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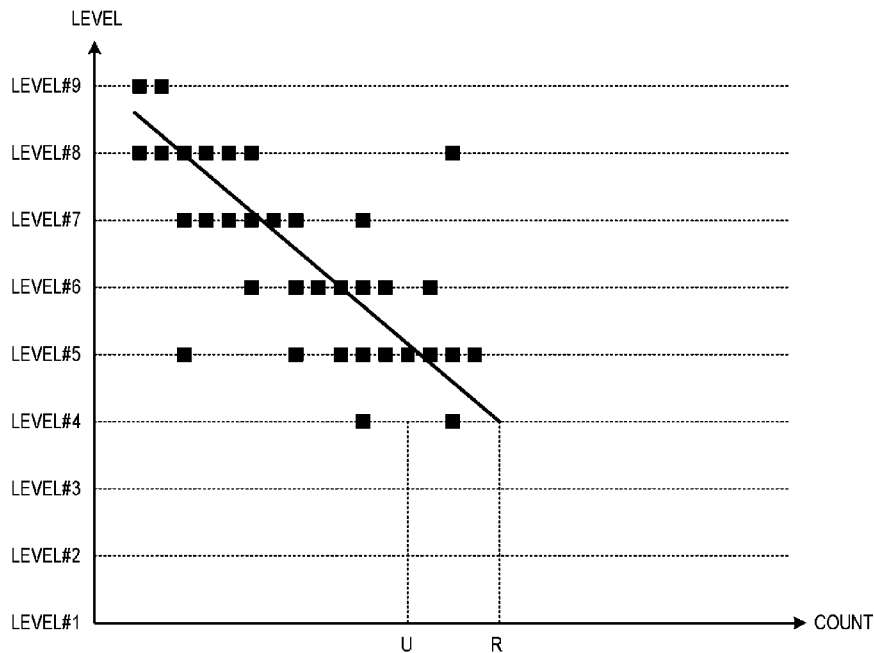
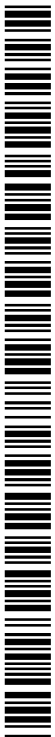
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(54) Title: MANAGEMENT SYSTEM OF STERILIZATION PROCESS, INFORMATION PROCESSING APPARATUS, MANAGEMENT METHOD, AND COMPUTER-READABLE STORAGE MEDIUM



(57) Abstract: A management system configured to manage a record of a sterilization process that is performed by a sterilization processing apparatus on a set including at least one sterilization target, and an indicator that has a discoloration area whose color changes in accordance with an achievement degree of the sterilization process is provided. The management system includes: retaining means for retaining sterilization record information including an achievement degree of the sterilization process determined based on a color of the discoloration area of the indicator of the set, and identification information for specifying a packaging member for packaging the set, for each sterilization process performed on the set; and generating means for generating information for determining the relationship between a usage count of the packaging member and the achievement degree of the sterilization process based on the sterilization

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## Description

### **Title of Invention: MANAGEMENT SYSTEM OF STERILIZATION PROCESS, INFORMATION PROCESSING APPARATUS, MANAGEMENT METHOD, AND COMPUTER-READABLE STORAGE MEDIUM**

#### **Technical Field**

[0001] The present invention relates to a technique for managing processes relating to sterilization of a sterilization target.

#### **Background Art**

[0002] Sterilizing processes are performed on sterilization targets such as medical instruments in hospitals. In such cases, so-called sterilization indicators such as a chemical indicator (hereinafter, CI) are used in order to determine the achievement degree of the sterilization process performed on the sterilization targets. The CI includes a discoloration area whose color changes in accordance with the achievement degree of a condition required for the sterilization process in which sterilizing agents (such as vapor or hydrogen peroxide) are used. Japanese Patent No. 3414291 discloses a management apparatus that manages records of the sterilization process. According to Japanese Patent No. 3414291, the date and time of a process of sterilizing a sterilization target, the sterilization condition, and the CI determination result are recorded.

