

DESCRIPTION

Title of Invention:

RECORD MANAGEMENT APPARATUS AND COMMUNICATION SYSTEM

5

Technical Field

[0001]

The present disclosure relates to a record management apparatus and a communication system.

10

Background Art

[0002]

By providing a refrigeration apparatus for cooling the interior of a container in a container for sea transportation or land transportation, it is possible to transport a package including food, chemicals, medicine, etc., for a long time. Further, conventionally, by using a communication system, there is a proposal that a management center centrally manages the distribution record of the packages in the container and implements the traceability of the packages (see Patent Document 1). Thus, even if a problem occurs regarding the quality of the package, the management center or the like can carry out a back-trace or tracking investigation of the package, and can address the problem. Further, the components of the refrigeration apparatus that cools the interior of the container may be replaced during transportation.

30

Citation List

Patent Document

[0003]

Patent document 1: Japanese Unexamined Patent
Application Publication No. 2019-516162

Summary of Invention

5 Technical Problem

[0004]

However, it is difficult for the
manufacturer of the refrigeration apparatus to
identify where the component was replaced. Therefore,
10 if the component was replaced with a component other
than the genuine component, and the refrigeration
apparatus breaks down because of this, and a problem
occurs in the package, it is difficult for the
manufacturer of the refrigeration apparatus to
15 identify the cause.

[0005]

It is an object of the present disclosure to
implement traceability concerning components of a
refrigeration apparatus provided in a container to be
20 transported in consideration of the above
circumstances.

Solution to Problem

[0006]

25 (1) The first aspect of the present
disclosure is a record management apparatus for
managing a record of a change relating to a
refrigeration apparatus provided in a container to be
transported, the record management apparatus
30 including a communication unit configured to acquire
first component identification information for
identifying a predetermined type of a component
included in the refrigeration apparatus at a first

time point and second component identification information for identifying the predetermined type of the component forming the refrigeration apparatus at a second time point after the first time point; and a
5 control unit configured to implement control to determine whether the second component identification information has been changed from the first component identification information.

[0007]

10 According to the first aspect, traceability concerning components of a refrigeration apparatus provided in a container to be transported can be implemented.

[0008]

15 (2) The second aspect of the present disclosure is the record management apparatus according to the first aspect, wherein when the second component identification information has been changed from the first component identification
20 information, the control unit determines that the predetermined type of the component has been replaced.

[0009]

25 According to the second aspect, based on the fact that the second component identification information has been changed from the first component identification information, it can be determined that a predetermined type of component has been replaced at the second time point.

30 [0010]

 (3) The third aspect of the present disclosure is the record management apparatus according to the first or second aspect, wherein the

communication unit acquires first time point
information indicating the first time point together
with the first component identification information,
and acquires second time point information indicating
5 the second time point together with the second
component identification information, and the control
unit determines whether the second component
identification information has been changed from the
first component identification information based on a
10 before-after relationship between the first time
point and the second time point.

[0011]

According to the third aspect, based on the
before-after relationship between the first time
15 point and the second time point, it can be determined
whether the second component identification
information has been changed from the first component
identification information.

[0012]

20 (4) The fourth aspect of the present
disclosure is the record management apparatus
according to any one of the first to third aspects,
further including a storage unit configured to store
the first component identification information and
25 the second component identification information
acquired by the communication unit.

[0013]

According to the fourth aspect, it is
possible to implement traceability regarding
30 components of a refrigeration apparatus provided in a
container to be transported.

[0014]

(5) The fifth aspect of the present

disclosure is the record management apparatus according to the fourth aspect, wherein when the second component identification information has been changed from the first component identification information and the communication unit has not acquired production information relating to production of a predetermined component indicated by the second component identification information, the communication unit acquires the production information from a production information management apparatus configured to manage the production information of each component; and the storage unit stores the production information in association with the second component identification information.

[0015]

According to the fifth aspect, even when the record management apparatus 7 does not manage the production information, the production information can be obtained from the production information management apparatus.

[0016]

(6) The sixth aspect of the present disclosure is the record management apparatus according to the fifth aspect, wherein the production information includes information indicating a place where the predetermined component was replaced, a date and time when the predetermined component was replaced, a replacing person who replaced the predetermined component, or a place where the predetermined component was stored.

[0017]

According to the sixth aspect, detailed information of the component can be obtained from the

production information.

[0018]

(7) The seventh aspect of the present disclosure is the record management apparatus according to the fourth aspect, wherein when the second component identification information has been changed from the first component identification information and the communication unit has not acquired production information related to production of a predetermined component indicated by the second component identification information, the communication unit makes a request for the production information to a production information management apparatus configured to manage the production information of each component, and when the communication unit cannot acquire the production information in response to the request, the storage unit stores a predetermined flag in association with the second component identification information.

[0019]

According to the seventh aspect, it is possible to recognize that the component is not genuine or the like by a predetermined flag.

[0020]

(8) The eighth aspect of the present disclosure is the record management apparatus according to any one of the first to sixth aspects, wherein the communication unit acquires the second component identification information transmitted by a communication apparatus provided in the container or in a mobile body loaded with the container.

[0021]

According to the eighth aspect, the second

component identification information can be acquired even during transportation of the container.

[0022]

(9) The ninth aspect of the present disclosure is the record management apparatus according to any one of the first to seventh aspects, wherein the communication unit acquires the second component identification information transmitted by a communication apparatus provided at a gate through which a mobile body mounted with the container passes.

[0023]

According to the ninth aspect, the second component identification information can be automatically acquired at the gate even during transportation of the container.

[0024]

(10) The tenth aspect of the present disclosure is a communication system including a communication apparatus configured to be installed in the container or a mobile body mounted with the container, and to transmit the second component identification information; and the record management apparatus according to any one of the first to seventh aspects.

[0025]

According to the tenth aspect, it is possible to implement traceability regarding components of a refrigeration apparatus provided in a container to be transported.

[0026]

(11) The eleventh aspect of the present disclosure is the communication system according to

the tenth aspect, further including a transfer apparatus configured to be installed in the container or the mobile body loaded with the container, to read, by short-range radio communication, the second component identification information from a radio tag in which the second component identification information is written, and to transmit the second component identification information to the communication apparatus.

10 [0027]

According to the eleventh aspect, it is possible to implement traceability regarding components of a refrigeration apparatus provided in a container to be transported.

15 [0028]

(12) The twelfth aspect of the present disclosure is the communication system according to the eleventh aspect, wherein the radio tag is an RFID tag that can be attached to the predetermined type of the component, the refrigeration apparatus, or the container, and in which the second component identification information is written.

[0029]

According to the twelfth aspect, component identification can be automatically performed by RFID.

[0030]

(13) The thirteenth aspect of the present disclosure is the record management apparatus according to the first aspect, wherein the communication unit acquires the second component identification information transmitted by a communication terminal that has read the second

30

component identification information from an identification image in which the second component identification information is embedded.

[0031]

5 According to the thirteenth aspect, it is possible to implement traceability of components of a refrigeration apparatus provided in a container to be transported.

10 Brief Description of Drawings

[0032]

[FIG. 1] FIG. 1 is an overall configuration diagram of a communication system according to an embodiment.

