(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 3 764 008 A1**

(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 153(4) EPC

(43) Date of publication:
13.01.2021 Bulletin 2021/02

(21) Application number: **18867302.4**

(22) Date of filing: **08.03.2018**

(51) Int Cl.:
F24F 11/36 *(2018.01)* ***F25B 49/00*** *(2006.01)*

(86) International application number:
PCT/JP2018/008893

(87) International publication number:
WO 2019/171520 (12.09.2019 Gazette 2019/37)

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

(71) Applicant: **Hitachi-Johnson Controls Air Conditioning, Inc.**
Tokyo 105-0022 (JP)

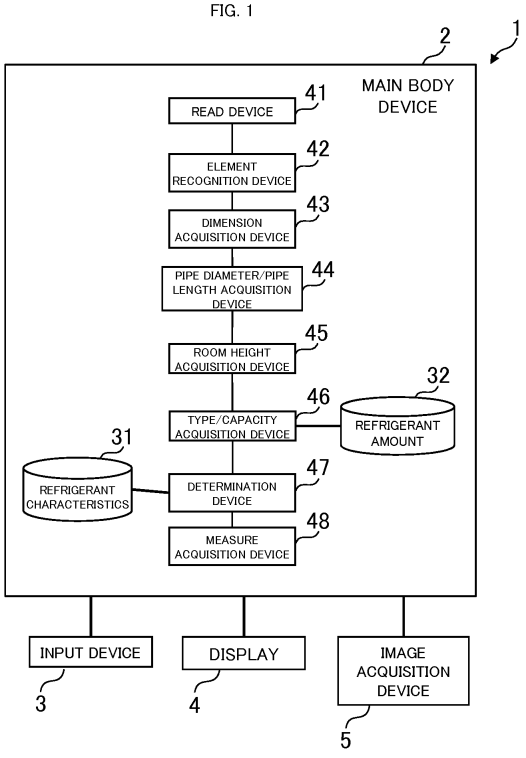
(72) Inventors:
- **YOKOZEKI, Atsuhiko**
  Tokyo
  1050022 (JP)
- **SASAKI, Shunji**
  Tokyo
  1050022 (JP)
- **YONEYAMA, Hiroyasu**
  Tokyo
  1050022 (JP)
- **YAMANASHI, Yoshiyuki**
  Tokyo
  1050022 (JP)

(74) Representative: **MERH-IP Matias Erny Reichl Hoffmann**
Patentanwälte PartG mbB
Paul-Heyse-Strasse 29
80336 München (DE)

(54) AIR CONDITIONER DESIGN ASSISTANCE DEVICE

(57) Provided is an air-conditioner design support device which makes it possible to determine the need for a safety measure with respect to an air conditioner automatically and easily. A design support device 1 is provided with: a read device 41 which reads data concerning a design drawing 20 for an air conditioner describing indoor devices 101 to 104, an outdoor device 200, rooms 11 to 14, and pipes a to g; acquisition devices 42 to 46 which acquire, from the data concerning the design drawing 20 that have been read, data concerning the indoor devices 101 to 104, the outdoor device 200, the rooms 11 to 14, and the pipes a to g; and a determination device 47 which calculates the amount of refrigerant required for the air conditioner based on the acquired data concerning the indoor devices 101 to 104, the outdoor device 200, and the pipes a to g, calculates the volume of each of the rooms 11 to 14 based on the acquired data concerning the rooms 11 to 14, determines the need for a safety measure with respect to the rooms 11 to 14 based on the amount of refrigerant and the volume, and outputs a determination result.

FIG. 1



EP 3 764 008 A1

Description

TECHNICAL FIELD

[0001] The present invention relates to an air-conditioner design support device.

BACKGROUND ART

[0002] In recent years, in order to reduce environmental load, air conditioners in which a CFC substitute gas is used as refrigerant have been developed. As the refrigerant, mildly flammable (flammable) A2L refrigerants, such as hydrofluorocarbon (HFC) type R32, are used, for example.

[0003] When a mildly flammable (flammable) A2L refrigerant is used in an air conditioner, a safety measure against refrigerant leak is required. In particular, when the amount of refrigerant used relative to the volume of the space to be air-conditioned is large, a safety measure guideline is established, as according to Non-Patent Document 1.

[0004] Non-Patent Document 1 indicates that a safety measure is necessary when the refrigerant concentration of a room (charge ratio) calculated from room volume and the amount of refrigerant based on the pipe length and the like exceeds a predetermined threshold value.

CITATION LIST

NON PATENT LITERATURE

[0005] Non-Patent Literature 1: Guideline of design construction for ensuring safety against refrigerant leak from commercial air conditioners using lower flammability (A2L) refrigerant, JRA GL-16: 2016, The Japan Refrigeration and Air Conditioning Industry Association, published on September 30, 2016

SUMMARY OF THE INVENTION

PROBLEMS TO BE SOLVED BY THE INVENTION

[0006] However, it is a cumbersome work to input room volume and the amount of refrigerant manually from design drawing, and to determine the need for a safety measure from calculation results. In addition, such work is difficult for a worker who is not versed in the calculation method and the like.

[0007] Thus, the present invention relates to a technology which makes it possible to easily determine the need for a safety measure with respect to an air conditioner.

SOLUTION TO THE PROBLEMS

[0008] In order to solve the problem, an air-conditioner design support device according to an aspect of the present invention includes a read means which reads data concerning a design drawing for an air conditioner describing an indoor device, an outdoor device, a space to be air-conditioned, and a pipe; an acquisition means which acquires, from the data concerning the design drawing that have been read, data concerning the indoor device, the outdoor device, the space to be air-conditioned, and the pipe; and a determination means which calculates the amount of refrigerant required for the air conditioner based on the acquired data concerning the indoor device, the outdoor device, and the pipe, calculates the volume of the space to be air-conditioned based on the acquired data concerning the space to be air-conditioned, determines the need for a safety measure with respect to the space to be air-conditioned based on the amount of refrigerant and the volume, and outputs a determination result.