[0003] The sterilization of sterilization targets are usually managed as a workflow constituted by a plurality of process stages including a sterilization stage. In order to improve the quality of the sterilization process, each process stage in this workflow is required to be appropriately performed. The apparatus disclosed in Japanese Patent No.3414291 organizes and stores records of the sterilization process, but does not present information for improving the quality of sterilization of sterilization targets.

#### **Summary of Invention**

[0004] According to an aspect of the present invention, a management system configured to manage a record of a sterilization process that is performed by a sterilization processing apparatus on a set including at least one sterilization target, and an indicator that has a discoloration area whose color changes in accordance with an achievement degree of the sterilization process is provided. The management system includes: retaining means for retaining sterilization record information including an achievement degree of the sterilization process that is determined based on a color of the discoloration area of the indicator of the set, and identification information for specifying a packaging member for packaging the set, for each sterilization process performed on

the set; and generating means for generating information for determining the relationship between a usage count of the packaging member used in the sterilization process and the achievement degree of the sterilization process based on the sterilization record information.

[0005] Further features of the present invention will become apparent from the following description of exemplary embodiments with reference to the attached drawings.

### **Brief Description of Drawings**

[0006] FIG. 1 is a diagram illustrating a sterilization workflow according to one embodiment.

[0007] FIG. 2 is a diagram illustrating a configuration of a management system according to one embodiment.

[0008] FIG. 3 is a diagram illustrating a CI according to one embodiment.

[0009] FIG. 4 is a diagram illustrating a configuration of a measurement apparatus according to one embodiment.

[0010] FIG. 5 is a diagram illustrating sterilization record information according to one embodiment.

[0011] FIG. 6 is a diagram illustrating information to be obtained from the sterilization record information according to one embodiment.

[0012] FIG. 7 is a diagram illustrating a relationship between a container usage count and an achievement level according to one embodiment.

[0013] FIG. 8 is a functional block diagram of the management system according to one embodiment.

### **Description of Embodiments**

[0014] Hereinafter, embodiments will be described in detail with reference to the attached drawings. Note, the following embodiments are not intended to limit the scope of the claimed invention. Multiple features are described in the embodiments, but limitation is not made an invention that requires all such features, and multiple such features may be combined as appropriate. Furthermore, in the attached drawings, the same reference numerals are given to the same or similar configurations, and redundant description thereof is omitted.

[0015] FIG. 1 shows a sterilization workflow relating to a sterilization process according to the present embodiment. In the present embodiment, the sterilization workflow means a series of process stages that are to be performed relating to processes for sterilizing a sterilization target. An assembly stage is a process stage in which one or more sterilization targets are grouped in a sterilization station. Note that the number of sterilization targets included in one group may be one. The grouping is performed based on a correspondence relationship between operations in which the sterilization targets

are to be used and sterilization processing apparatuses to be used in the sterilization process of the sterilization targets. For example, the sterilization targets that are to be used in the same operation, and on which the sterilization process are performed by the same sterilization processing apparatus may be grouped into a same group. A packaging stage is a process stage in which one set is formed by packaging, in a sterilization station, one or more sterilization targets of one group and a CI using one packaging member. Usually, in hospitals or the like, a plurality of sterilization targets of the same type are used, and therefore a plurality of sets each including the same sterilization target are formed. Hereinafter, each set including the same sterilization target is referred to as a set of the same type. Conversely, the types of two sets being different means that at least one of the sterilization targets included in the respective two sets is different. The type of a CI to be packaged into a set in the packaging stage is determined in accordance with the combination between the type of a set and the type of a sterilization processing apparatus that performs a sterilization process on the set, or the like. A sterilization stage is a process stage in which the sterilization process is performed on a packaged set using a sterilization processing apparatus.

