) given above instead of the total circulation amount F_{tol} at the rated load, a compressor frequency depending on the indoor unit capacity can be obtained.

[0045] In this way, the characteristic value C for which a refrigerant circulation amount depending on the indoor unit capacity is considered is calculated for each indoor unit connectable to the outdoor unit 2, and the calculated characteristic value C is associated with the discrimination information (the combination of the indoor unit type and the indoor unit capacity) of each indoor unit, whereby the first information is created.

[0046] The accumulation unit 23 acquires, from the first information, the characteristic value C associated with the discrimination information of each connected indoor unit 5 inputted from the input unit 21, and accumulates the acquired characteristic values C, to thereby calculate an accumulated characteristic value ΣC.

[0047] For example, in the case where two wall type indoor units each having a capacity of 28 kW and two ceiling cassette type indoor units each having a capacity of 56 kW are connected to the outdoor unit 2, the accumulated characteristic value ΣC is as follows.

$$\Sigma C = 2 \times C_{(28)} + 2 \times C_{(56)} \qquad (4)$$

[0048] In Expression (4) given above, $C_{(28)}$ represents the degree of effectiveness of the heat exchanger of each wall type indoor unit having a capacity of 28 kW, and $C_{(56)}$ represents the degree of effectiveness of the heat exchanger of each ceiling cassette type indoor unit having a capacity of 56 kW.

[0049] Next, the second information is described.

[0050] For example, indoor units are connected to the outdoor unit 2 in various combination patterns. Examples of the combination patterns include: a pattern in which two wall type indoor units each having a capacity of 56 kW are connected to the outdoor unit 2; a pattern in which two ceiling cassette type indoor units each having a capacity of 56 kW are connected thereto; a pattern in which four ceiling cassette type indoor units each having a capacity of 28 kW are connected thereto; and a pattern in which two wall type indoor units each having a capacity of 28 kW and two wall type indoor units each having a capacity of 56 kW are connected thereto.

[0051] In view of the above, the system COP is calculated in advance for each connection pattern of indoor units, and the calculated system COP and the accumulated characteristic value ΣC are associated with each other, whereby the second information is created. Here, the second information may be correspondingly provided for each connection pattern of indoor units. Alternatively, in the case where the connection patterns have similar system COP characteristics, an approximate curve of the similar characteristics may be obtained, whereby the system COP characteristics of the connection patterns may be integrated into one. Moreover, because the value of the system COP is different between an air cooling operation and an air heating operation, the second information may be prepared for both the air cooling operation and the air heating operation. Fig. 4 illustrates an example of the second information in the air heating operation in the case of using an approximate curve.

[0052] The system COP acquiring unit 24 acquires a system COP corresponding to the accumulated characteristic value ΣC calculated by the accumulation unit 23, from the second information stored in the storage unit 22. At this time, in the case where the second information corresponding to the air cooling operation and the second information corresponding to the air heating operation are stored in the storage unit 22, the system COP acquiring unit 24 may acquire the system COP from the second information corresponding to each of the air heating operation and the air cooling operation.

[0053] Next, the third information and the fourth information are described.

[0054] The relation between the system COP and the SEER is obtained for each connection pattern of indoor units connectable to the outdoor unit 2 by performing examinations and simulations in advance, and an approximate curve of the results is obtained, whereby the third information is obtained. Fig. 5 illustrates an example of the third information. In Fig. 5, the horizontal axis represents the system COP, and the vertical axis represents the SEER.

[0055] Similarly, the relation between the system COP and the SCOP is obtained for each connection pattern, and an approximate curve of the results is obtained, whereby the fourth information is obtained. Fig. 6 illustrates an example of the fourth information. In Fig. 6, the horizontal axis represents the system COP, and the vertical axis represents the SCOP.

[0056] Here, the system COP associated with the SEER and the SCOP may be a coefficient in the air cooling operation, and may be a coefficient in the air heating operation. For example, the third information and the fourth information may be prepared in accordance with the system COP obtained by the system COP acquiring unit 24 described above. Moreover, in the case where the system COP acquiring unit 24 obtains both the system COP in the air cooling operation and the system COP in the air heating operation, for example, the third information associated with the system COP in

the air cooling operation may be prepared for the SEER, and the fourth information associated with the system COP in the air heating operation may be prepared for the SCOP.

[0057] The SEER acquiring unit 25 acquires the SEER corresponding to the system COP acquired by the system COP acquiring unit 24, from the third information.

[0058] The SCOP acquiring unit 26 acquires the SCOP corresponding to the system COP acquired by the system COP acquiring unit 24, from the fourth information.

[0059] The output unit 27 is, for example, a display device, and displays the SEER acquired by the SEER acquiring unit 25 and the SCOP acquired by the SCOP acquiring unit 26 on the display screen, to thereby present the same to the user.

[0060] Next, procedures of processing performed by the evaluation supporting apparatus 10a configured as described above are described with reference to Fig. 7.

[0061] First, if the user operates the input unit 21, the indoor unit type and the indoor unit capacity are sequentially inputted as the discrimination information of each connected indoor unit 5 connected to the outdoor unit 2. If acquiring the discrimination information of each connected indoor unit 5 inputted from the input unit 21 (Step SA1), the evaluation supporting apparatus 10a acquires the characteristic value C of each connected indoor unit 5 from the first information (Step SA2), and accumulates the acquired characteristic values C, to thereby calculate the accumulated characteristic value ΣC (Step SA3). Then, the evaluation supporting apparatus 10a acquires the system COP corresponding to the accumulated characteristic value ΣC from the second information (Step SA4). Subsequently, the evaluation supporting apparatus 10a acquires the SEER corresponding to the system COP from the third information (Step SA5), and acquires the SCOP corresponding to the system COP from the fourth information (Step SA6). The evaluation supporting apparatus 10a displays the SEER and the SCOP acquired in this way on the output unit 27, to thereby present the same to the user (Step SA7).

[0062] As described above, according to the evaluation supporting apparatus, method, and program for the air conditioning system of the present embodiment, the SEER and the SCOP can be obtained through simple work of inputting the discrimination information for identifying each connected indoor unit 5 connected to the outdoor unit 2. Accordingly, efforts and time of the user can be reduced.

[0063] Here, in the present embodiment, the degree of effectiveness of the heat exchanger is used as the characteristic value C. Alternatively, a heat exchange capability may be used as the characteristic value C. The heat exchange capability is represented by Expression (5) given below.

{0047}

Heat Exchange Capability = Degree of Effectiveness of Heat Exchanger × (Heat Exchanger Temperature − Intake Air Temperature) (5)

(Second Embodiment)

[0064] The characteristic value C, that is, the degree of effectiveness of the heat exchanger, which is set as the first information according to the first embodiment, is calculated in consideration of the refrigerant circulation amount F that is calculated on the basis of the ratio of the indoor unit capacity to the maximum indoor unit capacity at the rated load (a load of 100%) of the outdoor unit 2.

[0065] An indoor unit having an indoor unit capacity above the rated load (for example, an indoor unit capacity above 112 kW in the above-mentioned case) or an indoor unit capacity below the rated load (for example, an indoor unit capacity below 112 kW in the above-mentioned case) may be connected to the outdoor unit 2.

[0066] In the case where the sum of the capacities of the indoor units connected to the outdoor unit 2 is other than the maximum indoor unit capacity (for example, 112 kW in the first embodiment) at the rated load of the outdoor unit 2 as described above, the accumulated characteristic value ΣC obtained from the first information unfavorably contains an error due to a change in capacity.