ADVANTAGEOUS EFFECTS OF THE INVENTION

[0009] According to the present invention, the need for a safety measure with respect to an air conditioner can be easily determined.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010]

Fig. 1 is a block diagram of the configuration of an air-conditioner design support device according to an embodiment.

Fig. 2 is a schematic diagram of a design drawing describing the room layout of a building and an air conditioner installation state.

Fig. 3 is an illustration of a drawing depicting constituent elements that have been recognized.

Fig. 4 is a flowchart of a procedure performed in the design support device for outputting an indication as to whether a safety measure is required with respect to refrigerant leak.

DESCRIPTION OF THE EMBODIMENTS

[0011] In the following, an air-conditioner design support device 1 according to an embodiment of the present invention will be described.

[0012] Fig. 1 is a block diagram of the configuration of the air-conditioner design support device 1 according to the embodiment.

[0013] As illustrated in Fig. 1, the air-conditioner design support device 1 includes a main body device 2, an input device 3, a display 4, and an image acquisition device 5.

[0014] The main body device 2 is configured, for example, from a general-purpose computer system including a processor and a memory, and constituent elements or functions provided in the main body device 2 are implemented by executing a computer program, for example. The computer program may be stored in a computer-readable recording medium. The input device 3, the display 4, and the image acquisition device 5 are connected to the main body device 2. The input device 3 may be a keyboard, a pointing device and the like. The display 4 may be a display and the like. The image acquisition device 5 may be a scanner or a camera, for example.

[0015] The main body device 2 is provided with: a refrigerant characteristics storage device 31; a refrigerant amount storage device 32; a read device 41; a constituent element recognition device 42; a dimension acquisition device 43; a pipe diameter/pipe length acquisition device 44; a room height acquisition device 45; a type/capacity acquisition device 46; and a determination device 47.

[0016] The design support device 1 performs a process of, with respect to an air conditioner in which a mildly flammable (A2L) refrigerant is used; reading data concerning a design drawing; recognizing constituent elements, such as an indoor device and an outdoor device, from the data; acquiring information concerning the constituent elements; and determining whether a safety measure with respect to refrigerant leak is necessary. If a safety measure is necessary, a worker selects a measure and reflects the measure in the design drawing, and determines whether an allowable concentration is satisfied. In the present embodiment, the refrigerant is R32.

[0017] In the refrigerant characteristics storage device 31, types/characteristics of mildly flammable (A2L) refrigerant are stored, as indicated in the following Table 1.

(Table 1)

Safety class	Type of refrigerant	LFL (kg/m^3)	1/4LFL	Molecular weight	Maximum refrigerant amount (kg)
A2L	R32	0.307	0.0768	52	59.8
	R1234yf	0.289	0.0723	114	56.3
	R1234ze(E)	0.303	0.0758	114	59.0
LFL and maximum refrigerant amount are in accordance with ISO5149-1 LFL values are those in the case of dry conditions (23°C, 50%RH)					

[0018] Table 1 corresponds to Table 1 of Non-Patent Document 1, in which LFL refers to the lower flammability limit according to ISO817 indicating the minimum concentration of the refrigerant capable of propagating a flame through a homogeneous mixture of the refrigerant and air.

[0019] The refrigerant amount storage device 32 stores the amounts of refrigerant corresponding to the type/capacity of the indoor device/outdoor device, and the additional amount of refrigerant corresponding to pipe diameters.

[0020] The read device 41 reads image data of the design drawing 20. The image data are data concerning an image of the design drawing 20 acquired by the image acquisition device 5.

[0021] Fig. 2 is a schematic diagram of the design drawing 20 describing the room layout of a building 10 and an air conditioner installation state.

[0022] The design drawing 20 describes rooms 11 to 14 in the building 10; the indoor devices 101 to 104 provided in the rooms 11, 13, and 14; doors 501 to 503 for entering and exiting the rooms 11, 13, and 14; ventilation devices 301, 302; pipes a to g; and an outdoor device 200 outside the building 10. Colors corresponding to the respective constituent elements may be determined in advance, and, before the design drawing 20 is acquired by the image acquisition device 5, the constituent elements of the design drawing 20 may be colored by the worker, using a marker pen and the like.

For example, the rooms 11 to 14 may be colored by being enclosed using a red pen; the indoor devices 101 to 104 may be colored by being enclosed using a blue pen; the outdoor device 200 may be colored by being enclosed using a green pen; and the pipes a to g may be colored by being traced using a yellow pen.

[0023] The constituent element recognition device 42 recognizes, from the image data that have been read, the constituent elements including the rooms, piping, a ventilating fan, the indoor devices, and the outdoor device, on the basis of structure/shape and the like. When the constituent elements are colored, the constituent elements may be recognized on the basis of the respective colors. The constituent element recognition device 42 then displays the result of the recognizing on the display 4. For example, the display 4 displays a drawing 21 in which the recognized constituent elements are represented diagrammatically, as depicted in Fig. 3, and Table 2 shown below in which the recognized constituent elements are numbered. The displayed drawing is provided with numbering numbers. The numbers provided are similar to the numbers used for describing the design drawing 20 with reference to Fig. 2. Regarding the pipes a to g, each of the sections between the indoor devices 101 to 104 or the outdoor device 200 and a piping branch portion, and each of the sections between adjacent branch portions are recognized as individual pipes.

(Table 2)

Constituent element	Room	Pipe	Outdoor device	Indoor device
Number	11	a	200	101
	12	b	-	102
	13	c	-	103
	14	d	-	104
	-	e	-	-
	-	f	-	-
	-	g	-	-

[0024] If there is any discrepancy from the design drawing 20 on the basis of the drawing and Table 2 being displayed, the worker makes, for example, correction on and addition to the discrepancy as appropriate using the input device 3. The constituent element recognition device 42 may also be configured to recognize the ventilation devices 301, 302. In Fig. 3, a mechanical ventilation device 300 and a cut-off valve 400, which are additional constituent elements, are depicted, in addition to the constituent elements that have been recognized.