[0016] A storing stage is a process stage in which a set on which the sterilization process has been performed in the sterilization stage is moved to and stored in a storage cabinet. A delivery stage is a process stage of moving a set to be used in an operation or the like from the storage cabinet to a place of usage, such as an operation room. An opening stage is a process stage of opening the package of a set that has been moved to the place of usage. An operation stage is also a using stage in which the sterilization target is used. Note that the achievement degree of the sterilization process is determined using the CI that is enclosed in the set before using the sterilization target in the opening stage, the operation stage, or both of the stages. Then, only when the achievement degree of the sterilization process can be determined to be sufficiently high using the CI, the sterilization target is actually used in the operation stage. A collection stage is a process stage in which, after a sterilization target is used, the sterilization target is moved to the sterilization station. A cleaning stage is a process stage in which a sterilization target is cleaned in the sterilization station. After a set is cleaned in the cleaning stage, the set is again transferred to the assembly stage.

[0017] FIG. 2 is a diagram illustrating a configuration of a management system 100 that manages the sterilization workflow. A server apparatus 14, a plurality of personal computers (hereinafter, PCs) 15, and a sterilization processing apparatus 13 are connected to a network. The server apparatus 14, the PCs 15, and the sterilization processing apparatus 13 can communicate to each other via the network. The server apparatus 14 manages sterilization record information regarding the sterilization workflow. The PCs 15 can add information to the sterilization record information

retained by the server apparatus 14, modify the retained information, and the like via the network. Also, the PCs 15 and the server apparatus 14 can present various types of information to a user of the management system 100 based on the sterilization record information retained by the server apparatus 14. The presentation of various types of information is performed through any method such as displaying presentation contents in a display of a PC 15, outputting presentation contents to a printer connected to a PC 15, or outputting information indicating presentation contents to a PC (not shown) that a user uses. As described above, although there are various methods regarding the manner with which various types of information are presented/displayed to a user, these are collectively referred to as "the management system 100 presenting/displaying (information to a user)" in the following. Note that, in the present invention, the user means a person related to the sterilization workflow such as operators that actually perform works in the respective process stages in the sterilization workflow, and a supervisor that supervises the operators.

[0018] The PCs 15 are installed at places where, in the sterilization workflow, sterilization record information needs to be referred to, information needs to be added to the sterilization record information, and the sterilization record information needs to be corrected. Also, as shown in FIG. 2, some PCs 15 are connected to respective measurement apparatuses 1. Each measurement apparatus 1 is an apparatus that measures a discoloration area of a CI. The measurement apparatuses 1 are installed at places where a CI needs to be measured, and are each connected to a PC 15 installed at the same place. Note that the network in FIG. 2 is not limited to a network that is closed inside a hospital. For example, the sterilization station may be located outside a hospital, and in this case, the network connects the hospital and the sterilization station outside the hospital. Also, the network may be a closed network such as a local area network (LAN) that is not connected to another network, or a network including the LAN and the Internet. For example, the network can be constituted by the Internet and a LAN inside a hospital to be connected to the Internet, and in this case, the management system 100 can be configured by installing the server apparatus 14 outside the hospital and connecting it to the Internet.

[0019] Also, in the present embodiment, the sterilization processing apparatus 13 is connected to the network, and the PCs 15 and the server apparatus 14 can acquire information to be added to the sterilization record information and information for modifying the sterilization record information from the sterilization processing apparatus 13. However, the configuration may also be such that the sterilization processing apparatus 13 is not connected to the network. In this case, an operator performs addition, modification, or the like of the sterilization record information by operating a PC 15 based on information output from the sterilization processing

apparatus 13. Note that, in order for an operator to perform input, update, display, or the like of the sterilization record information, the operator needs to operate a PC 15 or the like, but the description of operating a PC 15 will be omitted in the following in order to simplify the description. For example, an operator inputting information to the management system 100 by operating the PC 15 is also represented as the operator inputting information to the management system 100.

[0020] In the present embodiment, the sets are each given identification information. The identification information may have a form of a serial number or a bar code that is printed on a seal, for example. A medium including the identification information may be attached to an exterior face of a packaging member of the set, for example. In the present embodiment, the serial number attached to the exterior face of the packaging member of a set is the identification information of the set.