[0067] Accordingly, in the present embodiment, in order to reduce the error contained in the accumulated characteristic value due to such a difference of the total indoor unit capacity of the connected indoor units, an evaluation supporting apparatus 10b illustrated in Fig. 8 further includes: fifth information (not illustrated) in which a first correction value that

is a correction value of the accumulated characteristic value ΣC and the total capacity of the connected indoor units 5 are associated with each other; and a first correction unit 28 that corrects the accumulated characteristic value ΣC obtained by the accumulation unit 23, compared with the evaluation supporting apparatus 10a according to the first embodiment illustrated in Fig. 3. Fig. 8 is a functional block diagram illustrating, in a developed manner, functions provided to the evaluation supporting apparatus 10b according to the present embodiment. Hereinafter, the fifth information and the first correction unit 28 characteristic of the evaluation supporting apparatus 10b according to the present embodiment are mainly described. Note that the fifth information is stored in the storage unit 22, and is referred to by the first correction unit 28.

[0068] First, the fifth information is described.

[0069] For each connection pattern of indoor units connected to the outdoor unit 2, obtained are: an accumulated characteristic value (an accumulated value of the degrees of effectiveness of the heat exchangers) in the case of considering a refrigerant circulation amount depending on the indoor unit capacity; and an accumulated characteristic value (an accumulated value of the degrees of effectiveness of the heat exchangers) in the case of setting a fixed refrigerant circulation amount not depending on the indoor unit capacity (for example, a refrigerant circulation amount in the case where the outdoor unit 2 exerts its rated capacity, in other words, a compressor frequency at the rated load). Consequently, the relation between the total heat capacity of the indoor units connected to the outdoor unit 2 and the accumulated characteristic value is acquired.

[0070] Fig. 9 illustrates the relation between the total capacity of the connected indoor units 5 and the accumulated characteristic value ΣC. In Fig. 9, the horizontal axis represents the total capacity of the connected indoor units in terms of a proportion to the maximum indoor unit capacity of 112 kW when the outdoor unit capacity is 100 %. That is, when the total capacity of the indoor units connected to the outdoor unit 2 is 112 kW, the value in the horizontal axis becomes 100 %. The vertical axis represents the accumulated characteristic value ΣC. In Fig. 9, the solid line is an approximate curve (hereinafter, referred to as "approximate curve A") obtained by approximating characteristics of the connection patterns in the case of assuming a refrigerant circulation amount depending on the capacity (in other words, in the case of assuming a compressor frequency depending on the capacity), and the broken line is an approximate curve (hereinafter, referred to as "approximate curve B") obtained by approximating characteristics of the connection patterns in the case of setting a fixed refrigerant circulation amount (in other words, in the case of setting a fixed compressor frequency).

[0071] As is apparent from Fig. 9, in the range in which the total capacity of the connected indoor units 5 is above 100 %, as the total capacity increases, a difference between the two characteristic curves becomes larger. The first correction value for the total capacity of the connected indoor units is obtained from Fig. 9. Specifically, a characteristic of the first correction value is obtained by dividing the approximate curve B by the approximate curve A. Fig. 10 illustrates an example of the fifth information in which the total capacity of the connected indoor units and the first correction value are associated with each other. In Fig. 10, the horizontal axis represents the total capacity of the indoor units, and the vertical axis represents the first correction value.

[0072] The first correction unit 28 acquires the first correction value corresponding to the total capacity of the connected indoor units 5 connected to the outdoor unit 2, from the fifth information, and corrects the accumulated characteristic value ΣC calculated by the accumulation unit 23, using the first correction value. Specifically, the first correction unit 28 may multiply the accumulated characteristic value ΣC by the first correction value.

[0073] In the subsequent processing, the corrected accumulated characteristic value ΣC is used to acquire the system COP.

[0074] According to the present embodiment, an error contained in the accumulated characteristic value ΣC due to a difference of the total capacity of the connected indoor units 5 connected to the outdoor unit 2 can be reduced. Accordingly, the calculation accuracy of the accumulated characteristic value ΣC can be improved. Moreover, the heat exchange capability can also be used as a characteristic value similarly to the first embodiment.

(Third Embodiment)

[0075] In the second information according to the first embodiment, the accumulated characteristic value ΣC and the system COP corresponding thereto are associated with each other. The present embodiment is different from the first embodiment in that the system COP corresponding to the accumulated characteristic value ΣC (that is, the accumulated value of the degrees of effectiveness of the heat exchangers) is obtained by using sixth information and seventh information instead of the second information.

[0076] Hereinafter, differences from the first embodiment are mainly described.

[0077] For each connection pattern of indoor units connected to the outdoor unit 2, examined are: the relation between the indoor heat exchange amount (indoor unit capacity) {W} and the accumulated characteristic value ΣC; and the relation between the sum of inverter power consumption and compressor power consumption (hereinafter, referred to as "machine power consumption") {W} and the accumulated characteristic value ΣC. Consequently, Fig. 11 and Fig. 12 are obtained.

[0078] Fig. 11 is a graph illustrating an approximate curve of characteristics of the connection patterns in the relation

between the accumulated characteristic value ΣC and the indoor heat exchange amount, and Fig. 12 is a graph illustrating an approximate curve of characteristics of the connection patterns in the relation between the accumulated characteristic value ΣC and the machine power consumption.

[0079] Fig. 11 and Fig. 12 show that the indoor heat exchange amount and the machine power consumption are correlated with the accumulated characteristic value ΣC.

[0080] In view of the above, with regard to the calculation of the system COP according to the present embodiment, the indoor heat exchange amount and the machine power consumption corresponding to the accumulated characteristic value ΣC are respectively acquired using parameters correlated with the accumulated characteristic value ΣC, that is, the indoor heat exchange amount characteristic illustrated in Fig. 11 and the machine power consumption characteristic illustrated in Fig. 12. Then, inputs of indoor and outdoor fan motors are taken into account together with these acquired values. In this way, the system COP is calculated.

[0081] Specifically, the indoor heat exchange amount characteristic illustrated in Fig. 11 is stored as the sixth information in the storage unit 23, and the machine power consumption characteristic illustrated in Fig. 12 is stored as the seventh information in the storage unit 23.

[0082] Then, the system COP acquiring unit 24 acquires the indoor heat exchange amount corresponding to the accumulated characteristic value ΣC from the sixth information, and acquires the machine power consumption corresponding to the accumulated characteristic value ΣC from the seventh information. Then, the system COP acquiring unit 24 performs an arithmetic operation by applying the pieces of acquired information, the indoor fan motor input held in advance, and the power consumption of the indoor and outdoor fan motors held in advance to the following arithmetic expression, to thereby obtain at least any one of the system COP in the air heating operation and the system COP in the air cooling operation.

[0083] The system COP in the air heating operation is obtained using Expression (6) given below.

5 using Expression (6) given below.

{0060}

System COP (Air Heating Operation)

= (Indoor Heat Exchange Amount + Indoor Fan Input) /

(Machine Power Consumption + Power Consumption of Indoor and

10 Outdoor Fans) (6)

{0061}

[0084] The system COP in the air cooling operation is obtained using Expression (7) given below.

using Expression (7) given below.

{0062}

15 System COP (Air Cooling Operation)

= (Indoor Heat Exchange Amount - Indoor Fan Input) /

(Machine Power Consumption + Power Consumption of Indoor and

Outdoor Fans) (7)

{0063}

[0085] As described above, the evaluation supporting apparatus according to the present embodiment reflects the

input of the indoor fan motor as a capacity, reflects the power consumption of the indoor and outdoor fan motors as power consumption, and thus can obtain the system COP with higher accuracy.

(Fourth Embodiment)

[0086] The evaluation supporting apparatus 10a according to the first embodiment does not consider standby power in acquiring the SEER and the SCOP. However, it is found out that the sensitivity of the SEER to the standby power is higher than expected and that the evaluation accuracy of the SEER can be improved by correcting the SEER depending on the standby power.