[0025] The dimension acquisition device 43 acquires reference dimensions from the image data that have been read. For example, if a part of the design drawing 20 indicates dimensions, such as the lengths of the sides of the building 10 or the rooms 11 to 14, or the lengths of the pipes a to g, such dimensions are acquired as the reference dimensions. Then, the dimension acquisition device 43, on the basis of the acquired dimensions, calculates the lengths of the sides of each of the rooms 11 to 14 and the floor areas thereof, and displays the lengths and floor areas on the display 4. The worker, if the floor areas and the like being displayed differ from the design drawing 20, makes corrections, as appropriate. If the design drawing 20 indicates the scale, the scale may be acquired as a reference dimension. The dimension acquisition device 43, if the reference dimensions cannot be acquired, may display an input screen on the display 4 and prompt the worker to input reference dimensions.

[0026] The pipe diameter/pipe length acquisition device 44 acquires, from the image data that have been read, the pipe diameter and pipe length of each of the pipes a to g. For example, if the design drawing 20 indicates the pipe diameter and pipe length of each of the pipes a to g, the pipe diameter/pipe length acquisition device 44 acquires the indicated pipe diameter and pipe length as the pipe diameter and pipe length of each of the pipes a to g. The pipe diameter/pipe length acquisition device 44 displays the acquired pipe diameter and pipe length on the display 4. The worker, if the pipe diameter and pipe length being displayed differ from the design drawing 20, makes corrections, as appropriate. The pipe diameter/pipe length acquisition device 44, if some or all of the pipe diameters and pipe lengths cannot be acquired, may display an input screen on the display 4 and prompt the worker to input the pipe diameter and pipe length.

[0027] The room height acquisition device 45 acquires the height of each of the rooms 11 to 14 from the image data that have been read. For example, if the height of each of the rooms 11 to 14 is described in the design drawing 20, the height is acquired. The room height acquisition device 45 displays the acquired height of each of the rooms 11 to 14 on the display 4. If the height of each of the rooms 11 to 14 being displayed differs from the design drawing 20, the worker makes corrections, as appropriate. The room height acquisition device 45, if some or all of the heights of the rooms 11 to 14 cannot be acquired, may display an input screen on the display 4 and prompt the worker to input the height of each of the rooms 11 to 14.

[0028] The type/capacity acquisition device 46 acquires the type and capacity of the outdoor device 200 and the indoor devices 101 to 104 from the image data that have been read. For example, if the type and capacity of the outdoor device 200 and the indoor devices 101 to 104 are described in the design drawing 20, the described type and capacity are acquired. The type/capacity acquisition device 46 displays the acquired type and capacity of the outdoor device 200 and the indoor devices 101 to 104 on the display 4. The worker, if the displayed type and capacity differ from the design drawing 20, makes corrections, as appropriate. If some or all of the types and capacities cannot be acquired, the type/capacity acquisition device 46 may display an input screen on the display 4 and prompt the worker to input the type/capacity.

[0029] The determination device 47, on the basis of the type and capacity acquired by the type/capacity acquisition device 46, the pipe diameter and pipe length acquired by the pipe diameter/pipe length acquisition device 44, the amount of refrigerant corresponding to the type/capacity of the indoor devices/outdoor devices stored in the refrigerant amount storage device 32, and the additional amount of refrigerant corresponding to the pipe diameter, calculates an amount of refrigerant, and displays the results of calculation of the amount of refrigerant, shown in Table 3, on the display 4.

(Table 3)

Location	Pipe diameter (mm)	Pipe length (m)	Additional amount of refrigerant (kq/m)	Refrigerant amount (kg)
a	12.7	20	0.12	2.40
b	12.7	5	0.12	0.60
c	9.53	3	0.07	0.21
d	9.53	5	0.07	0.35
e	9.53	5	0.07	0.35
f	6.35	4	0.03	0.12
g	6.35	10	0.03	0.30
For outdoor device	-	-	-	8.00
For indoor device	-	-	-	2.00
Total	-	-	-	14.33

[0030] The determination device 47 also, on the basis of the calculated amount of refrigerant, the height of each of the rooms 11 to 14 acquired by the room height acquisition device 45, and the floor area of each of the rooms 11 to 14 calculated by the dimension acquisition device 43, determines the need for a safety measure with respect to refrigerant leak on a room by room basis. The determination device 47 displays, on the display 4, Table 4 shown below as the result indicating the need, and the drawing 21 depicted in Fig. 3, in which the constituent elements recognized by the constituent element recognition device 42 are diagrammatically represented.

(Table 4)

Room number	Floor area (m^2)	Ceiling height (m)	Room volume (m^3)	Full-leak concentration (kg/m^3)	Need for measure	Shut-off valve position (m)	Shut-off leak amount (kg)	Concentration during shut-off valve activation
11	150	2.6	390	0.037	No	-	-	-
12	50	2.6	130	0.110	-	-	-	-
13	30	2.4	72	0.199	Yes	3	0.21 +0.5 = 0.71	0.010 OK
14	100	2.4	240	0.060	No	-	-	-

[0031] The determination device 47 calculates the concentration (kg/m^3, refrigerant charge ratio) in the event of leak

of all refrigerant in the rooms 11 to 14. If the concentration value is equal to or greater than the value of 1/4 LFL (allowable concentration) stored in the refrigerant characteristics storage device 31, the determination device 47 indicates "Yes" with respect to the need for a measure. If smaller, "No" is indicated. At this point in time, the determination device 47 displays only the portion to the left of the column for the need for a measure in Table 4. While the determination for the need is not being performed with respect to the room 12 because an indoor device is not arranged therein, the determination for the need may be performed with respect to the room 12.