[0021] FIG. 3 shows a CI according to the present embodiment. The CI is a sheet-like test paper and includes a discoloration area 21 in which a chemical treatment is performed on its surface. The discoloration area 21 changes its color according to the achievement degree of a sterilization process. In the present embodiment, the discoloration area 21 of a CI is assumed to be configured such that its color value is a color value C#1 in an initial state, changes to a color value C#2, ..., and to a color value C#9 according to the achievement degree of the sterilization process, and finally stabilizes at a color value C#10. Hereinafter, the achievement degree of the sterilization process at which a color value C#k (k is an integer from 1 to 10) is obtained is defined as an achievement degree #k. Note that the discoloration area 21 does not take one of the color values C#1 to C#10, and continuously change its color from the color value C#1 to the color value C#10. That is, the discoloration area 21 can take a color between a color value C#m (m is an integer from 1 to 9) and a color value C#m+1. In the present embodiment, the level of the achievement degree of the sterilization process is evaluated in nine stages. Specifically, if the color of the discoloration area 21 is in a range between a color value C#m and a color value C#m+1, the level of the sterilization process is determined to be a level #m. Also, it is assumed that levels #4 to #9 are OK levels and levels #1 to #3 are NG levels, for example. Here, the level of the sterilization process being a level #m means that the achievement degree of the sterilization process is in a range from an achievement degree #m to an achievement degree #m + 1.

[0022] FIG. 4 is a cross-sectional view illustrating the measurement apparatus 1 according to one embodiment. Note that the reference sign 2 in FIG. 4 indicates a CI that has been conveyed to a measurement position of the measurement apparatus 1, and the dotted line indicates a CI before being inserted into the measurement apparatus 1. The CI that has been inserted into an insertion portion 4 of the measurement apparatus 1 is

conveyed to the measurement position by a conveyance roller pair 6. A measurement unit 3 measures the color of the discoloration area 21 of a CI. After the measurement of a CI, the CI is discharged outside the measurement apparatus 1 by rotating the conveyance roller pair 6 in a reverse direction. The measurement unit 3 reads an optical measurement value relating to the color value of the discoloration area 21 of a CI, e.g. spectral reflectance, using light 7. A control unit 8 controls the measurement apparatus 1. Various types of information to be used in the measurement are stored in a storage unit 9 of the control unit 8. Also, a computational processing unit 10 of the control unit 8 determines the color value of the discoloration area 21 of a CI based on a measurement result of the measurement unit 3, that is, spectral reflectance, for example. The control unit 8 outputs the color information indicating the determined color value to a PC 15.

[0023] Note that the measurement apparatus 1 shown in FIG. 4 discharges a CI from the insertion portion 4, but the configuration of the measurement apparatus 1 may be such that a discharging portion is provided on an opposite side of the insertion portion 4 relative to the measurement position of a CI, and the CI is discharged from the discharging portion after measurement. Also, the measurement apparatus 1 shown in FIG. 4 is configured to measure, after a CI has been conveyed to the measurement position, the CI by a fixed measurement unit 3, but the measurement apparatus 1 may be configured such that the measurement unit 3 can be moved. That is, the configuration may also be such that the discoloration area 21 of a CI is read by moving the measurement unit 3 in a predetermined direction. Moreover, the configuration may also be such that the discoloration area 21 of a CI is read by an operator moving the measurement apparatus 1 on the CI. Such a configuration is advantageous when CIs having various sizes are used.

[0024] The PC 15 determines the level of the sterilization process based on the color value of the discoloration area 12 acquired from the measurement apparatus 1, and records the determination result in the sterilization record information of the server apparatus 14. With this, the server apparatus 14 manages the sterilization record information including at least the type of a set, the date and time of the sterilization process of the set, and the determined level of the sterilization process performed on the set, for example.