15 [FIG. 2] FIG. 2 is a longitudinal cross-sectional view in the front-rear direction of a refrigeration apparatus according to an embodiment.

[FIG. 3] FIG. 3 is a perspective view of the refrigeration apparatus viewed from the front.

20 [FIG. 4] FIG. 4 is a piping system diagram of the refrigeration apparatus.

[FIG. 5] FIG. 5 is a schematic diagram of the refrigeration apparatus.

[FIG. 6] FIG. 6 is a schematic diagram of a transfer apparatus.

25 [FIG. 7] FIG. 7 is a schematic diagram of a communication apparatus.

[FIG. 8] FIG. 8 is a schematic diagram of a reading apparatus.

30 [FIG. 9] FIG. 9 is a schematic diagram of a worker terminal.

[FIG. 10] FIG. 10 is a schematic diagram of a record management apparatus.

[FIG. 11] FIG. 11 is a conceptual diagram of a

component data management table.

[FIG. 12] FIG. 12 is a conceptual diagram of component data.

[FIG. 13] FIG. 13 is a schematic diagram of a
5 production information management apparatus.

[FIG. 14] FIG. 14 is a conceptual diagram of a production information management table.

[FIG. 15] FIG. 15 is a sequence diagram illustrating component data registration processing in the initial
10 stage or repair stage.

[FIG. 16] FIG. 16 is a sequence diagram illustrating component data registration processing in the container transportation stage.

[FIG. 17] FIG. 17 is a conceptual diagram of
15 component data transmitted in the container transportation stage.

[FIG. 18] FIG. 18 is a sequence diagram illustrating component data registration processing in the transportation stage where a truck loaded with the
20 container passes through a centralized management gate.

[FIG. 19] FIG. 19 is a conceptual diagram of component data transmitted in the transportation stage where the truck loaded with the container
25 passes through the centralized management gate.

[FIG. 20] FIG. 20 is a flowchart illustrating component replacement record analysis processing.

[FIG. 21] FIG. 21 is a flowchart illustrating component replacement record analysis processing.

[FIG. 22] FIG. 22 is a diagram illustrating analysis
30 results.

Description of Embodiments

[0033]

Embodiments will be described below with reference to drawings. The present disclosure is not limited to the embodiments described below, and
5 various changes may be made within the scope of not deviating from the technical concept of the present disclosure. Because the drawings are intended to explain the present disclosure conceptually, the dimensions, ratios, or numbers may be exaggerated or
10 simplified as necessary for ease of understanding.

[0034]

[Overall configuration of communication system]

First, the overall configuration of a communication system 1 of the present embodiment will
15 be described with reference to FIG. 1. FIG. 1 is an overall configuration diagram of the communication system according to the present embodiment.

[0035]

As illustrated in FIG. 1, the communication
20 system 1 of the present embodiment is constructed by a refrigeration apparatus 2, a transfer apparatus 3, a communication apparatus 4, a reading apparatus 5, a worker terminal 6, a record management apparatus 7, and a production information management apparatus 9.
25 The communication apparatus 4, the reading apparatus 5, the worker terminal 6, the record management apparatus 7, and the production information management apparatus 9 are all composed of computers, and can communicate by connecting them to a
30 communication network 100 such as the Internet. The connection mode between the communication apparatus 4 and the communication network 100 is wireless. The connection mode between the reading apparatus 5, the

worker terminal 6, the record management apparatus 7, and the production information management apparatus 9, and the communication network 100, can be either wireless or wired. Because the communication

5 apparatus 4 connects to the communication network not only from land but also from sea, the Internet may be a satellite (space) Internet. The record management apparatus 7 and the production information management apparatus 9 are composed of a single computer or a
10 plurality of computers.

[0036]

The refrigeration apparatus 2 is installed across the exterior of the container C to the interior of the container C to cool the air inside
15 the container C. A wireless tag T in which component data including component identification information for identifying each component is written, is attached to each predetermined component of the refrigeration apparatus 2. The wireless tag T is a
20 generic name for the wireless tags T1, T2, and T3 described later. The component data will be described later in detail. Because the refrigeration apparatus 2 is installed across the exterior of the container C to the interior of the container C, there are radio
25 tags T attached to components inside the container C and radio tags T attached to components outside the container C. Packages including food, chemicals, medicine, etc., are stored in the container C and transported by sea by a ship V or by land by a truck
30 TR.

[0037]

The transfer apparatus 3 is installed outside the container C, reads component data from

the radio tag T inside or outside the container C by short-range radio communication, and transmits the component data to the communication apparatus 4 by (medium-range) radio communication. For short-range
5 radio communication, RFID (Radio Frequency Identifier) is used, for example. If there is no obstacle, communication up to approximately 7 m is usually possible. For (medium-range) radio communication from the transfer apparatus 3 to the
10 communication apparatus 4, for example, Wi-Fi is used. If there is no obstacle, communication up to approximately 500 m is usually possible. Further, wired communication using a cable may be used from the transfer apparatus 3 to the communication
15 apparatus 4. In this case, the transfer apparatus 3 is mounted on a modem.

[0038]

Note that component data including component identification information for identifying components
20 of the refrigeration apparatus 2 inside or outside the container C may be written to the transfer apparatus 3 instead of the wireless tag T.

[0039]

The communication apparatus 4 is installed
25 outside the container C, on the ship V or on the truck TR, and can communicate with the transfer apparatus 3 by (medium-range) wireless communication. The communication apparatus 4 is equipped with a wireless modem and can communicate with the record
30 management apparatus through the communication network 100 by (long-range) wireless communication. Thus, for example, component data written to the wireless tag T inside or outside the container C is

transmitted to the record management apparatus 7 through the transfer apparatus 3, the communication apparatus 4 and the communication network 100. The communication apparatus 4 may have the function of the transfer apparatus 3.
[0040]

The reading apparatus 5 is installed at the centralized management gate G through which the truck TR loaded with the container C passes when the container C is shipped or unloaded, and can communicate with the wireless tag T outside the container C by short-range wireless communication. The reading apparatus 5 may be able to communicate with the transfer apparatus 3 by (medium-range) wireless communication.
[0041]

Thus, when the truck TR passes through the centralized management gate G, for example, the component data written in the radio tag T outside the container C is directly read by the reading apparatus 5 and transmitted to the record management apparatus 7 via the communication network 100. Alternatively, the component data written in the radio tag T outside the container C is transmitted to the reading apparatus 5 via the transfer apparatus 3 and transmitted from the reading apparatus 5 via the communication network 100 to the record management apparatus 7. When the radio tag T is inside the container C, the radio wave strength from the inside to the outside is weak, so the component data written in the radio tag T inside the container C is transmitted to the reading apparatus 5 via the transfer apparatus 3 and transmitted from the reading

apparatus 5 via the communication network 100 to the record management apparatus 7.

[0042]

5 The worker terminal 6 is a kind of communication terminal used in the production factory or the repair factory of the refrigeration apparatus 2, and when the refrigeration apparatus 2 is produced or the component of the refrigeration apparatus 2 is replaced, the component data of the component is
10 input by the worker, and this component data is transmitted to the record management apparatus 7 via the communication network 100. Note that the replacement of the component of the refrigeration apparatus 2 includes a case in which, even if the
15 component is not replaced when a worker repairs the component, the component identification information is replaced, and thereafter, the component is managed as another component.