[0032] The worker selects a safety measure with respect to the room 13 determined to require a measure. The worker selects at least one of the cut-off valve 400 and the mechanical ventilation device 300 depicted as alternatives in Fig. 3. In the present embodiment, the case in which the cut-off valve 400 has been selected will be described. The worker selects the cut-off valve 400, and inputs the position for its installation on the drawing being displayed. The determination device 47, upon detecting that the worker has made the input, indicates, to the right of the column for the need for a measure in Table 4, the cut-off valve position, the leak amount at the time of cut-off, and the concentration (kg/m^3) during the activation of the cut-off valve. If the concentration (refrigerant charge ratio) in the event of refrigerant leak in the room 13 becomes smaller than the 1/4 LFL value because of the measure, the determination device 47 indicates "OK". That is, the determination device 47 determines whether the safety measure that has been input is effective or not. If the concentration in the event of refrigerant leak in the room 13 becomes equal to or greater than the 1/4 LFL value because of the measure, the determination device 47 indicates "NG" and prompts the worker to input a safety measure again.

[0033] The determination device 47, if the calculated concentration in the event of full leak is outside a range determined by design conditions, indicates "Error" with respect to the need for a measure. The range determined by the design conditions refers to a range determined by the room volume, the minimum amount of refrigerant of the indoor device, and the maximum amount of the refrigerant. The upper limit of the range is the value (2.49 kg/m^3) determined from the maximum amount of refrigerant (59.8kg in the case of R32) in Table 1, and the minimum volume (for example, 24 m^3(=10 m^2 (floor area) * 2.4 m (height)) of the room in which an indoor device of the minimum capacity is applied. The lower limit of the range is the value (0.009 kg/m^3) determined from the amount of refrigerant (for example, 0.4 kg) of the indoor device with the minimum capacity, and the volume (for example, 30 m^3(=15 m^2 (floor area) $*$ 3.0 m (height)) of the room in which installation of the indoor device is recommended. That is, if the need for a measure is "Error", this indicates the presence of an erroneous detection or erroneous input in the numerical values acquired by the acquisition devices 43 to 46. If it is determined that the calculated concentration in the event of full leak is outside the range determined by the design conditions, the determination device 47 displays Tables 3 and 4 on the display 4, and prompts the worker to confirm whether the numerical value of each of the items is correct and to correct the numerical values.

[0034] The air-conditioner design support device 1 having the above configuration reads the data concerning the design drawing and outputs an indication of the need for a safety measure with respect to refrigerant leak, according to a procedure described below.

[0035] Fig. 4 is a flowchart of the procedure in the design support device 1 for outputting an indication of the need for a safety measure with respect to refrigerant leak.

[0036] First, the read device 41 reads the image data of the design drawing 20 that have been acquired by the image acquisition device 5 (S101). The constituent element recognition device 42 recognizes, from the image data that have been read, the constituent elements including the rooms, piping, ventilating fan, indoor devices, and outdoor devices on the basis of the structure/shape and the like, and displays the result of recognition on the display 4 (S102). Specifically, the drawing 21 depicted in Fig. 3, in which the recognized constituent elements are diagrammatically represented, and Table 2, described above, relating to the recognized constituent elements are displayed on the display 4. The constituent element recognition device 42, if there has been an input of correction/addition and the like from the worker, reflects the input result in the drawing 21.

[0037] The dimension acquisition device 43 acquires the reference dimensions from the image data that have been read, calculates the lengths of the sides of each of the rooms 11 to 14 and the floor areas thereof, and displays the calculated results on the display 4 (S103). If the reference dimensions cannot be acquired, the dimension acquisition device 43 acquires the reference dimensions by displaying an input screen on the display 4 and having the worker input the reference dimensions.

[0038] The pipe diameter/pipe length acquisition device 44 acquires the pipe diameter and pipe length of each of the pipes a to g from the image data that have been read, and displays the acquired pipe diameters and pipe lengths on the display 4 (S104). If some or all of the pipe diameters and pipe lengths cannot be acquired, the pipe diameter/pipe length acquisition device 44 acquires the pipe diameters and pipe lengths by displaying an input screen on the display 4 and having the worker input the pipe diameters and pipe lengths.

[0039] The room height acquisition device 45 acquires the height of each of the rooms 11 to 14 from the image data that have been read, and displays the acquired height of each of the rooms 11 to 14 on the display 4 (S105). If some or all of the heights of the rooms 11 to 14 cannot be acquired, the room height acquisition device 45 acquires the heights of the rooms 11 to 14 by displaying an input screen on the display 4 and having the worker input the heights of the rooms 11 to 14.

[0040] The type/capacity acquisition device 46 acquires the type and capacity of the outdoor device 200 and the indoor devices 101 to 104 from the image data that have been read, and displays the acquired type and capacity of the outdoor device 200 and the indoor devices 101 to 104 on the display 4 (S106). If some or all of the types and capacities cannot be acquired, the type/capacity acquisition device 46 acquires the type/capacity by displaying an input screen on the display 4 and having the worker input the type/capacity. The type/capacity acquisition device 46 also calculates the amounts of refrigerant on the basis of the acquired type and capacity, pipe diameter and pipe length, and the amount of refrigerant and the additional amount of refrigerant stored in the refrigerant amount storage device 32, and displays the results of calculation of the amounts of refrigerant shown in Table 3 on the display 4.

[0041] The determination device 47, on the basis of the calculated amounts of refrigerant, the height of each of the rooms 11 to 14, and the floor area of each of the rooms 11 to 14, determines (S107) the need for a safety measure with respect to refrigerant leak on a room by room basis, and determines (S108) if there is a room for which a safety measure is necessary. If there is a room for which a safety measure is necessary (S108: YES), the determination device 47 determines (S109) whether there has been an input of a safety measure from the worker with respect to the drawing 21 being displayed on the display 4. If there has been an input from the worker (S109: YES), the determination device 47 determines (S110) whether, due to the safety measure that has been input, the concentration in the event of refrigerant leak in the room for which the safety measure is necessary is smaller than the allowable concentration. If there is no room for which a safety measure is necessary (S108: NO), or if the concentration in the event of refrigerant leak is greater than or equal to the allowable concentration (S110), the determination device 47 ends the process.