[0025] As described above, in the packaging stage, one set is formed by packaging at least one sterilization target and a CI by one packaging member. Here, there are packaging members that, once used, are discarded after the opening stage, and packaging members that are repeatedly used. The latter packaging members are metal containers, for example, and are provided with a filter that allows the sterilizing agent to pass, but prevents bacteria to enter the inside. At least one sterilization target is stored inside a

container in a state of being housed in a tray or the like. In the following, the packaging member that is repeatedly used is denoted as a "container", in the present embodiment.

[0026] As described above, the container is repeatedly used in the sterilization workflow shown in FIG. 1. Note that one usage of a container means a period from when used for packaging/housing a set in the packaging stage until when the set is taken out in the opening stage thereafter. The container deteriorates due to being repeatedly used, which may cause the sterilizing agent to not sufficiently spread inside thereof, and cause the quality of sterilization to decrease. Therefore, in order to keep the quality of sterilization high, it is important to grasp the maximum usage count of repeated use (hereinafter, upper limit count) for each type of the container. Therefore, in the present embodiment, information for determining the upper limit count of a container is added to the sterilization record information.

[0027] FIG. 5 shows an example of a history table of the sterilization process (sterilization record information) managed by the server apparatus 14. An operator adds a record of a set to the history table before packaging the set in the packaging stage. In a "number" field of the history table, a value obtained by adding one to the value in the number field of the last record before the addition is made is automatically recorded. The operator inputs the type of a set to be packaged to a "set" field, and an identifier attached to a container for packaging the set to a "container identifier" field. Note that when the identifier attached to the container is bar-coded, the operator can input information to the container identifier field by reading the container identifier using a bar-code reader connected to a PC 15. In the present embodiment, the first character of the container identifier indicates a container type, and therefore the container type corresponding to the container identifier is automatically input to a "container type" field. Note that a mode in which the operator inputs the container type may also be adopted.

[0028] Also, the operator inputs information for specifying a sterilization processing apparatus 13 to be used in a "sterilization processing apparatus" field of a record corresponding to the set on which the sterilization process is to be performed before the sterilization process is performed by the sterilization processing apparatus 13, and input information for specifying the operator in an "operator" field. Note that, in this example, it is envisioned that the same operator performs the packaging stage and the sterilization stage, but when different operators perform the packaging stage and the sterilization stage, information for specifying the operators are recorded in the record.

[0029] Also, the operator, upon performing the sterilization process on a set, records the date and time when the sterilization process has been performed in a "sterilization date and time" field of a record corresponding to the set. Thereafter, in the opening stage, the measurement apparatus 1 reads a CI housed in the container along with the sterilization

target. The measurement apparatus 1 outputs the measurement result to a PC 15, the PC 15 determines the level of the sterilization process performed on the set, and transmit the determination result to the server apparatus 14. The server apparatus 14 records the determination result (level) regarding the set received from the PC 15 in an "achievement level" field of a record corresponding to the set. Note that the record is specified using a set identifier.

[0030] The server apparatus 14 can determine the usage counts of containers from the history table shown in FIG. 5. For example, if a record in which the value in the container identifier field is M12345 is not present in records whose numbers are less than 100, the server apparatus 14 can determine that the record whose number is 100 is a record when a container having an identifier M12345 is used first time. Also, if a record in which the value in the container identifier field is M12345 is not present in records whose numbers are from 101 to 204, the server apparatus 14 can determine that the record whose number is 205 is a record when a container having an identifier M12345 is used second time. Therefore, the server apparatus 14 can determine the relationship between the usage counts for each container type and the achievement levels, shown in FIG. 6, from the history table shown in FIG. 5. Therefore, the server apparatus 14 can present information shown in FIG. 7 to a user from the relationship shown in FIG. 6, for example.

[0031] Black squares in FIG. 7 are plotted at points each indicating the relationship between a usage count and an achievement level with respect to the container of type C1 in FIG. 6. Also, the straight line in FIG. 7 indicates the relationship between the usage counts and the achievement levels with respect to the containers of type C1 based on the plotted points. The straight line in FIG. 7 can be obtained by performing statistical processing such as a least squares method, for example. For example, when the threshold value is a level #4, the usage count R at which the achievement level reaches the threshold value on average can be determined from the straight line in FIG. 7. Also, the server apparatus 14 can set a usage count U that is smaller than the usage count R by a predetermined number as the upper limit count. Note that the predetermined number corresponds to a margin. Note that a variance is obtained from the plots in FIG. 7, and the number serving as a margin can also be determined based on the variance instead of setting the predetermined number as the margin.