[0087] As illustrated in Fig. 13, an evaluation supporting apparatus 10c according to the present embodiment includes eighth information (not illustrated) and a second correction unit 29 as a configuration for correcting the SEER obtained by the SEER acquiring unit 25 using a second correction value depending on the standby power, and thus improves the evaluation accuracy of the SEER. Here, the eighth information is stored in the storage unit 22. Fig. 13 is a functional block diagram illustrating, in a developed manner, functions provided to the evaluation supporting apparatus 10c according to the present embodiment.

[0088] Specifically, the relation between the SEER and the standby power PTO is obtained for each connection pattern or each connected indoor unit by performing examinations and simulations in advance, and an approximate characteristic thereof is obtained. Then, the approximate characteristic is divided by a reference characteristic (for example, a standby power PTO - SEER characteristic in a connection pattern in which the value of the SEER is largest), whereby the eighth information in which the standby power PTO and the second correction value are associated with each other is obtained. Fig. 14 illustrates an example of the eighth information. Moreover, the storage unit 22 also stores ninth information in which the discrimination information of each indoor unit and the standby power are associated with each other. For example, a prescribed standby power may be adopted, and a standby power depending on the indoor fan input may be set for each indoor unit.

[0089] The second correction unit 29 acquires the standby power concerning each connected indoor unit 5 from the ninth information, and accumulates the acquired standby powers, to thereby calculate the standby power of the entire system. Then, the second correction unit 29 acquires the second correction value corresponding to the accumulated standby power from the eighth information, and corrects the SEER using the acquired second correction value.

[0090] Similarly for the SCOP, information in which the SCOP and the standby power PTO are associated with each other may be stored in the storage unit 22, and the SCOP may be corrected using the information.

[0091] As described above, the evaluation supporting apparatus 10c according to the present embodiment corrects the values of the SEER and the SCOP respectively obtained by the SEER acquiring unit 25 and the SCOP acquiring unit 26, using the second correction value depending on the standby power, and thus can make the evaluation accuracy of the SEER and the SCOP higher.

[0092] The present invention is not limited to only the above embodiments, and various modifications can be carried out by, for example, partially or wholly combining the above embodiments within a range not departing from the scope of the present invention.

{Reference Signs List}

[0093]

1	air conditioning system
2	outdoor unit
5	indoor unit (connected indoor unit)
10a, 10b, 10c	evaluation supporting apparatus for air conditioning system
21	input unit
22	storage unit
23	accumulation unit
24	system COP acquiring unit
25	SEER acquiring unit
26	SCOP acquiring unit
27	output unit
28	first correction unit
29	second correction unit

Claims

1. An evaluation supporting apparatus for an air conditioning system, comprising:

an input means (21) for inputting discrimination information for identifying each connected indoor unit (5) connected to an outdoor unit (2);
first information in which the discrimination information of each indoor unit (5) connectable to the outdoor unit (2) and a characteristic value concerning a heat exchanger of the indoor unit (5) are associated with each other;
an accumulation means (23) for acquiring the characteristic value corresponding to each connected indoor unit (5) from the first information and accumulating the acquired characteristic values, to thereby calculate an accumulated characteristic value;
second information in which the accumulated characteristic value and a coefficient of system performance are associated with each other;
a coefficient-of-system-performance acquiring means (24) for acquiring the coefficient of system performance corresponding to the accumulated characteristic value calculated by the accumulation means (23), from the second information;
third information in which the coefficient of system performance and a seasonal energy efficiency ratio are associated with each other; and
a seasonal energy efficiency ratio acquiring means (25) for acquiring the seasonal energy efficiency ratio corresponding to the coefficient of system performance acquired by the coefficient-of-system-performance acquiring means (24), from the third information.

2. An evaluation supporting apparatus for an air conditioning system, comprising:

an input means (21) for inputting discrimination information for identifying each connected indoor unit (5) connected to an outdoor unit (2);
first information in which the discrimination information of each indoor unit (5) connectable to the outdoor unit (2) and a characteristic value concerning a heat exchanger of the indoor unit (5) are associated with each other;
an accumulation means (23) for acquiring the characteristic value corresponding to each connected indoor unit (5) from the first information and accumulating the acquired characteristic values, to thereby calculate an accumulated characteristic value;
second information in which the accumulated characteristic value and a coefficient of system performance are associated with each other;
a coefficient-of-system-performance acquiring means (24) for acquiring the coefficient of system performance corresponding to the accumulated characteristic value calculated by the accumulation means (23), from the second information;
fourth information in which the coefficient of system performance and a seasonal coefficient of performance are associated with each other; and
a seasonal coefficient-of-performance acquiring means (26) for acquiring the seasonal coefficient of performance corresponding to the coefficient of system performance acquired by the coefficient-of-system-performance acquiring means (23), from the fourth information.

3. The evaluation supporting apparatus for the air conditioning system according to claim 1 or claim 2, wherein the characteristic value in the first information is set assuming one of a refrigerant circulation amount and a compressor frequency depending on a capacity of each indoor unit.

4. The evaluation supporting apparatus for the air conditioning system according to claim 3, further comprising:

fifth information in which a total capacity of the connected indoor units and a first correction value are associated with each other; and
a first correction means (28) for acquiring the first correction value corresponding to the total capacity of the connected indoor units (5) from the fifth information and correcting the accumulated characteristic value using the acquired first correction value, wherein
the coefficient-of-system-performance acquiring means (24) acquires the coefficient of system performance corresponding to the corrected accumulated characteristic value from the second information.

5. The evaluation supporting apparatus for the air conditioning system according to claim 4, wherein the first correction value is set to 1 in a case where the total capacity of the connected indoor units (5) is coincident with an indoor unit

capacity at a rated capacity of the outdoor unit (2), and is set to a value that becomes smaller than 1 as the total capacity of the connected indoor units (5) becomes higher than the indoor unit capacity at a rated capacity of the outdoor unit (2).

6. The evaluation supporting apparatus for the air conditioning system according to any of claim 1 to claim 5, wherein the second information is provided for each of an air cooling operation and an air heating operation.

7. The evaluation supporting apparatus for the air conditioning system according to any of claim 1 to claim 6, wherein the characteristic value is a degree of effectiveness of the heat exchanger,
the evaluation supporting apparatus comprises: sixth information in which the accumulated characteristic value and an indoor heat exchange amount are associated with each other; and seventh information in which the accumulated characteristic value and a sum of inverter power consumption and compressor power consumption are associated with each other, instead of the second information, and
the coefficient-of-system-performance acquiring means (24) respectively acquires the indoor heat exchange amount and the sum of the inverter power consumption and the compressor power consumption corresponding to the accumulated characteristic value, from the sixth information and the seventh information, and applies: the acquired indoor heat exchange amount; the acquired sum of the inverter power consumption and the compressor power consumption; an input of an indoor fan motor; and power consumption of indoor and outdoor fan motors, to a predetermined arithmetic expression set in advance, to thereby calculate the coefficient of system performance.

8. The evaluation supporting apparatus for the air conditioning system according to claim 1 or any of claim 3 to claim 7 depending on claim 1, further comprising:

eighth information in which a standby power and a second correction value are associated with each other; and
a second correction means (29) for acquiring the second correction value corresponding to the standby power of each connected indoor unit (5) from the eighth information and correcting the seasonal energy efficiency ratio acquired by the seasonal energy efficiency ratio acquiring means, using the second correction value.