[0042] Thus, the air-conditioner design support device 1 is provided with: the read device 41 which reads data concerning the design drawing 20 for the air conditioner describing the indoor devices 101 to 104, the outdoor device 200, the rooms 11 to 14, and the pipes a to g; the acquisition devices 42 to 46 which acquire, from the data concerning the design drawing 20 that have been read, data concerning the indoor devices 101 to 104, the outdoor device 200, the rooms 11 to 14, and the pipes a to g; and the determination device 47 which calculates the amount of refrigerant required for the air conditioner on the basis of the acquired data concerning the indoor devices 101 to 104, the outdoor device 200, and the pipes a to g, calculates the volume of each of the rooms 11 to 14 on the basis of the acquired data concerning the rooms 11 to 14, determines the need for a safety measure with respect to each of the rooms 11 to 14 on the basis of the amounts of refrigerant and the respective volumes, and outputs the determined results. With this configuration, it is possible to automatically and easily determine the need for a safety measure with respect to the air conditioner.

[0043] If the data concerning the indoor devices 101 to 104, the outdoor device 200, the rooms 11 to 14, or the pipes a to g cannot be acquired from the data concerning the design drawing 20 that have been read, the acquisition devices 42 to 46 output a screen for inputting the data. In this way, if there are data that cannot be acquired automatically, the data can be acquired solely by means of a manual input operation. Accordingly, the need for a safety measure with respect to an air conditioner can be determined easily.

[0044] The determination device 47 calculates the refrigerant charge ratio in each of the rooms 11 to 14 by dividing the amount of refrigerant by the respective volume, determines whether the refrigerant charge ratio is within a predetermined range, and, if the refrigerant charge ratio is not within the predetermined range, outputs information indicating the presence of an error in data acquisition by the acquisition devices 42 to 46. In this way, it is possible to prevent determination of the need for a safety measure on the basis of erroneous detection in the acquisition devices 42 to 46.

[0045] The determination device 47, if a safety measure with respect to the rooms 11 to 14 has been input, determines whether the safety measure is effective or not, on the basis of the amount of refrigerant that leaks to the rooms 11 to 14 after the safety measure is implemented, and the room volume. In this way, whether the safety measure is effective or not can be determined easily.

[0046] The present invention is not limited to the foregoing embodiment. A person skilled in the art will appreciate that various additions or modifications may be made within the scope of the present invention.

[0047] For example, while in the foregoing embodiment, selection was made to install the cut-off valve 400 in the room determined to require a safety measure, the mechanical ventilation device 300 may be selected. When the mechanical ventilation device 300 is selected, a required amount of ventilation with respect to the room is calculated automatically, and the installation position is also selected. In the room determined to require a safety measure, a detector and an alarm may be installed in addition to the mechanical ventilation device 300 and the cut-off valve 400. The data concerning the design drawing 20 that are read by the read device 41 may include CAD data.

DESCRIPTION OF REFERENCE SIGNS

[0048]

1:	Design support device
101 to 104:	Indoor device
200:	Outdoor device

a to g: Pipes
11 to 14: Room
20: Design drawing
41: Read device
42: Element recognition device
43: Dimension acquisition device
44: Pipe diameter/pipe length acquisition device
45: Room height acquisition device
46: Type/capacity acquisition device
47: Determination device

Claims

1. An air-conditioner design support device comprising:

a read means for reading data concerning a design drawing for an air conditioner describing an indoor device, an outdoor device, a space to be air-conditioned, and a pipe;
an acquisition means for acquiring, from the data concerning the design drawing that have been read, data concerning the indoor device, the outdoor device, the space to be air-conditioned, and the pipe; and
a determination means for calculating an amount of refrigerant required for the air conditioner based on the acquired data concerning the indoor device, the outdoor device, and the pipe, calculating a volume of the space to be air-conditioned based on the acquired data concerning the space to be air-conditioned, determining a need for a safety measure with respect to the space to be air-conditioned based on the amount of refrigerant and the volume, and outputting a determination result.

2. The air-conditioner design support device according to claim 1, wherein the acquisition means, if from the data concerning the design drawing that have been read, the data concerning the indoor device, the outdoor device, the space to be air-conditioned, or the pipe cannot be acquired, outputs a screen for inputting the data.

3. The air-conditioner design support device according to claim 1 or claim 2, wherein the determination means:

calculates a refrigerant charge ratio of the space to be air-conditioned by dividing the amount of refrigerant by the volume, and determines whether the refrigerant charge ratio is within a predetermined range; and
if the refrigerant charge ratio is not within the predetermined range, outputs information indicating a presence of an error in data acquisition by the acquisition means.

4. The air-conditioner design support device according to claim 1 to claim 3, wherein, if the safety measure with respect to the space to be air-conditioned has been input, the determination means determines whether the safety measure is effective based on an amount of refrigerant that leaks into the space to be air-conditioned and the volume following the safety measure.