[0032] The server apparatus 14, when an operator input a container identifier in the container identifier field of a record, determines the usage count of the container this time. Note that the usage count this time is a value obtained by adding one to the previous usage count that can be determined from the records before the recording target record. For example, it is assumed that, in a state shown in FIG. 5, an operator adds a record whose number is 208 to the history table, and inputs M12345 to the

container identifier field. Also, it is assumed that, in the history table in FIG. 5, the records in which M12345 is recorded in the container identifier field are only the records whose numbers are 100 and 205. In this case, the usage count this time is three. That is, the usage count this time means the usage count when the container is used in the packaging stage as is input in the container identifier field of the recording target record. Also, if the usage count this time is the upper limit count, the management system 100 can present to the user that this is the final usage of the container. Also, if the usage count exceeds the upper limit count, the management system 100 can warn the user that the container cannot be used, and another container should be used. Also, the management system 100 can also warn the user by presenting the number of times exceeding the upper limit count. Also, a configuration may also be adopted in which the management system 100 presents the usage count or the remaining usage count obtained by subtracting the usage count from the upper limit count to the user, regardless of whether the usage count is the upper limit count or more. Also, a configuration may also be adopted in which the remaining usage count is presented to the user when the remaining usage count is less than a predetermined value. Also, a configuration may also be adopted in which the management system 100 warns the user by presenting that the remaining usage count is small when the remaining usage count is less than a predetermined value.

[0033] Note that the management system 100 is configured such that an operator can confirm the usage condition of a container at any timing. When an operator confirms the usage condition of a container, the operator inputs the identifier of the container to be confirmed to the management system 100. Upon the identifier being input, the management system 100 can present, to the operator, the current usage count of the container to be confirmed that is specified by the input identifier or the remaining usage count as the usage condition, for example. Note that the current usage count is a usage count that can be determined from the records recorded in the history table when the inquiry is performed. For example, it is assumed that, in a state of FIG. 5, the usage count of a container whose identifier is M12345 has been inquired about. Also, it is assumed that, in the history table in FIG. 5, the records whose number is 100 and 205 are only the records in which M12345 is recorded in the container identifier field. In this case, the current usage count is two. The remaining usage count can be obtained by subtracting the current usage count from the upper limit count. Note that, if the value obtained by subtracting the current usage count from the upper limit count is one or more, the container can be used in the next packaging stage. Therefore, the management system 100 can present, to the operator, whether or not the container can be used in the next packaging stage, in place of the remaining usage count. Note that the fact that the value obtained by subtracting the current usage count from the upper

limit count is negative indicates that a container that cannot be used is used, and therefore the management system 100 gives a warning to the user. Here, the user can be notified of the number of times that the container has been used exceeding the upper limit count. Also, the management system 100 can, when an operator makes an inquiry by inputting the container type at any timing, display the upper limit count that is set to the container type.