9. An evaluation supporting method for an air conditioning system, comprising:

a first step (SA1) of acquiring discrimination information for identifying each connected indoor unit (5) connected to an outdoor unit (2);
a second step (SA2, SA3) of acquiring, from first information in which the discrimination information of each indoor unit (5) connectable to the outdoor unit (2) and a characteristic value concerning a heat exchanger of the indoor unit (5) are associated with each other, the characteristic value corresponding to each connected indoor unit and accumulating the acquired characteristic values, to thereby calculate an accumulated characteristic value;
a third step (SA4) of acquiring, from second information in which the accumulated characteristic value and a coefficient of system performance are associated with each other, the coefficient of system performance corresponding to the accumulated characteristic value calculated in the second step; and
a fourth step (SA5) of acquiring, from third information in which the coefficient of system performance and a seasonal energy efficiency ratio are associated with each other, the seasonal energy efficiency ratio corresponding to the coefficient of system performance acquired in the third step.

10. An evaluation supporting method for an air conditioning system, comprising:

a first step (SA1) of acquiring discrimination information for identifying each connected indoor unit (5) connected to an outdoor unit (2);
a second step (SA2, SA3) of acquiring, from first information in which the discrimination information of each indoor unit (5) connectable to the outdoor unit (2) and a characteristic value concerning a heat exchanger of the indoor unit (5) are associated with each other, the characteristic value corresponding to each connected indoor unit and accumulating the acquired characteristic values, to thereby calculate an accumulated characteristic value;
a third step (SA4) of acquiring, from second information in which the accumulated characteristic value and a coefficient of system performance are associated with each other, the coefficient of system performance corresponding to the accumulated characteristic value calculated in the second step; and
a fifth step (SA6) of acquiring, from fourth information in which the coefficient of system performance and a seasonal coefficient of performance are associated with each other, the seasonal coefficient of performance

corresponding to the coefficient of system performance acquired in the third step.

11. An evaluation supporting program for an air conditioning system, causing a computer to execute:

a first process (SA1) of acquiring discrimination information for identifying each connected indoor unit (5) connected to an outdoor unit (2);
a second process (SA2, SA3) of acquiring, from first information in which the discrimination information of each indoor unit (5) connectable to the outdoor unit (2) and a characteristic value concerning a heat exchanger of the indoor unit (5) are associated with each other, the characteristic value corresponding to each connected indoor unit and accumulating the acquired characteristic values, to thereby calculate an accumulated characteristic value;
a third process (SA4) of acquiring, from second information in which the accumulated characteristic value and a coefficient of system performance are associated with each other, the coefficient of system performance corresponding to the accumulated characteristic value calculated in the second process; and
a fourth process (SA5) of acquiring, from third information in which the coefficient of system performance and a seasonal energy efficiency ratio are associated with each other, the seasonal energy efficiency ratio corresponding to the coefficient of system performance acquired in the third process.

12. An evaluation supporting program for an air conditioning system, causing a computer to execute:

a first process (SA1) of acquiring discrimination information for identifying each connected indoor unit (5) connected to an outdoor unit (2);
a second process (SA2, SA3) of acquiring, from first information in which the discrimination information of each indoor unit (5) connectable to the outdoor unit (2) and a characteristic value concerning a heat exchanger of the indoor unit (5) are associated with each other, the characteristic value corresponding to each connected indoor unit and accumulating the acquired characteristic values, to thereby calculate an accumulated characteristic value;
a third process (SA4) of acquiring, from second information in which the accumulated characteristic value and a coefficient of system performance are associated with each other, the coefficient of system performance corresponding to the accumulated characteristic value calculated in the second process; and
a fifth process (SA6) of acquiring, from fourth information in which the coefficient of system performance and a seasonal coefficient of performance are associated with each other, the seasonal coefficient of performance corresponding to the coefficient of system performance acquired in the third process.

FIG. 1

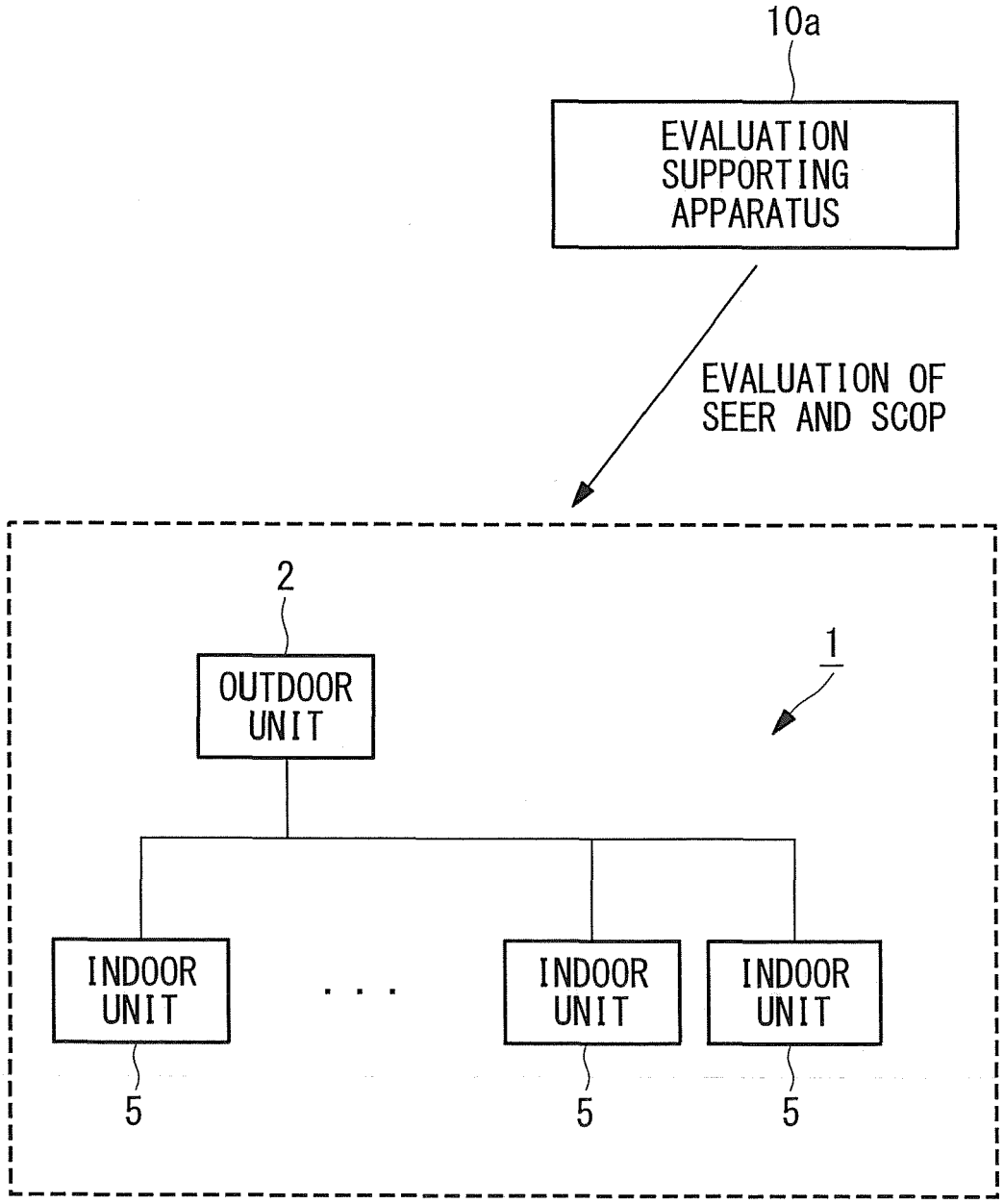

10a
EVALUATION SUPPORTING APPARATUS
EVALUATION OF SEER AND SCOP
2
OUTDOOR UNIT
1
INDOOR UNIT
. . .
INDOOR UNIT
INDOOR UNIT
5
5
5