[0043]

20 In the above example, the radio tag T in which the component data is written is used, but the embodiment is not limited thereto. For example, instead of the radio tag T, an identification image in which the component data is embedded may be
25 directly printed on the component of the refrigeration apparatus 2, or a seal on which the identification image is printed may be affixed. A recognition image is, for example, a two-dimensional code such as a QR code (registered trademark) or a
30 bar code. Further, a plate printed with one or more identification images in which component data of all or some of the components of the refrigeration apparatus 2 are compiled, may be affixed to a

predetermined position of the refrigeration apparatus 2. Further, a sticker printed with one or more identification images in which component data of all or some of components of the refrigeration apparatus 2 are compiled, may be affixed to a predetermined position of the refrigeration apparatus 2.

[0044]

In this case, in the production factory or the repair factory, the worker reads the component data embedded in the recognition image by using the worker terminal 6, and transmits the component data from the worker terminal 6 to the record management apparatus 7 via the communication network 100. In the centralized management gate G, the worker inspecting the container C reads the component data embedded in the recognition image by using the worker terminal 6, and transmits the component data from the worker terminal 6 to the record management apparatus 7 via the communication network 100.

[0045]

The record management apparatus 7 manages the component data transmitted from the communication apparatus 4, the reading apparatus 5, and the worker terminal 6 via the communication network 100. Further, the record management apparatus 7 determines whether the component identification information included in the component data of the predetermined type of component has been changed, and if it has been changed, the record management apparatus 7 determines that the predetermined type of component has been replaced. Thus, the manager of the record management apparatus 7 can identify the state of the components of the refrigeration apparatus 2 by

confirming the component data managed by the record management apparatus 7 or the determination result obtained by the record management apparatus 7. The manager of the record management apparatus 7 may be a
5 manufacturer of the refrigeration apparatus 2 or an affiliated company of the manufacturer.

[0046]

The production information management apparatus 9 manages production information related to
10 the production of each predetermined component that is a genuine component of the producer or a component approved by the producer, and transmits predetermined production information corresponding to the request to the record management apparatus 7 in response to a
15 request from the record management apparatus 7. The production information includes, for example, information indicating the place where the component was replaced, information indicating the date and time when the component was replaced, information
20 indicating a replacing person who replaced the component, or information indicating the place where the component was stored. Here, the production information is information for determining whether each component is a genuine component of the producer
25 or a component recognized by the producer. Here, the producer is, for example, the manufacturer of the refrigeration apparatus 2.

[0047]

[Configuration of communication system]

30 Next, the configuration of each of the refrigeration apparatus 2, the transfer apparatus 3, the communication apparatus 4, the worker terminal 6, the record management apparatus 7, and the production

information management apparatus 9 constructing the communication system 1 will be described with reference to the figures.

[0048]

5 <Configuration of refrigeration apparatus>

First, the configuration of the refrigeration apparatus will be described with reference to FIGS. 2 to 5. FIG. 2 is a longitudinal cross-sectional view along the front-rear direction
10 of the refrigeration apparatus according to the embodiment. FIG. 3 is a perspective view of the refrigeration apparatus viewed from the front side. FIG. 4 is a piping system diagram of the refrigeration apparatus. FIG. 5 is a schematic
15 configuration diagram of the refrigeration apparatus. In the following description, the words "front", "rear", "left", "right", "top", and "bottom" refer to the direction indicated by the arrows in FIG. 3. Because the refrigeration apparatus 2 is closely
20 related to the container C, the overall configuration of the container will be described first.

[0049]

(1) Overall configuration of the container

The container C is used for sea
25 transportation and land transportation. The container C is a refrigeration container having a function of cooling the air inside. The container C has a container body 11 and the refrigeration apparatus 2 for the container. The container body 11 stores
30 foodstuffs, chemicals, medicines, etc. The refrigeration apparatus 2 cools an interior space 212 of the container body 11. Hereinafter, the interior space 212 may be referred to as the interior of the

container and the space outside the container body 11 may be referred to as the exterior of the container. As illustrated in FIG. 2, an opening 213 is formed in the front face of the container body 11. The
5 refrigeration apparatus 2 is attached to the container body 11 so as to close the opening 213 of the container body 11.

[0050]

(2) The refrigeration apparatus

10 The refrigeration apparatus 2 has a casing 21. The casing 21 constitutes a lid of the opening 213 of the container body 11. The casing 21 has a casing body 22 and a partition plate 23. The casing body 22 partitions the interior and exterior of the
15 container body 11. The partition plate 23 is arranged so as to be located in the interior space 212 on the back side (rear side) of the casing 21.

[0051]

 The refrigeration apparatus 2 has a
20 compressor 240, an exterior heat exchanger 241, and an exterior fan 242 as components (elements) arranged in the exterior of the refrigeration apparatus. The refrigeration apparatus 2 has an interior heat exchanger 244 and an interior fan 245 as components
25 (elements) arranged in the interior of the refrigeration apparatus.

[0052]

(2-1) Casing body

 As illustrated in FIG. 2, the casing body 22
30 has a flat plate portion 22a and a recess portion 22b. The flat plate portion 22a is formed on the upper portion of the casing body 22 so as to be substantially flush with the opening 213 of the

casing 21. As illustrated in FIG. 3, two inspection windows 24 are formed in the middle portion of the flat plate portion 22a in the left-right direction. The inspection window 24 is a transparent window for checking the inside of the casing body 22. A ventilator 25 is provided to the left of the inspection window 24. The ventilator 25 ventilates the interior of the casing.

[0053]

The recess portion 22b is formed in the lower part of the casing 21. The recess portion 22b is recessed backward from the lower end of the flat plate portion 22a. An exterior storage space 26 outside the casing is formed in the front side of the recess portion 22b. An interior storage space 27 inside the casing is formed above the recess portion 22b and between the flat plate portion 22a and the partition plate 23. The lower end of the recess portion 22b constitutes a bottom plate 22c. The bottom plate 22c extends over the left and right ends of the casing body 22.

[0054]

The casing body 22 is formed by laminating an exterior casing 28, a heat insulating layer 29, and an interior casing 230 in the thickness direction (front-rear direction). The exterior casing 28 faces the exterior of the casing. The interior casing 230 faces the interior of the casing. The heat insulating layer 29 is provided between the exterior casing 28 and the interior casing 230. The exterior casing 28 is composed of an aluminum material. The interior casing 230 is composed of a reinforced fiber plastic (FRP). The heat insulating layer 29 is made of foamed

resin.

[0055]

(2-2) Partition plate and air passage

The partition plate 23 is a plate-like
5 member located on the rear side of the recess portion
22b. The partition plate 23 extends vertically so as
to have a predetermined interval with the rear
surface of the recess portion 22b. An internal
10 passage 231 through which the interior air flows is
formed between the casing body 22 and the partition
plate 23. An inlet 232 is formed between the upper
end of the partition plate 23 and the upper wall 11a
of the container body 11. The inlet 232 communicates
15 the interior space 212 with the inlet end of the
internal passage 231. An outlet 233 is formed between
the lower end of the partition plate 23 and the lower
wall 11b of the container body 11. The outlet 233
communicates the interior space 212 with the outlet
end of the internal passage 231.