- [0034] As described above, as a result of presenting, to a user, the information with which the relationship between the container usage count and the achievement level can be determined, the user can avoid using a container with which the quality of sterilization may decrease. With this, the quality of sterilization can be increased.
- [0035] Note that when the container is configured such that the filter is replaceable, a configuration may be adopted in which the usage count from when a filter is replaced is also managed in addition to the usage count of the container body described in the present embodiment. In this case, the upper limit count of each filter can also be determined in addition to the upper limit count of the container body.
- [0036] Also, in the present embodiment, the measurement apparatus 1 is connected to a PC 15, and the PC 15 determines the level of the sterilization process based on the color value of the discoloration area 12 acquired from the measurement apparatus 1, and records the determination result in the sterilization record information of the server apparatus 14. However, a configuration may also be adopted in which the measurement apparatus 1 determines the level of the sterilization process. In this case, a configuration may be adopted in which the measurement apparatus 1 is connected to a network, and the measurement apparatus 1 transmits the determined level of the sterilization process to the server apparatus 14. Moreover, a configuration may also be adopted in which, instead of connecting the measurement apparatus 1 to a network, the determination result is displayed in a display unit (not shown) of the measurement apparatus 1. In this case, an operator inputs the determination result displayed in the display unit of the measurement apparatus 1 to the management system 100.
- [0037] Note that, in the present embodiment, the management system 100 determines the upper limit count of a container type, but the configuration may also be such that a user inputs the upper limit count to the management system 100. The user can determine the upper limit count based on the information, shown in FIG. 7, that is displayed by the management system 100, and input the upper limit count to the management system 100, for example. Also, the user can input an upper limit count recommended by the manufacturer of the container to the management system 100. The server apparatus 14 retains and uses the upper limit count input by the user.
- [0038] Note that, in the present embodiment, the serial number attached to an exterior face of a packaging member of a set is the identification information of the set. However, it

is possible that a medium that is attached to the exterior face of a packaging member and has a serial number is replaced. In such a case, as a result of recording the correspondence relationship between the serial number before replacement and the serial number after replacement in the history table, the usage count of each container can be determined. Also, when a CI is provided with a serial number, the serial number of the CI can be used as the set identifier. In this case, although the serial number attached to an exterior face of a packaging member of the set is not a set identifier, as a result of recording the serial number attached to the exterior face of the packaging member in the history table, the usage count of each container can be determined. Moreover, as a result of recording the correspondence relationship between the serial number of a CI and the serial number attached to an exterior face of a packaging member, even in a state in which the packaging member and the CI are separated after the package is opened, the relationship between the container usage count and the achievement level can be derived.

[0039] Block diagram of management system

FIG. 8 is a functional block diagram of the management system 100. A retention unit 101 corresponds to a storage apparatus such as a hard disk of the server apparatus 14, for example, and retains sterilization record information and an upper limit count for each container type. An input/output unit 106 corresponds to input/output devices such as a display, a keyboard, and a mouse of a PC 15, and a storage device such as a hard disk, for example. The input/output unit 106 provides a user interface for a user to operate the management system 100, acquires data to be added to the sterilization record information retained by the retention unit 101, and furthermore performs display of various types of information to the user, and the like. Note that when the server apparatus 14 is provided with input/output devices such as a display, a keyboard, a mouse, and a printer, these input/output devices also correspond to the input/output unit 106.

[0040] A recording unit 102 corresponds to a processor of the server apparatus 14, for example, and performs update, or the like, of various pieces of information retained by the retention unit 101 based on the user operation performed using the input/output unit 106, and the like. A generation unit 103 corresponds to the processor of the server apparatus 14, for example, and generates information for determining the relationship between the usage count of a container having been used in the sterilization process and the achievement degree of the sterilization process for each container type based on the sterilization record information, for example. The generation unit 103 presents the generated information to the user via the input/output unit 106. A determination unit 104 corresponds to the processor of the server apparatus 14, and determines the upper limit value of the usage count for each container type based on the information

generated by the generation unit 103.

[0041] Also, when container identification information is input to the sterilization record information, the determination unit 104 determines the usage count this time of the container based on the sterilization record information, and compares the usage count with the upper limit value (upper limit count). If the determination unit 104 determines that the usage count this time is the upper limit value, a notification unit 105 can notify the user of the fact that the usage count has reached the upper limit value via the input/output unit 106. Moreover, if the determination unit 104 determines that the usage count this time exceeds the upper limit value, the notification unit 105 can notify the user of the fact that the container cannot be used via the input/output unit 106. Note that when container identification information is input to the sterilization record information, the notification unit 105 can notify the user of various types of information. The contents to be notified may be at least one of a current usage count, a remaining usage count, and the number of usages exceeding the upper limit value if the usage count exceeds the upper limit value, for example. When a notification of the remaining usage count has been made, a configuration may also be adopted in which a notification is made only if the remaining usage count is smaller than a predetermined value. Also, a configuration may also be adopted in which, if the remaining usage count is smaller than a predetermined value, a warning is given to the user by presenting this fact.