FIG. 2

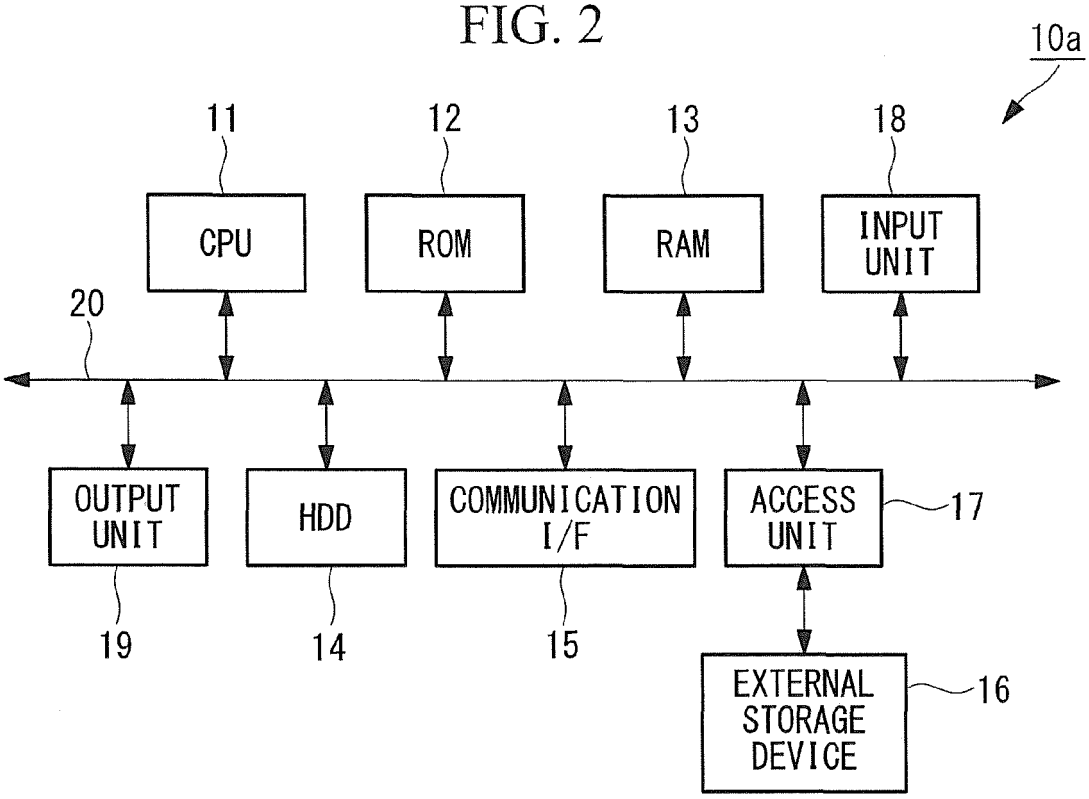

10a
11
12
13
18
CPU
ROM
RAM
INPUT UNIT
20
OUTPUT UNIT
HDD
COMMUNICATION I/F
ACCESS UNIT
17
19
14
15
EXTERNAL STORAGE DEVICE
16

FIG. 3

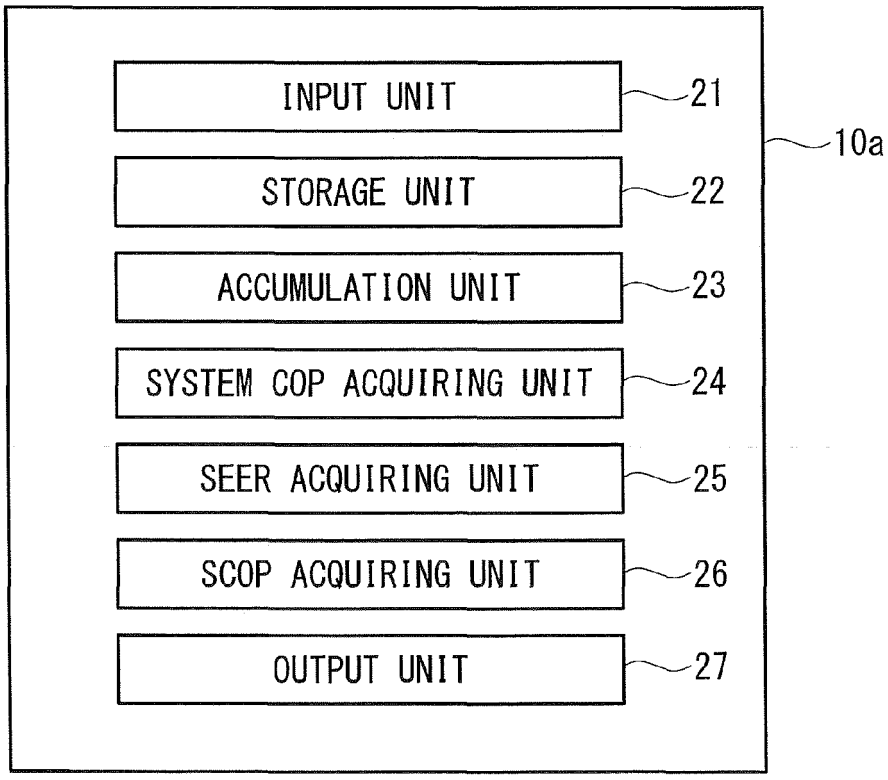

INPUT UNIT
21
10a
STORAGE UNIT
22
ACCUMULATION UNIT
23
SYSTEM COP ACQUIRING UNIT
24
SEER ACQUIRING UNIT
25
SCOP ACQUIRING UNIT
26
OUTPUT UNIT
27