20 [0056]

(2-3) Elemental components outside the container

The exterior storage space 26 is provided
with a compressor 240, an exterior heat exchanger
241, and an exterior fan 242. The compressor 240 is
25 installed on the bottom plate 22c of the casing 21.
The compressor 240 is arranged near the bottom of the
exterior storage space 26. The compressor 240 is
arranged near the right of the exterior storage space
26.

30 [0057]

The exterior fan 242 is located near the top
of the exterior storage space 26. The exterior fan
242 is composed of a propeller fan. The exterior fan

242 has an impeller and a motor M for rotationally driving the impeller. As illustrated in FIG. 3, an external passage 243 through which the exterior air flows is formed on the back side of the exterior fan 242.

[0058]

The exterior heat exchanger 241 is provided at a height between the exterior fan 242 and the compressor 240 in the exterior storage space 26. The exterior heat exchanger 241 is located in the external passage 243. The exterior heat exchanger 241 is a fin-and-tube type heat exchanger.

[0059]

(2-4) Element components in the container

The interior storage space 270 is provided with an interior heat exchanger 244 and an interior fan 245. The exterior heat exchanger 241 is supported by the casing 21 so as to extend over the casing body 22 and the partition plate 23. The interior heat exchanger 244 is a fin-and-tube type heat exchanger.

[0060]

The internal fan 245 is arranged on the upstream side of the internal heat exchanger 244 in the internal passage 231. The internal fan 245 is positioned above the internal heat exchanger 244. The internal fan 245 is composed of a propeller fan. The internal fan 245 has an impeller and a motor for rotationally driving the impeller.

[0061]

(2-5) Configuration of the refrigerant circuit

As illustrated in FIG. 4, the refrigeration apparatus 2 has a refrigerant circuit 250. The refrigerant circuit 250 is filled with refrigerant.

The refrigerant circuit 250 performs a vapor compression refrigeration cycle by circulating refrigerant. The refrigerant circuit 250 mainly includes a compressor 240, an exterior heat exchanger 241, an expansion valve 251, and an interior heat exchanger 244.

[0062]

The compressor 240 compresses the inhaled refrigerant. The compressor 240 discharges the compressed refrigerant. A discharge pipe 252 is connected to the discharge part of the compressor 240. An inhale pipe 253 is connected to the inhale part of the compressor 240.

[0063]

The exterior heat exchanger 241 exchanges heat between the refrigerant flowing inside and the exterior air. The gas end of the exterior heat exchanger 241 communicates with the discharge pipe 252. The liquid end of the exterior heat exchanger 241 is connected to the liquid end of the interior heat exchanger 244 via the liquid pipe 255. The exterior heat exchanger 241 functions as a radiator (condenser) for radiating refrigerant to air.

[0064]

The expansion valve 251 is provided in the liquid tube 255. The expansion valve 251 reduces the pressure of high-pressure refrigerant to low-pressure refrigerant. The expansion valve 251 is an electronic expansion valve whose opening is adjustable. A receiver 256 is provided between the exterior heat exchanger 241 and the expansion valve 251 in the liquid tube 255. The receiver 256 is a container for storing excess refrigerant of the refrigerant circuit

250.

[0065]

The interior heat exchanger 244 exchanges heat between the refrigerant flowing inside and the interior air. The gas end of the interior heat exchanger 244 communicates with the inhale pipe 253. The internal heat exchanger 244 functions as an evaporator of refrigerant for absorbing heat from air.

10 [0066]

The refrigerant circuit 250 has a bypass pipe 257. The inlet end of the bypass pipe 257 communicates with the discharge pipe 252, and the outlet end of the bypass pipe 257 communicates with the liquid pipe 255. The bypass pipe 257 sends refrigerant discharged from the compressor 240 to the internal heat exchanger 244 by bypassing the external heat exchanger 241.

[0067]

20 The refrigerant circuit 250 is provided with a first valve 258 and a second valve 259. The first valve 258 is provided between the discharge side of the compressor 240 and the gas end of the external heat exchanger 241, and downstream from the connection of the bypass pipe 257. The second valve 259 is provided in the bypass pipe 257. The first valve 258 and the second valve 259 are composed of electromagnetic switching valves. The first valve 258 and the second valve 259 may be a flow control valve whose opening is adjustable.

30 [0068]

(2-6) Electrical component box

As illustrated in FIG. 3, the casing 21 is

provided with an electrical component box 260. The electrical component box 260 houses electrical components such as a control board 263, a power circuit board, a power supply terminal, and other electronic equipment. The electrical component box 260 is provided at an intermediate portion in the vertical direction of the casing 21. The electrical component box 260 has a box body 260a whose front side is opened, and a lid 260b which closes the open portion of the box body 260a. The box body 260a is formed in a hollow substantially rectangular parallelepiped shape. The lid 260b is fixed to the box body 260a via a hinge (not illustrated). The lid 260b is configured so that the front opening surface of the box body 260a can be opened and closed. A sealing member is provided between the electrical component box 260 and the lid 260b to prevent water and air from entering. The electrical component box 260 is made of a resin material.

[0069]

The communication apparatus 4 and the control board 263 are accommodated in the first space 261 inside the electrical component box 260. The communication apparatus 4 is arranged in a substantially middle portion in the left-right direction in the first space 261. The external shape of the communication apparatus 4 is substantially rectangular parallelepiped with the left-right direction in the thickness direction.

[0070]

The control board 263 is a printed circuit board on which a control circuit is mounted to control each device of the refrigeration apparatus 2.

The control board 263 is also mounted with wiring for power supply or grounding. The control board 263 is arranged in what is referred to as a weak electric space in the first space 261. The control board 263 of this example is supported by the electrical component box 260 so that the thickness direction of the substrate is in the front-rear direction. The control board 263 is vertically elongated.

[0071]

10 (2-7) Control unit

As illustrated in FIG. 5, the refrigeration apparatus 2 includes a control unit 20. The control unit 20 controls the refrigeration apparatus 2. The control unit 20 includes the control board 263 described above and is arranged in the first space 261 inside the electrical component box 260. The control unit 20 includes a microprocessor, an electrical circuit, and an electronic circuit. The microprocessor includes a central processing unit (CPU), a memory, a communication interface, an analog input/output, and a contact input/output interface. The memory stores various programs to be executed by the CPU and data to be used by the programs.

[0072]

25 The control unit 20 controls the ON/OFF switching of the compressor 240 and the rotational speed of the motor of the compressor 240. The control unit 20 controls the ON/OFF switching of the exterior fan 242 and the rotational speed of the motor of the exterior fan 242. The control unit 20 controls the ON/OFF switching of the interior fan 245 and the rotational speed of the motor of the interior fan 245. The control unit 20 controls the opening of the

expansion valve 251. The control unit 20 controls the opening and closing states of the first valve 258 and the second valve 259.