FIG. 1

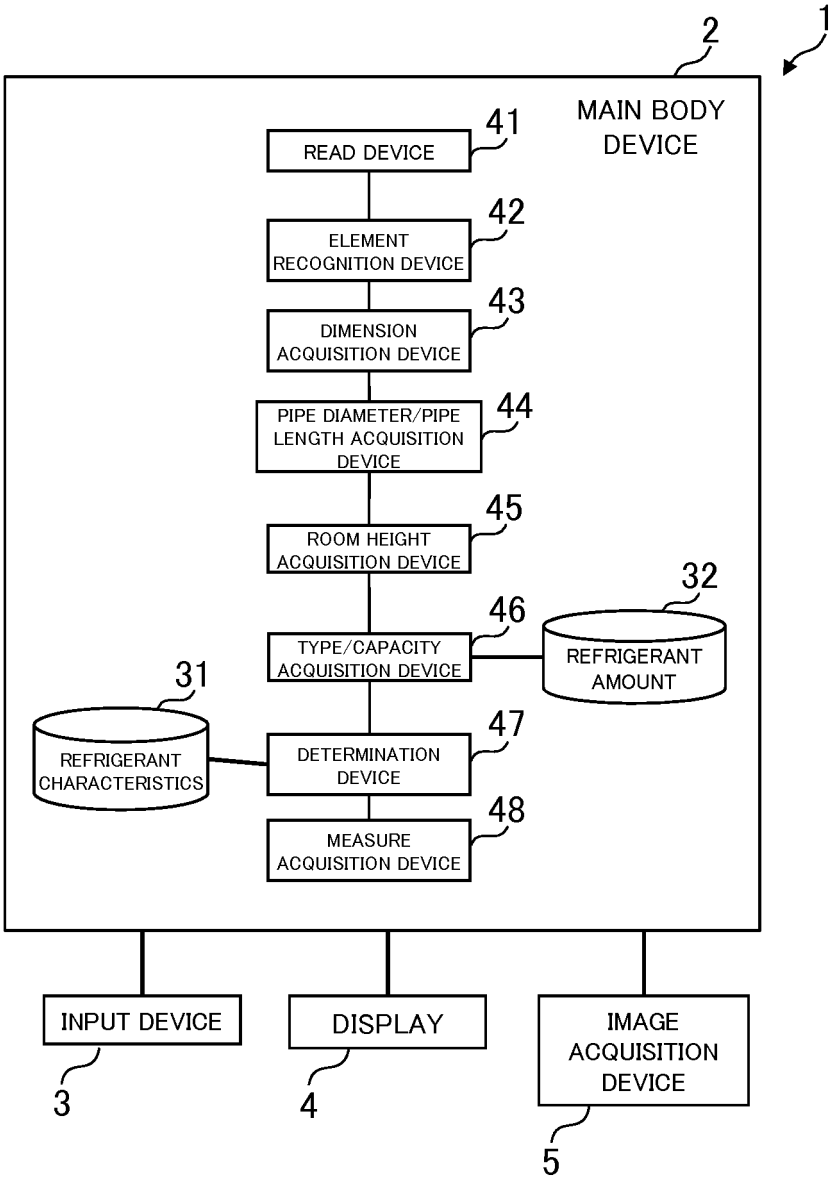

1
2
MAIN BODY DEVICE
READ DEVICE
41
ELEMENT RECOGNITION DEVICE
42
DIMENSION ACQUISITION DEVICE
43
PIPE DIAMETER/PIPE LENGTH ACQUISITION DEVICE
44
ROOM HEIGHT ACQUISITION DEVICE
45
TYPE/CAPACITY ACQUISITION DEVICE
46
REFRIGERANT AMOUNT
32
REFRIGERANT CHARACTERISTICS
31
DETERMINATION DEVICE
47
MEASURE ACQUISITION DEVICE
48
INPUT DEVICE
3
DISPLAY
4
IMAGE ACQUISITION DEVICE
5