FIG. 4

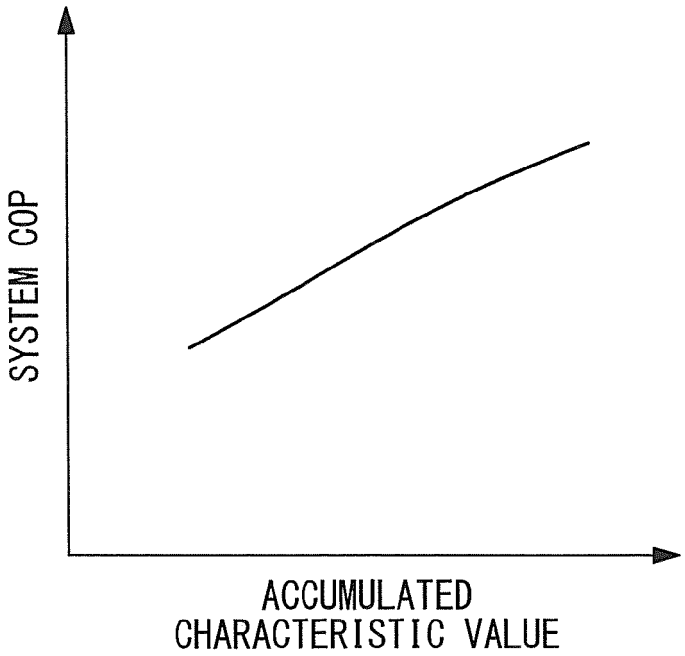

SYSTEM COP
ACCUMULATED
CHARACTERISTIC VALUE

FIG. 5

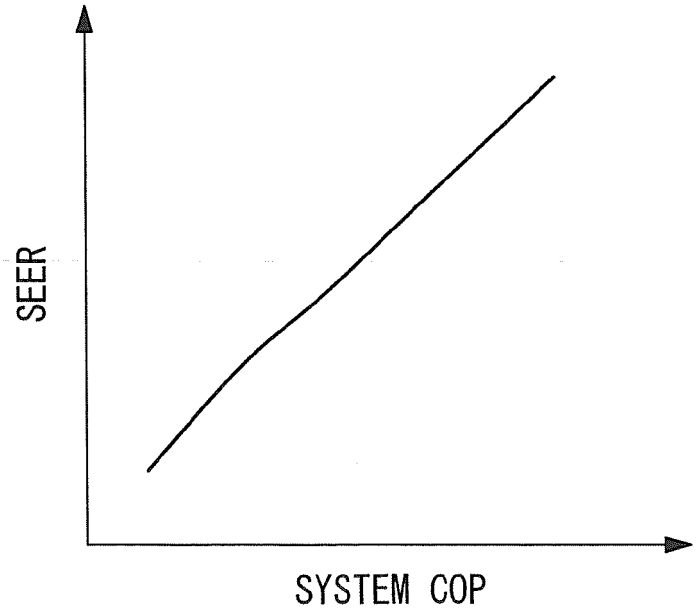

SEER
SYSTEM COP

FIG. 6

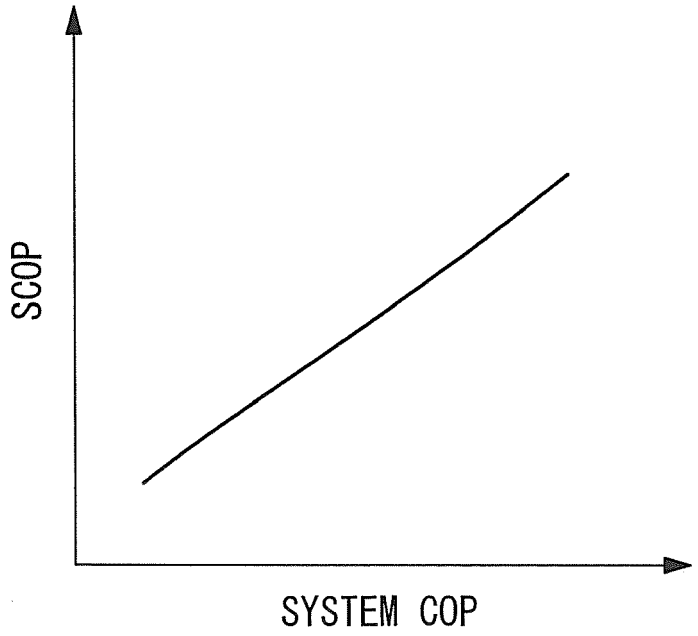


FIG. 7

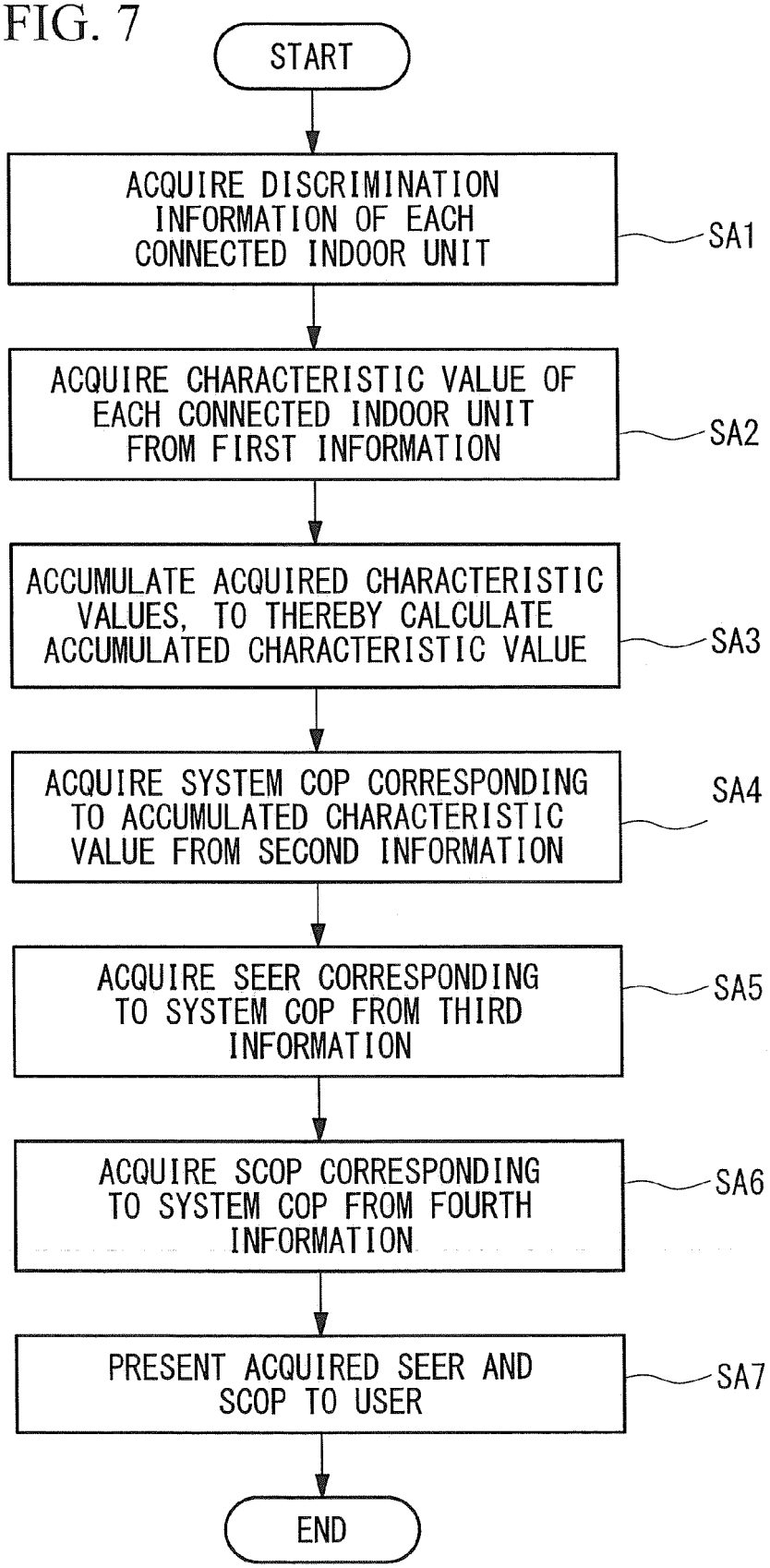

START
ACQUIRE DISCRIMINATION INFORMATION OF EACH CONNECTED INDOOR UNIT
SA1
ACQUIRE CHARACTERISTIC VALUE OF EACH CONNECTED INDOOR UNIT FROM FIRST INFORMATION
SA2
ACCUMULATE ACQUIRED CHARACTERISTIC VALUES, TO THEREBY CALCULATE ACCUMULATED CHARACTERISTIC VALUE
SA3
ACQUIRE SYSTEM COP CORRESPONDING TO ACCUMULATED CHARACTERISTIC VALUE FROM SECOND INFORMATION
SA4
ACQUIRE SEER CORRESPONDING TO SYSTEM COP FROM THIRD INFORMATION
SA5
ACQUIRE SCOP CORRESPONDING TO SYSTEM COP FROM FOURTH INFORMATION
SA6
PRESENT ACQUIRED SEER AND SCOP TO USER
SA7
END