[0073]

5 The control unit 20 receives detection signals from a plurality of sensors. The plurality of sensors include a refrigerant temperature sensor, a refrigerant pressure sensor, and an air temperature sensor. The refrigerant temperature sensor includes a
10 sensor for detecting the temperature of the refrigerant discharged from the compressor 240 and a sensor for detecting the temperature of the refrigerant inhaled to the compressor 240. The refrigerant pressure sensor includes a sensor for
15 detecting high pressure of the refrigerant circuit 250 and a sensor for detecting low pressure of the refrigerant circuit 250. The air temperature sensor includes a sensor for detecting temperature of air on the inhaling side of the interior heat exchanger 244
20 and a sensor for detecting temperature of air on the blowing-out side of the interior heat exchanger 244.

[0074]

(2-8) Main power supply

As illustrated in FIG. 5, the refrigeration
25 apparatus 2 has a main power supply 271. The main power supply 271 is a power supply for operating the refrigeration apparatus 2. The main power supply 271 supplies power to each device of the refrigeration apparatus 2. Specifically, the main power supply 271
30 supplies power to the compressor 240, the exterior fan 242, and the interior fan 245 via a power supply circuit. The main power supply 271 supplies power to the valves of the refrigerant circuit 250 including

the first valve 258 and the second valve 259. The main power supply 271 supplies power to the control unit 20.

[0075]

5 (2-9) Radio tag and identification image

As illustrated in FIGS. 2 and 3, the above-mentioned radio tags T1, T2, and T3 are respectively attached to the predetermined components (the compressor 240, the internal fan 245, the exterior
10 fan 242). The radio tag T is not limited to the components illustrated in FIGS. 2 and 3, but may be attached to other components. Instead of, or together with the radio tag T, the above-mentioned identification image such as a two-dimensional code
15 may be printed. Further, as described above, a sticker on which the identification image is printed may be affixed instead of printing on the components.

[0076]

<Configuration of the transfer apparatus>

20 Next, a schematic configuration of the transfer apparatus 3 will be described with reference to FIG. 6. FIG. 6 is a schematic configuration diagram of the transfer apparatus. As illustrated in FIG. 3, the transfer apparatus 3 is installed outside
25 the storage unit. In FIG. 3, as an example, the transfer apparatus 3 is installed near the compressor 240 which is a component.

[0077]

As illustrated in FIG. 6, the transfer
30 apparatus 3 has a control unit 30, a communication unit 31, an operation unit 32, a reading unit 33, a display unit 34, and a storage unit 39.

[0078]

Of these, the control unit 30 controls the entire transfer apparatus 3 and is a computing device such as a CPU.

[0079]

5 The communication unit 31 is a communication device for transmitting and receiving various kinds of information to and from the communication apparatus 4 by Wi-Fi or the like.

[0080]

10 The operation unit 32 is a device for receiving operations from an operator and is a touch panel or the like.

[0081]

15 The reading unit 33 is a device which writes various kinds of information into the wireless tag T and reads various kinds of information from the wireless tag T by short-range wireless communication such as RFID.

[0082]

20 The display unit 34 is a display device for displaying a screen.

[0083]

25 The storage unit 39 is a storage device such as a ROM (Read Only Memory), a RAM (Random Access Memory), an SSD (Solid State Drive), etc.

[0084]

<Configuration of communication apparatus>

30 Next, a schematic configuration of the communication apparatus 4 will be described with reference to FIG. 7. FIG. 7 is a schematic configuration diagram of the communication apparatus.

[0085]

As illustrated in FIG. 7, the communication

apparatus 4 has a control unit 40, a communication unit 41, an operation unit 42, a reading unit 43, a display unit 44, a position information acquisition unit 46, and a storage unit 49.

5 [0086]

Of these, the control unit 40 controls the entire communication apparatus 4 and is a computing device such as a CPU.

[0087]

10 The communication unit 41 is a communication device for transmitting and receiving various kinds of information to and from other devices (a terminal, a server) via the communication network 100. The communication unit 41 can also transmit and receive
15 various kinds of information to and from the transfer apparatus 3 by Wi-Fi or the like.

[0088]

The operation unit 42 is a device for receiving operations from an operator and is a touch
20 panel or the like.

[0089]

The reading unit 43 is a device that writes various kinds of information into the wireless tag T or reads various kinds of information from the
25 wireless tag T by short-range wireless communication such as RFID. The communication apparatus 4 may not have the reading unit 43.

[0090]

The display unit 44 is a display device for
30 displaying a screen.

[0091]

The position information acquisition unit 46 is a device that identifies the position of the

communication apparatus 4 in the world by acquiring a GNSS satellite signal from a GNSS (Global Navigation Satellite System) satellite.

[0092]

5 The storage unit 49 is a storage device such as a ROM, a RAM, an SSD, or the like.

[0093]

<Configuration of the reading apparatus>

10 Next, a schematic configuration of the reading apparatus 5 will be described with reference to FIG. 8. FIG. 8 is a schematic configuration diagram of the reading apparatus.

[0094]

15 As illustrated in FIG. 8, the reading apparatus 5 has a control unit 50, a communication unit 51, an operation unit 52, a reading unit 53, a display unit 54, a position information acquisition unit 56, and a storage unit 59.

[0095]

20 Of these, the control unit 50 controls the entire reading apparatus 5, and is a computing device such as a CPU.

[0096]

25 The communication unit 51 is a communication device for transmitting and receiving various kinds of information to and from other devices (a terminal, a server) via the communication network 100. The communication unit 41 can also transmit and receive various kinds of information to and from the transfer
30 apparatus 3 by Wi-Fi or the like.

[0097]

 The operation unit 52 is a device for receiving operations from an operator, such as a

touch panel.

[0098]

The reading unit 53 is a device for writing various kinds of information into the wireless tag T or reading various kinds of information from the wireless tag T by short-range wireless communication such as RFID.

[0099]

The display unit 54 is a display device for displaying a screen.

[0100]

The position information acquisition unit 56 is a device for identifying the position of the reading apparatus 5 in the world by acquiring a GNSS satellite signal from a GNSS satellite. The reading apparatus 5 may not have the position information acquisition unit 56.

[0101]

The storage unit 59 is a storage device such as a ROM, a RAM, or an SSD.

[0102]

<Configuration of the worker terminal>

Next, a schematic configuration of the worker terminal 6 will be described with reference to FIG. 9. FIG. 9 is a schematic configuration diagram of the worker terminal.

[0103]

As illustrated in FIG. 9, the worker terminal 6 has a control unit 60, a communication unit 61, an operation unit 62, a reading unit 63, a display unit 64, an imaging unit 65, a position information acquisition unit 66, and a storage unit 69.

[0104]

Of these, the control unit 60 controls the entire worker terminal 6 and is a computing device such as a CPU.

5 [0105]

The communication unit 61 is a communication device for transmitting and receiving various kinds of information to and from other devices (a terminal, a server) via the communication network 100.

10 [0106]

The operation unit 62 is a device for receiving operations from an operator, such as a touch panel.

[0107]

15 The reading unit 63 is a device for writing various kinds of information to the wireless tag T and reading various kinds of information from the wireless tag T by short-range wireless communication such as RFID.