FIG. 2

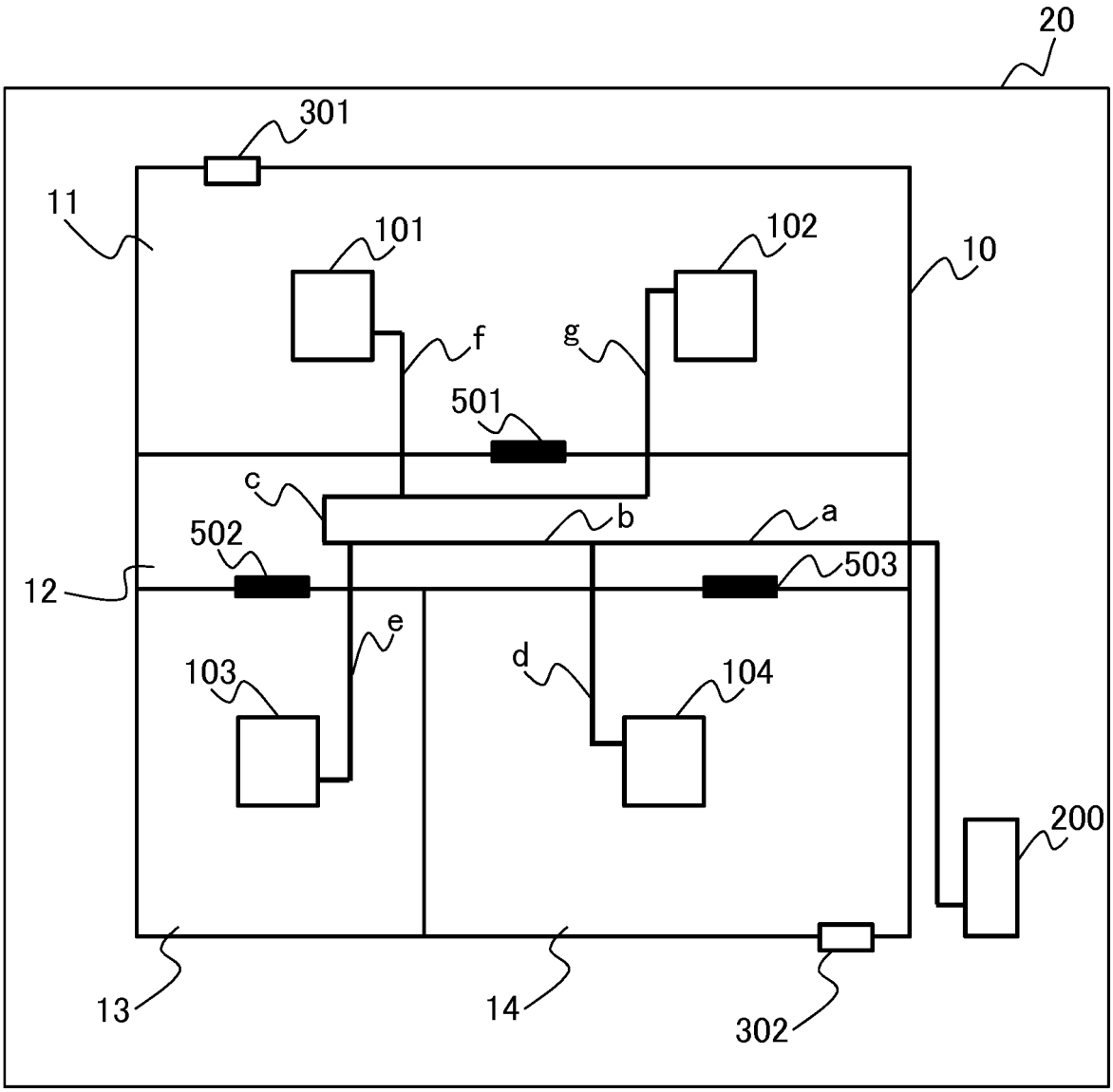


FIG. 3

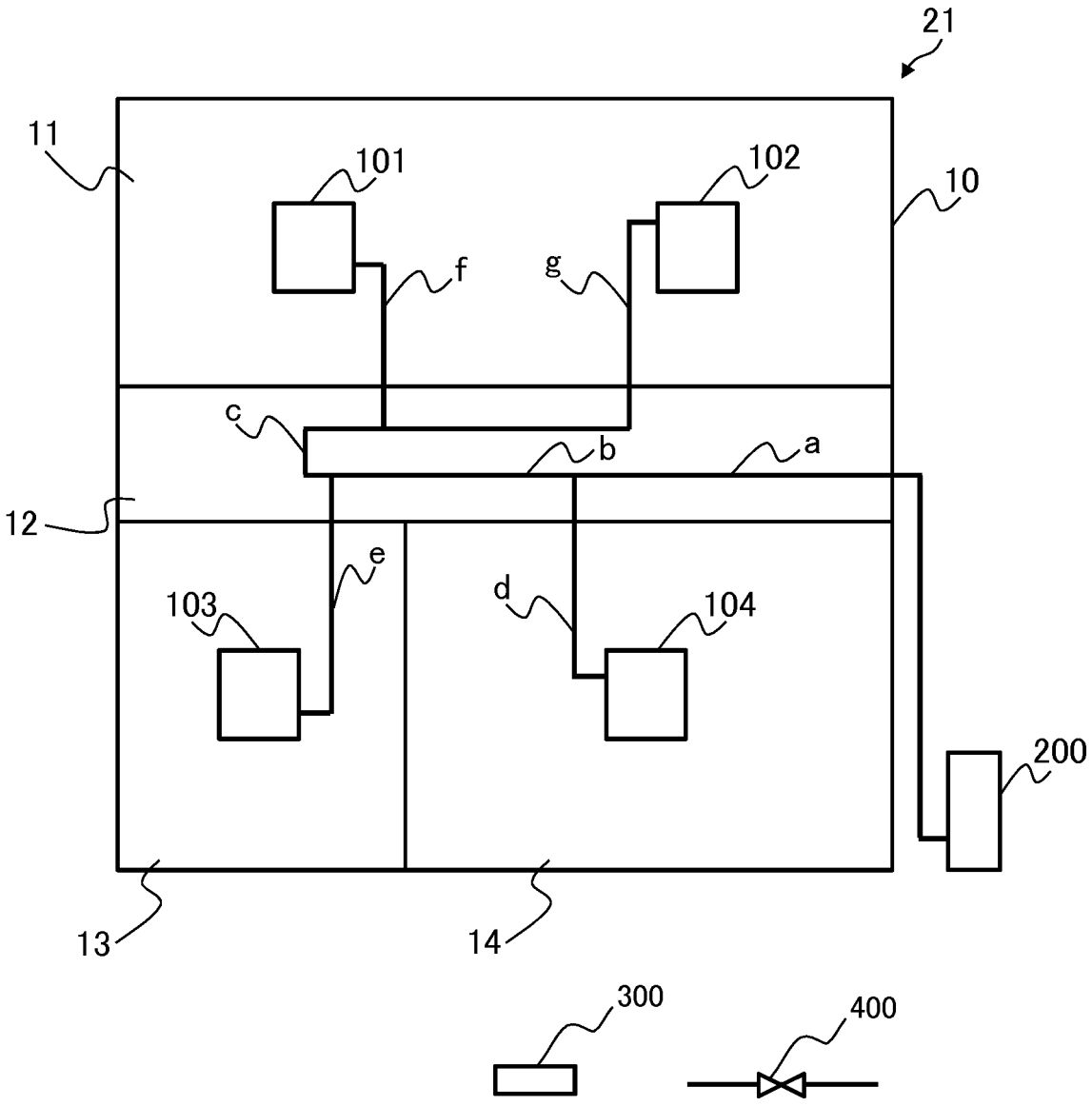
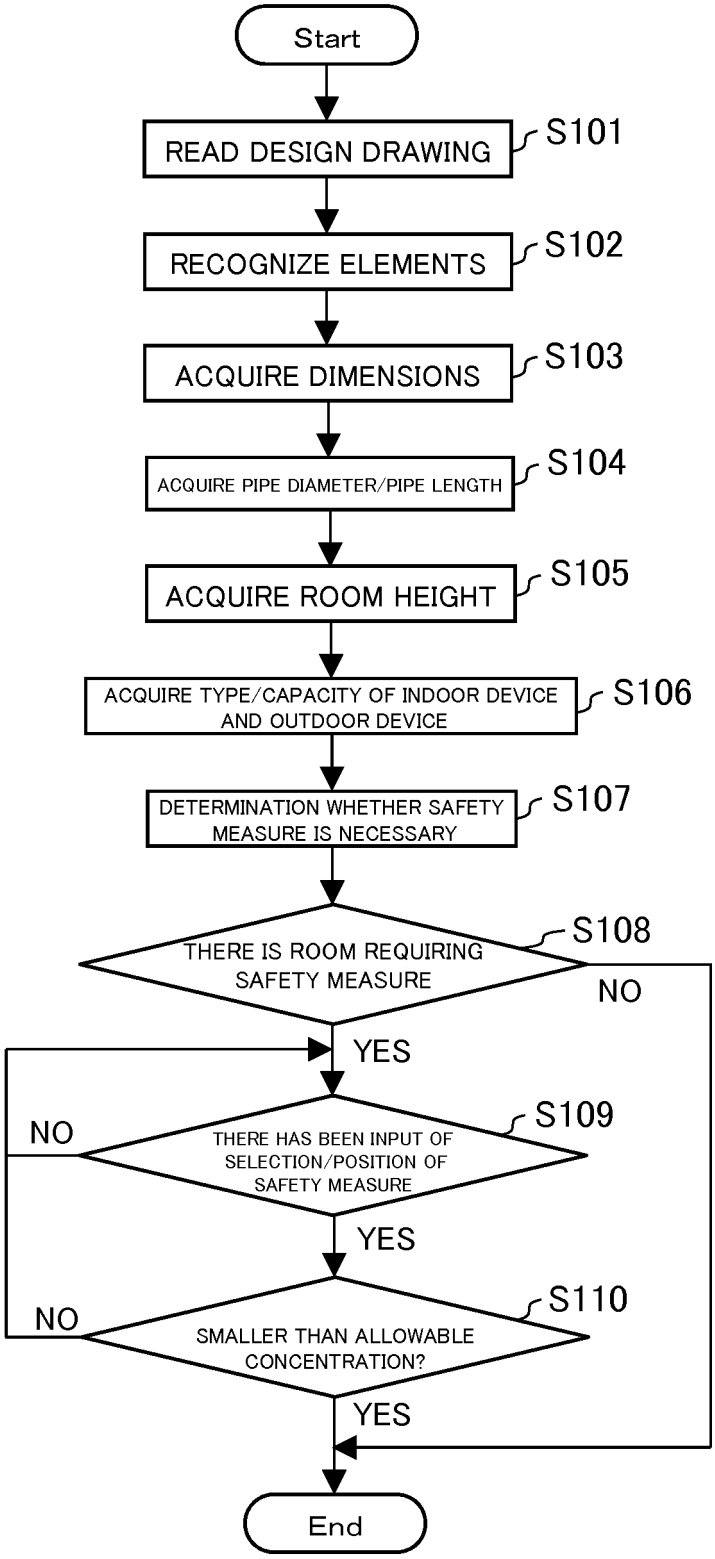