FIG. 8

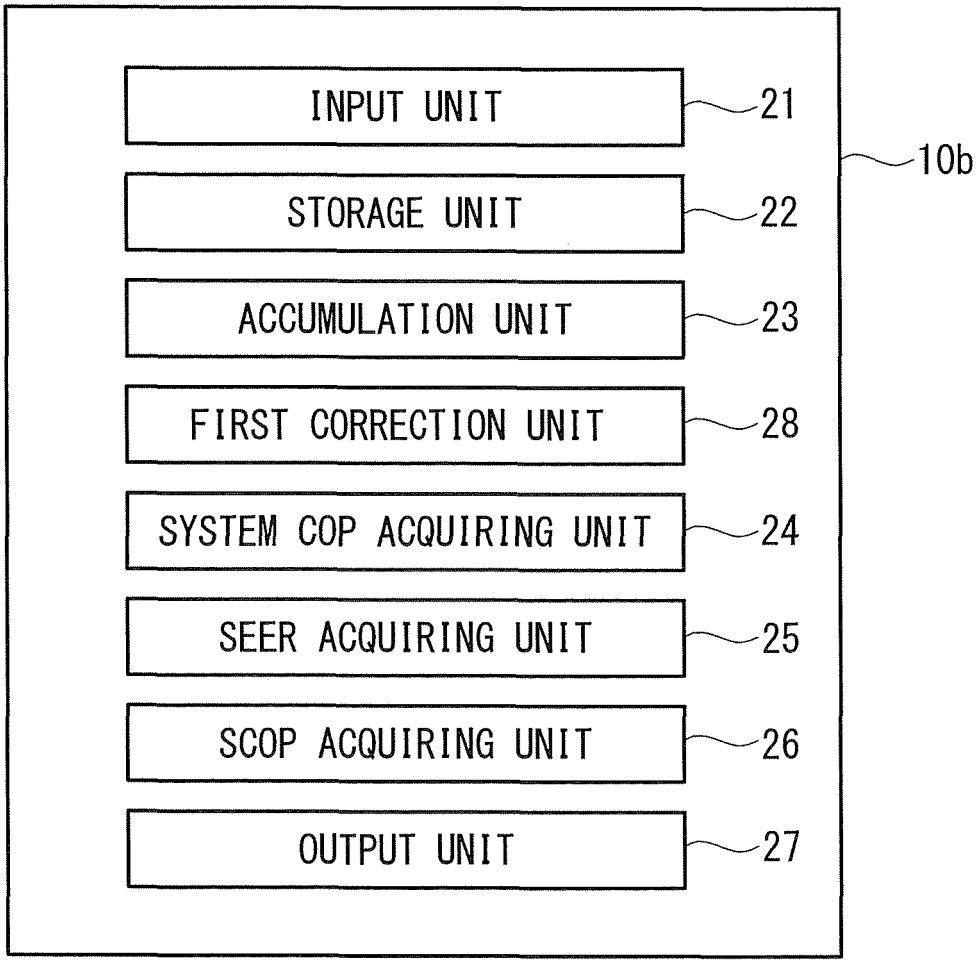

INPUT UNIT
21
STORAGE UNIT
22
ACCUMULATION UNIT
23
FIRST CORRECTION UNIT
28
SYSTEM COP ACQUIRING UNIT
24
SEER ACQUIRING UNIT
25
SCOP ACQUIRING UNIT
26
OUTPUT UNIT
27
10b

FIG. 9

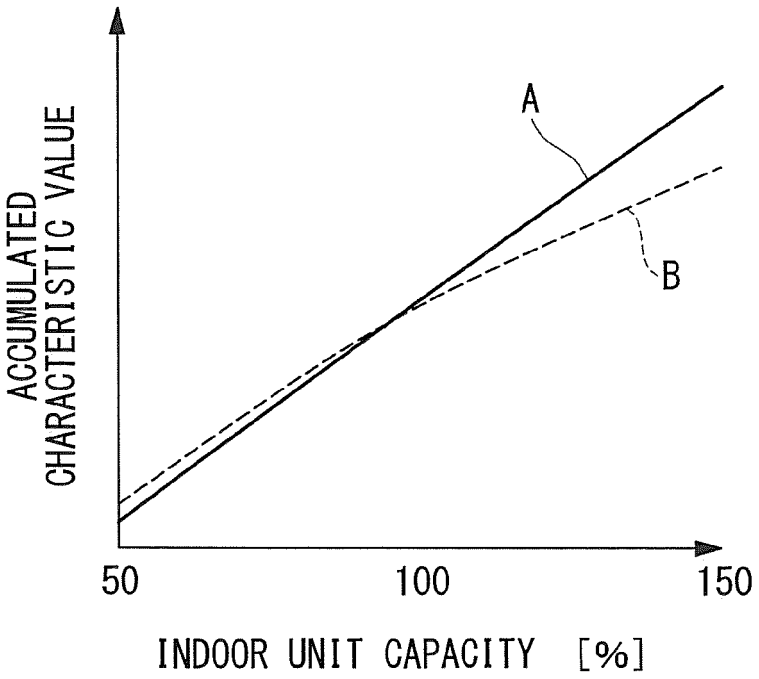

ACCUMULATED CHARACTERISTIC VALUE
A
B
50
100
150
INDOOR UNIT CAPACITY [%]

FIG. 10

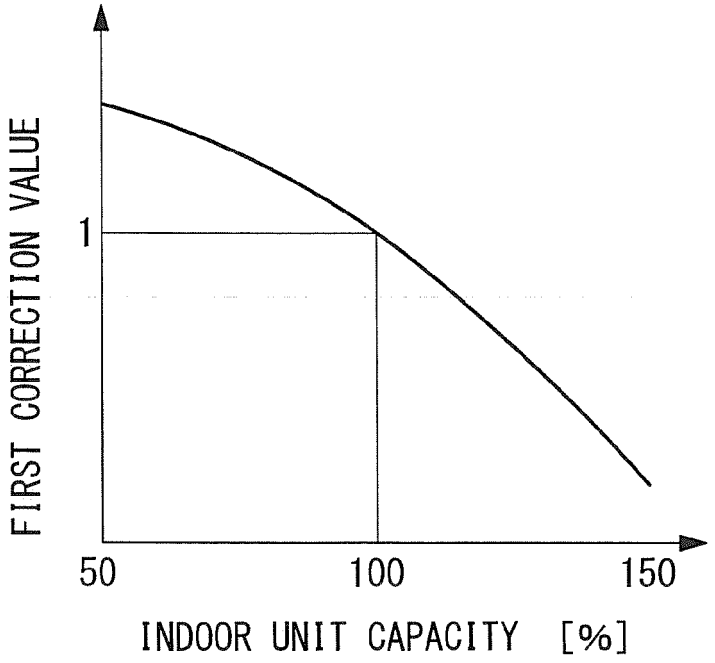

FIRST CORRECTION VALUE
1
50
100
150
INDOOR UNIT CAPACITY [%]