20 [0108]

The display unit 64 is a display device for displaying a screen.

[0109]

25 The imaging unit 65 is a device for generating image data by imaging an object or a landscape, such as a CMOS (Complementary Metal Oxide Semiconductor) sensor or a CCD (Charge Coupled Device) sensor.

[0110]

30 The position information acquisition unit 66 is a device for identifying the position of the worker terminal 6 in the world by acquiring a GNSS satellite signal from a GNSS satellite.

[0111]

The storage unit 69 is a storage device such as a ROM, a RAM, or an SSD.

[0112]

5 <Configuration of the record management apparatus>

Next, a schematic configuration of the record management apparatus 7 will be described with reference to FIG. 10. FIG. 10 is a schematic configuration diagram of the record management
10 apparatus 7.

[0113]

As illustrated in FIG. 10, the record management apparatus 7 includes a control unit 70, a communication unit 71, an operation unit 72, a
15 display unit 74, and a storage unit 79.

[0114]

Of these, the control unit 70 controls the entire record management apparatus 7 and a computing device such as a CPU.

20 [0115]

The communication unit 71 is a communication device for transmitting and receiving various kinds of information to and from other devices (a terminal, a server) via the communication network 100.

25 [0116]

The operation unit 72 is a device for receiving operations from an operator, such as a keyboard and mouse.

[0117]

30 The display unit 74 is a display device for displaying a screen.

[0118]

The storage unit 79 is a storage device such

as a ROM, a RAM, or an SSD. The storage unit 79 has a component data management DB (data base) 79a as described below.

[0119]

5 (Component data management table)

FIG. 11 is a conceptual diagram of a component data management table. The component data management DB 79a is composed of the component data management table illustrated in FIG. 11. In the
10 component data management table, the acquisition date and time of the component data and the component data are managed in association with each piece of refrigeration apparatus identification information for identifying the refrigeration apparatus. The
15 "acquisition date and time" is the date and time when the record management apparatus 7 acquired the component data from the worker terminal 6 or the like. Further, the component data are stored in the order of the acquisition date and time.

20 [0120]

Each piece of the component data has a data structure illustrated in FIG. 12. FIG. 12 is a conceptual diagram of the component data. As illustrated in FIG. 12, each piece of the component
25 data is managed by associating the component type name of each component of the refrigeration apparatus 2, the component identification information for identifying the components, and the production information about the components, with each assembly
30 date and time of the refrigeration apparatus 2, the refrigeration apparatus identification information for identifying the refrigeration apparatus 2, and the position information of the assembly place of the

refrigeration apparatus 2. In some cases, the replacement date and time of the components of the refrigeration apparatus 2 are indicated instead of the assembly date and time of the refrigeration apparatus 2.

[0121]

<Configuration of the production information management apparatus>

Next, a schematic configuration of the production information management apparatus 9 will be described with reference to FIG. 13. FIG. 13 is a schematic configuration diagram of the production information management apparatus 9.

[0122]

As illustrated in FIG. 13, the production information management apparatus 9 includes a control unit 90, a communication unit 91, an operation unit 92, a display unit 94, and a storage unit 99.

[0123]

Of these, the control unit 90 controls the entire production information management apparatus 9 and is a computing device such as a CPU.

[0124]

The communication unit 91 is a communication device for transmitting and receiving various kinds of information to and from other devices (a terminal, a server) via the communication network 100.

[0125]

The operation unit 92 is a device for receiving operations from an operator, such as a keyboard and mouse.

[0126]

The display unit 74 is a display device for

displaying a screen.

[0127]

The storage unit 79 is a storage device such as a ROM, a RAM, or an SSD. The storage unit 99 has a
5 production information management DB 99a as illustrated below.

[0128]

(Production information management table)

FIG. 14 is a conceptual diagram of the
10 production information management table. The production information management DB 99a is composed of the production information management table illustrated in FIG. 14. The production information management table manages the component type names of
15 the components of the refrigeration apparatus 2, component identification information for identifying the components, and production information related to the components in association with each other. Here, for example, information about each predetermined
20 component of the refrigeration apparatus 2 that is genuine or approved by the producer is managed. When the component identification information is different even if the component type is the same, the respective pieces of component identification
25 information are managed.

[0129]

[Processing or operation of communication system]

Next, the processing or operation of the communication system 1 will be described with
30 reference to FIGS. 15 to 22.

[0130]

<Initial stage or repair stage>

First, the process of registering component

data in the initial stage or repair stage will be described with reference to FIG. 15. FIG. 15 is a sequence diagram illustrating the process of registering component data in the initial stage or repair stage. Note that the initial stage indicates, for example, the time of the first factory shipment of the refrigeration apparatus 2.

[0131]

S11: The worker terminal 6 acquires component identification information and the like of components of the refrigeration apparatus 2. As illustrated in FIG. 12, the component identification information and the like includes at least one of assembly date/time (or repair date/time), refrigeration apparatus identification information, position information, component type information, or production information in addition to the component identification information. The worker terminal 6 may acquire only component identification information of components of the refrigeration apparatus 2. As the acquisition methods, there are methods in which the operation unit 62 acquires component identification information and the like input by the worker, the reading unit 63 acquires component identification information and the like from the wireless tag T, and the control unit 60 acquires (reads) component identification information and the like from an identification image of a two-dimensional code and the like imaged by the imaging unit 65.

30 [0132]

S12: The communication unit 61 of the worker terminal 6 transmits component data including component identification information and the like to

the record management apparatus 7. The component data is, for example, data illustrated in FIG. 12. The communication unit 61 reads, from the storage unit 69, information for supplementing deficiencies in the component data, when the component data is deficient only by the component identification information and the like acquired by the worker terminal 6, and adds the read information to the component identification information and the like, thereby finally transmitting the component data as illustrated in FIG. 12. Thus, the communication unit 71 of the record management apparatus 7 receives the component data. In place of the processes S11 and S12, the processes S13 to S15 described later may be executed.

15 [0133]

S13: The reading unit 33 of the transfer apparatus 3 acquires the component identification information and the like from the radio tag T attached to the component.

20 [0134]

S14: Similarly to the process S12, the communication unit 31 of the transfer apparatus 3 reads, from the storage unit 39, the information for supplementing deficiencies in the component identification information and the like read by the reading unit 33, and adds the read information to the component identification information and the like, thereby transmitting the component data to the communication apparatus 4. Thus, the communication unit 41 of the communication apparatus 4 receives the component data.

[0135]

S15: The communication unit 41 of the

communication apparatus 4 transmits component data including component identification information and the like to the record management apparatus 7. This component data is, for example, data illustrated in
5 FIG. 12. Thus, the communication unit 71 of the record management apparatus 7 receives the component data.

[0136]

S16: In the record management apparatus 7,
10 the control unit 70 stores the component data received in the process S12 or the process S15 in the component data management DB 79a in the order in which they were received.

[0137]

15 <Transportation stage>

Next, the process of registering component data in the transportation stage of a container will be described with reference to FIGS. 16 and 17. FIG. 16 is a sequence diagram illustrating the process of
20 registering component data in the transportation stage of a container. The transportation stage includes each stage of sea transportation and land transportation.