FIG. 4


Start
READ DESIGN DRAWING
S101
RECOGNIZE ELEMENTS
S102
ACQUIRE DIMENSIONS
S103
ACQUIRE PIPE DIAMETER/PIPE LENGTH
S104
ACQUIRE ROOM HEIGHT
S105
ACQUIRE TYPE/CAPACITY OF INDOOR DEVICE AND OUTDOOR DEVICE
S106
DETERMINATION WHETHER SAFETY MEASURE IS NECESSARY
S107
THERE IS ROOM REQUIRING SAFETY MEASURE
S108
NO
YES
THERE HAS BEEN INPUT OF SELECTION/POSITION OF SAFETY MEASURE
S109
NO
YES
SMALLER THAN ALLOWABLE CONCENTRATION?
S110
NO
YES
End

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2018/008893

A. CLASSIFICATION OF SUBJECT MATTER
Int. Cl. F24F11/36(2018.01)i, F25B49/00(2006.01)i

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. Cl. F24F11/36, F25B49/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Published examined utility model applications of Japan 1922-1996
Published unexamined utility model applications of Japan 1971-2018
Registered utility model specifications of Japan 1996-2018
Published registered utility model applications of Japan 1994-2018

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 A	JP 3477184 B2 (TOSHIBA CARRIER CORP.) 10 December 2003, paragraphs [0001]-[0075], fig. 1-8 (Family: none)	1 2-4
Y A	JP 2016-188757 A (MITSUBISHI ELECTRIC CORP.) 04 November 2016, paragraphs [0013], [0079], [0080] & US 2017/0284718 A1, paragraphs [0096], [0097] & WO 2016/079801 A1 & AU 2015351400 A & CN 107003051 A	1 2-4
Y	JP 2003-120982 A (HITACHI, LTD.) 23 April 2003, paragraphs [0011], [0017], [0020] & US 2003/0070438 A1, paragraphs [0011], [0041], [0044] & TW 257995 B & KR 10-2003-0032795 A & CN 1412485 A	1

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

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
23.04.2018	15.05.2018
Name and mailing address of the ISA/ Japan Patent Office 3-4-3, Kasumigaseki, Chiyoda-ku, Tokyo 100-8915, Japan	Authorized officer Telephone No.

Form PCT/ISA/210 (second sheet) (January 2015)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2018/008893

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2008/0120069 A1 (MARTIN, Jason) 22 May 2008, paragraphs [0002]-[0043], fig. 1-4 & WO 2008/064260 A2	1
A	JP 2014-142141 A (MITSUBISHI ELECTRIC CORP.) 07 August 2014, paragraphs [0001]-[0067], fig. 1-5 (Family: none)	1-4
A	JP 2013-178075 A (DAIKIN INDUSTRIES, LTD.) 09 September 2013, paragraphs [0001]-[0089], fig. 1-9 & US 2015/0233622 A1 & WO 2014/034099 A & EP 2905563 A1 & AU 2013310668 A & CN 104603557 A & KR 10-2015-0048193 A	1-4
A	US 2013/0213068 A1 (GOEL, Rakesh) 22 August 2013, paragraphs [0001]-[0052], fig. 1-3 & EP 2631570 A2 & CA 2805504 A1	1-4

Form PCT/ISA/210 (continuation of second sheet) (January 2015)