FIG. 11

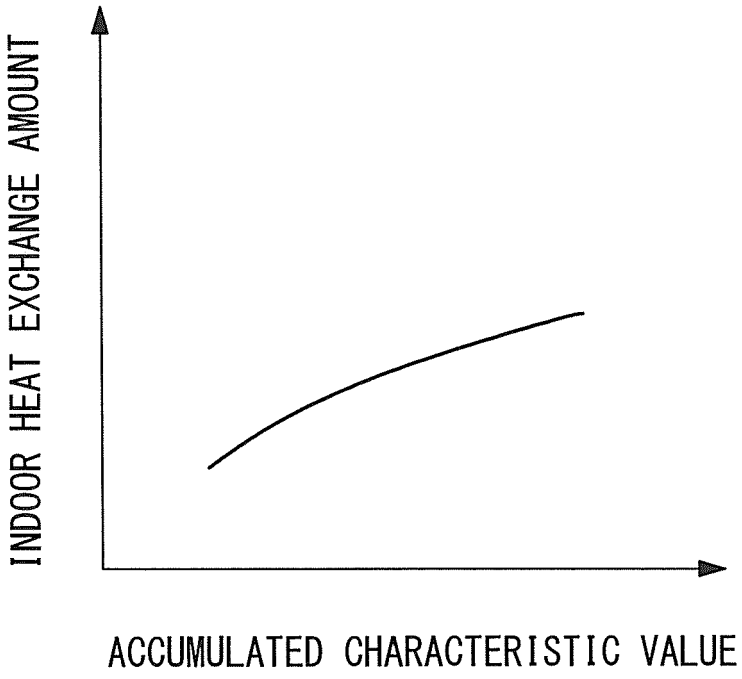

INDOOR HEAT EXCHANGE AMOUNT
ACCUMULATED CHARACTERISTIC VALUE

FIG. 12

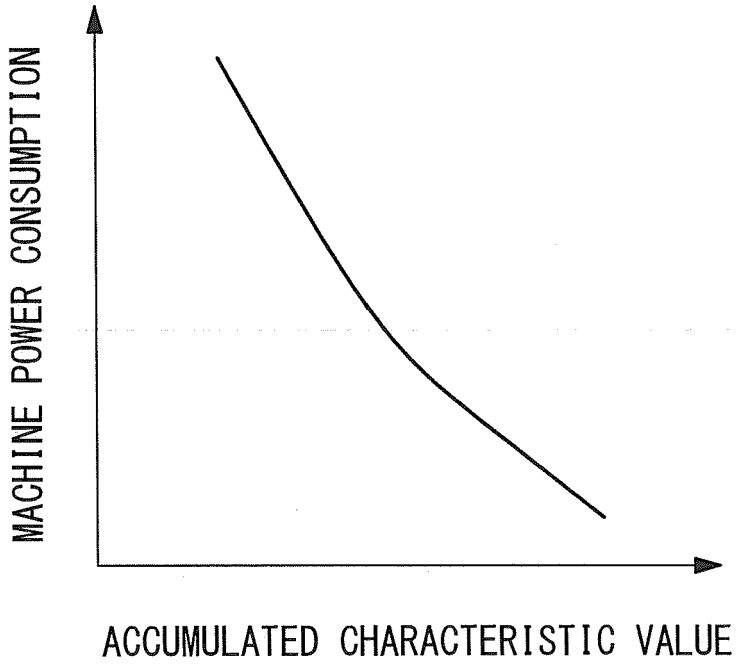

MACHINE POWER CONSUMPTION
ACCUMULATED CHARACTERISTIC VALUE

FIG. 13

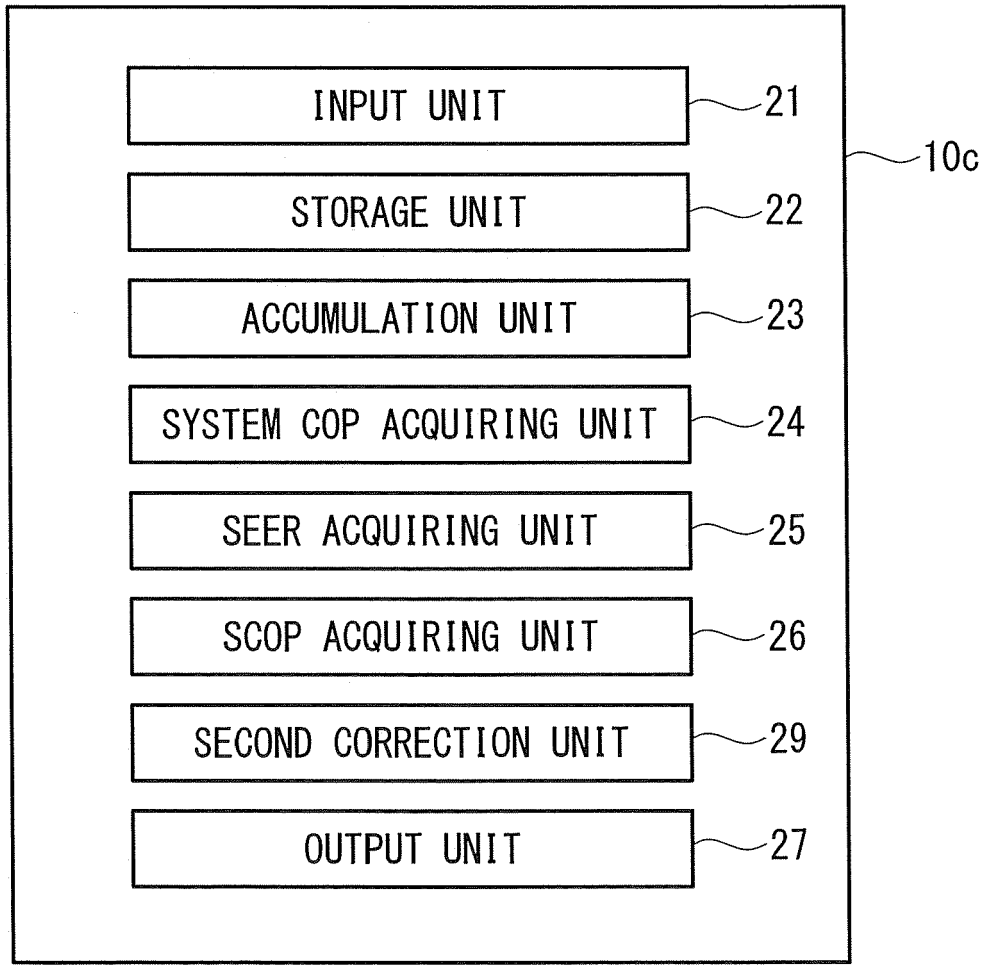
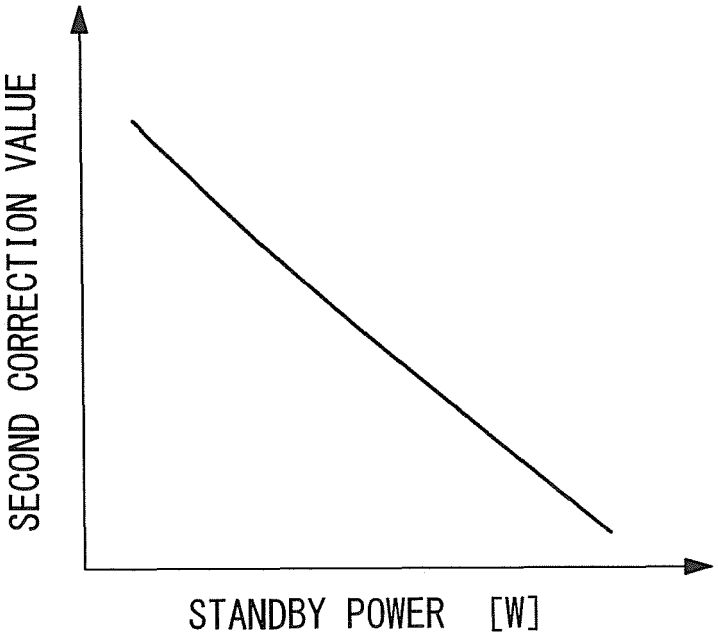

INPUT UNIT
21
10c
STORAGE UNIT
22
ACCUMULATION UNIT
23
SYSTEM COP ACQUIRING UNIT
24
SEER ACQUIRING UNIT
25
SCOP ACQUIRING UNIT
26
SECOND CORRECTION UNIT
29
OUTPUT UNIT
27

FIG. 14



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Patent documents cited in the description

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