[0138]

25 S21: Similar to the process S13, the reading unit 33 of the transfer apparatus 3 acquires the component identification information and the like from the radio tag T attached to the component.

[0139]

30 S22: Similar to the process S14, the communication unit 31 of the transfer apparatus 3 reads, from the storage unit 39, the information for supplementing deficiencies in the component

identification information and the like read by the reading unit 33, and adds the read information to the component identification information and the like, thereby transmitting the component data to the communication apparatus 4. Thus, the communication unit 41 of the communication apparatus 4 receives the component data.

[0140]

S23: Similar to the process S15, the communication unit 41 of the communication apparatus 4 transmits the component data including the component identification information and the like to the record management apparatus 7. This component data is, for example, data illustrated in FIG. 17. FIG. 17 is a conceptual diagram of the component data transmitted in the transportation stage of the container. Thus, the communication unit 71 of the record management apparatus 7 receives the component data. The "position information" in this case indicates, for example, the position of the refrigeration apparatus 2 (container C) during sea transportation or land transportation.

[0141]

S24: Similarly to the process S16, in the record management apparatus 7, the control unit 70 stores the component data received in the process S23 in the component data management DB 79a in the order in which they were received.

[0142]

S25: Next, the record management apparatus 7 analyzes the replacement record of the components. This process will be described below in detail with reference to FIGS. 20 to 22.

[0143]

<Stage of passing through the centralized management gate>

Next, FIGS. 18 and 19 are sequence diagrams
5 illustrating the process of registering the component
data in the transportation stage in which the truck
TR loaded with the container C passes through the
centralized management gate G. FIG. 18 is a sequence
10 diagram illustrating the process of registering the
component data in the transportation stage in which
the truck loaded with the container passes through
the centralized management gate.

[0144]

S31: Similar to the process S13, the reading
15 unit 33 of the transfer apparatus 3 acquires the
component identification information and the like
from the radio tag T attached to the component.

[0145]

S32: Similar to the process S14, the
20 communication unit 31 of the transfer apparatus 3
reads, from the storage unit 39, the information for
supplementing deficiencies in the component
identification information and the like read by the
reading unit 33, and adds the read information for
25 supplementing deficiencies in to the component
identification information and the like, thereby
transmitting the component data to the communication
apparatus 4. Thus, the communication unit 41 of the
communication apparatus 4 receives the component
30 data.

[0146]

S33: Similar to the process S15, the
communication unit 41 of the communication apparatus

4 transmits the component data including the
component identification information and the like to
the record management apparatus 7. The component data
is, for example, data illustrated in FIG. 19. Thus,
5 the communication unit 71 of the record management
apparatus 7 receives the component data. If an
identification image such as a two-dimensional code
is printed on the component of the refrigeration
apparatus 2 instead of the radio tag T, the processes
10 S34 and S35 described below may be executed instead
of the processes S31 to S33.

[0147]

S34: When the operator of the centralized
management gate G operates the operation unit 72, the
15 imaging unit 65 of the worker terminal 6 picks up an
identification image such as a two-dimensional code,
and the control unit 60 acquires (reads) the
component identification information, etc., from the
identification image.

20 [0148]

S35: Similar to the process S12, the
communication unit 61 of the worker terminal 6
transmits component data including the component
identification information, etc., to the record
25 management apparatus 7. This component data is, for
example, data illustrated in FIG. 19. The
communication unit 61 reads, from the storage unit
69, information for supplementing deficiencies in the
component data, when the component data is deficient
30 only by the component identification information,
etc., acquired by the worker terminal 6, and adds the
read information to the component identification
information, etc., and finally transmits component

data as illustrated in FIG. 12. Thus, the communication unit 71 of the record management apparatus 7 receives the component data.

[0149]

5 S36: Similarly to the process S16, in the record management apparatus 7, the control unit 70 stores the component data received in the process S33 or S35 in the component data management DB 79a in the order in which they were received.

10 [0150]

 S37: The record management apparatus 7 analyzes the component replacement record. This process will be described in detail below with reference to FIGS. 20 to 22.

15 [0151]

<Component replacement record analysis>

 Next, the processes S25 and S37 (component replacement record analysis) will be described in detail with reference to FIGS. 20 to 22. FIGS. 20 and
20 21 are flowcharts illustrating the process of component replacement record analysis. FIG. 22 is a diagram illustrating the analysis result.

[0152]

 S101: The control unit 70 reads the
25 corresponding component data management table from the component data management DB 79a, by using predetermined refrigeration apparatus identification information included in the component data received by the communication unit 71, as a retrieval key.

30 [0153]

 S102: The control unit 70 determines whether the component identification information (an example of the second component identification information)

of the predetermined type of component stored this
current time, has been changed from the component
identification information (an example of the first
component identification information) of the same
5 predetermined type of component stored previous time.
For example, FIG. 22 illustrates the result of
determining that the component identification
information of the component type "compressor" has
been changed from "Comp-001" to "Comp-002". Also, the
10 result of determining that the component
identification information of the component type
"exterior fan motor" has been changed from "OFM-001"
to "OFM-999" is illustrated. Note that the previous
time is an example of a "first time point" and the
15 current time is an example of a "second time point".
When distinguishing between the previous time and the
current time, the control unit 70 may refer to the
assembly date and time (replacement date and time)
included in the component data or to the acquisition
20 date and time when the record management apparatus 7
acquired the component data as illustrated in FIG.
11.

[0154]

S103: When the control unit 70 determines
25 that there is a change in the process S102 (S102;
YES), the control unit 70 identifies the component
identification information that has changed.

[0155]

S104: The control unit 70 determines whether
30 the production information has been registered in the
component data including the identified component
identification information.

[0156]

S105: If the production information has not been registered (S104; NO), the communication unit 71 transmits a request for the production information to the production information management apparatus 9.

5 This request includes the component identification information identified in the process S103. Thus, the communication unit 91 of the production information management apparatus 9 receives the request for the production information. Then, in the production
10 information management apparatus 9, the control unit 90 uses the component identification information received in the process S105 as a retrieval key to retrieve the corresponding production information in the production information management DB 99a. In the
15 production information management DB 99a, there are cases in which the corresponding production information is managed because the component is a genuine component, etc., and cases in which the corresponding production information is not managed
20 because the component is not a genuine component, etc. Then, the communication unit 91 of the production information management apparatus 9 transmits, to the record management apparatus 7 that is the requester, the managed production information,
25 or transmits information indicating that the corresponding production information is not managed because it is not managed.

[0157]

S106: In the record management apparatus 7,
30 the control unit 70 determines whether the production information is received by the communication unit 71.

[0158]

S107: If the production information is

received (S106: YES), the control unit 70 stores the production information determined to be received in the process S106 in association with the changed component identification information (the component
5 identification information identified in the process S103). Thus, the process of analyzing the replacement record of the components is completed.

[0159]

S108: On the other hand, if the production
10 information is not received (S106: NO), the control unit 70 associates and stores a predetermined flag indicating that the production information is unknown, in association with the changed component identification information (the component
15 identification information identified in the process S103) as illustrated in FIG. 22.

[0160]

S109: The control unit 70 notifies the manager of the record management apparatus 7 via the
20 display unit 74 of information indicating that the production information is unknown. This information includes the component identification information and the component type name identified in the process S103. Note that the communication unit 71 may
25 transmit the information indicating that the production information is unknown to a predetermined manager terminal used by the manager of the record management apparatus 7. As a result, the manager of the record management apparatus 7 can recognize that
30 there is a trace that a component which is not genuine or the like has been installed.

[0161]

If the determination is NO in the process

S102 and YES in the process S104, the analysis of the replacement record of the component ends.

[0162]

[Effect of embodiment]

5 For example, in a case where a package is loaded in a container C and transported by sea from a first country to a second country, and the package is replaced with another package in the second country and transported by sea to a third country, even if a
10 component of the refrigeration apparatus 2 is replaced, it is difficult to identify where (in which country or region) the component is replaced. On the other hand, according to this embodiment, the record management apparatus 7 determines whether the
15 component identification information has been changed based on the change record of the component identification information obtained from the communication apparatus 4 installed in the container C, the reading apparatus 5 installed in the
20 centralized management gate G, or the worker terminal 6. Thus, traceability of the components of the refrigeration apparatus 2 can be implemented. Also, the manager of the record management apparatus 7 can identify or estimate that a predetermined type of
25 component has been replaced based on the change of the component identification information.

[0163]

 (2) The record management apparatus 7
determines that a predetermined type of component has
30 been replaced based on the fact that the second component identification information has been changed from the first component identification information. Thus, the manager of the record management apparatus

7 can recognize that a predetermined type of component has been replaced.

[0164]

(3) The record management apparatus 7 can
5 determine whether the second component identification information has been changed from the first component identification information based on the before-after relationship between the first time point and the second time point.

10 [0165]

(4) Even if the record management apparatus 7 does not manage the production information, the production information can be obtained from the production information management apparatus. Thus,
15 the manager of the record management apparatus 7 can obtain more detailed information in implementing the traceability of the components of the refrigeration apparatus 2. Further, the manager of the record management apparatus 7 can recognize that the
20 components are not genuine by a predetermined flag.

[0166]

[Supplement]

(1) The control units 20, 30, 40, 50, 60, 70, and 90 execute processing by each program, and
25 each program can be recorded on a (non-transitory) recording medium or can be provided via the communication network 100.

[0167]

(2) The worker terminal 6 may be a
30 smartphone, a tablet terminal, a notebook computer, or a desktop computer.

[0168]

[Relationship to the basic application]

The present international application is based upon and claims priority to Japanese patent application no. 2023-69559 filed on April 20, 2023, the entire contents of which are incorporated herein
5 by reference.

Reference Signs List

[0169]

- 1 communication system
- 10 2 refrigeration apparatus
- 3 transfer apparatus
- 4 communication apparatus
- 5 reading apparatus
- 6 worker terminal (an example of a communication
15 terminal)
- 7 record management apparatus
- 9 production information management apparatus
- 70 control device
- 71 communication unit
- 20 72 operation unit
- 74 display unit
- 79 storage unit
- C container
- TR truck (example of a mobile body)
- 25 V ship (example of a mobile body)

CLAIMS

5

[Claim 1]

A record management apparatus (7) for
managing a record of a change relating to a
refrigeration apparatus provided in a container (C)
10 to be transported, the record management apparatus
(7) comprising:

a communication unit (71) configured to
acquire first component identification information
for identifying a predetermined type of a component
15 included in the refrigeration apparatus at a first
time point and second component identification
information for identifying the predetermined type of
the component forming the refrigeration apparatus at
a second time point after the first time point; and
20 a control unit (70) configured to implement
control to determine whether the second component
identification information has been changed from the
first component identification information.

25

[Claim 2]

The record management apparatus (7)
30 according to claim 1, wherein when the second
component identification information has been changed
from the first component identification information,
the control unit (70) determines that the

predetermined type of the component has been replaced.

5

[Claim 3]

The record management apparatus (7)
according to claim 1, wherein

10 the communication unit (71) acquires first
time point information indicating the first time
point together with the first component
identification information, and acquires second time
point information indicating the second time point
15 together with the second component identification
information, and

 the control unit determines whether the
second component identification information has been
changed from the first component identification
20 information based on a before-after relationship
between the first time point and the second time
point.

25

[Claim 4]

The record management apparatus (7)
according to claim 1, further comprising:

30 a storage unit configured to store the first
component identification information and the second
component identification information acquired by the
communication unit.

5 [Claim 5]

The record management apparatus (7)
according to claim 4, wherein

when the second component identification
information has been changed from the first component
10 identification information and the communication unit
(71) has not acquired production information relating
to production of a predetermined component indicated
by the second component identification information,
the communication unit acquires the production
15 information from a production information management
apparatus configured to manage the production
information of each component; and

the storage unit (79) stores the production
information in association with the second component
20 identification information.

25 [Claim 6]

The record management apparatus (7)
according to claim 5, wherein the production
information includes information indicating a place
where the predetermined component was replaced, a
30 date and time when the predetermined component was
replaced, a replacing person who replaced the
predetermined component, or a place where the
predetermined component was stored.

5 [Claim 7]

The record management apparatus (7)
according to claim 4, wherein

when the second component identification
information has been changed from the first component
10 identification information and the communication unit
has not acquired production information related to
production of a predetermined component indicated by
the second component identification information, the
communication unit (71) makes a request for the
15 production information to a production information
management apparatus configured to manage the
production information of each component, and

when the communication unit (71) cannot
acquire the production information in response to the
20 request, the storage unit (79) stores a predetermined
flag in association with the second component
identification information.

25

[Claim 8]

The record management apparatus (7)
according to any one of claims 1 to 6, wherein the
30 communication unit (71) acquires the second component
identification information transmitted by a
communication apparatus provided in the container (C)
or in a mobile body (TR) loaded with the container

(C).

5

[Claim 9]

The record management apparatus (7)
according to any one of claims 1 to 7, wherein the
communication unit acquires the second component
10 identification information transmitted by a
communication apparatus provided at a gate through
which a mobile body (TR) mounted with the container
(C) passes.

15

[Claim 10]

A communication system (1) comprising:
20 a communication apparatus (4) configured to
be installed in the container (C) or a mobile body
(TR) mounted with the container (C), and to transmit
the second component identification information; and
the record management apparatus (7)
25 according to any one of claims 1 to 7.

30 [Claim 11]

The communication system (1) according to
claim 10, further comprising:
a transfer apparatus configured to be

installed in the container (C) or the mobile body
(TR) loaded with the container (C), to read, by
short-range radio communication, the second component
identification information from a radio tag (T) in
5 which the second component identification information
is written, and to transmit the second component
identification information to the communication
apparatus.

10

[Claim 12]

The communication system (1) according to
15 claim 11, wherein the radio tag (T) is an RFID tag
that can be attached to the predetermined type of the
component, the refrigeration apparatus, or the
container (C), and in which the second component
identification information is written.

20

[Claim 13]

25 The record management apparatus (7)
according to claim 1, wherein the communication unit
(51) acquires the second component identification
information transmitted by a communication terminal
that has read the second component identification
30 information from an identification image in which the
second component identification information is
embedded.