[0042] Also, when an operator makes an inquiry about the container usage condition by inputting container identification information, the determination unit 104 determines the current usage count of the container based on the sterilization record information, and further obtains a value by subtracting the current usage count from the upper limit value. Also, the notification unit 105 can present, to the user, the current usage count and the remaining usage count of the container regarding which inquiry has been made, and information regarding whether or not the container can be used in the next packaging stage and the like, for example. Note that the remaining usage count corresponds to a value obtained by subtracting the current usage count from the upper limit value. Also, if the remaining usage count is positive, the container regarding which inquiry has been made can be used in the next packaging stage, and if the remaining usage count is zero or negative, the container regarding which inquiry has been made cannot be used in the next packaging stage. Moreover, if the remaining usage count is negative, the fact that the usage count exceeds the upper limit count is warned to the user.

[0043] Note that, in the present embodiment, the server apparatus 14, which is an information processing apparatus, manages the sterilization record information, determines the upper limit value, and makes various types of notifications. That is, the

functional blocks in FIG. 8 other than the input/output unit 106 are assumed to be provided in the server apparatus 14. However, the configuration may be such that the sterilization record information is managed by a database apparatus that is different from the server apparatus 14. In this case, the server apparatus 14 acquires the sterilization record information by accessing the database apparatus. In other words, a configuration may be adopted in which the functions described as being implemented in the server apparatus 14 is realized by a plurality of computers that can communicate to each other via the network.

[0044] Note that the management system 100 of the present embodiment includes the server apparatus 14 and at least one PC 15 that are connected to a network. That is, the management system 100 includes a plurality of computers connected via a network. However, the functions shown in FIG. 8 can be realized by one computer. That is, the management system of the present embodiment also includes a case of being realized by one computer in addition to the case of being realized by a plurality of computers. Also, in the case of being realized by one computer, this configuration may also be referred to as a management apparatus or an information processing apparatus instead of the management system. Moreover, the present embodiment can be realized by a program that, upon being executed by at least one computer, causes the at least one computer to function as the management system 100. The program may be stored in a computer-readable storage medium, for example.

[0045] Other Embodiments

Embodiment(s) of the present invention can also be realized by a computer of a system or apparatus that reads out and executes computer executable instructions (e.g., one or more programs) recorded on a storage medium (which may also be referred to more fully as a 'non-transitory computer-readable storage medium') to perform the functions of one or more of the above-described embodiment(s) and/or that includes one or more circuits (e.g., application specific integrated circuit (ASIC)) for performing the functions of one or more of the above-described embodiment(s), and by a method performed by the computer of the system or apparatus by, for example, reading out and executing the computer executable instructions from the storage medium to perform the functions of one or more of the above-described embodiment(s) and/or controlling the one or more circuits to perform the functions of one or more of the above-described embodiment(s). The computer may comprise one or more processors (e.g., central processing unit (CPU), micro processing unit (MPU)) and may include a network of separate computers or separate processors to read out and execute the computer executable instructions. The computer executable instructions may be provided to the computer, for example, from a network or the storage medium. The storage medium may include, for example, one or more of a hard

disk, a random-access memory (RAM), a read only memory (ROM), a storage of distributed computing systems, an optical disk (such as a compact disc (CD), digital versatile disc (DVD), or Blu-ray Disc (BD)<sup>TM</sup>), a flash memory device, a memory card, and the like.

[0046] While the present invention has been described with reference to exemplary embodiments, it is to be understood that the invention is not limited to the disclosed exemplary embodiments. The scope of the following claims is to be accorded the broadest interpretation so as to encompass all such modifications and equivalent structures and functions.

[0047] This application claims the benefit of Japanese Patent Application No. 2019-131397, filed on July 16, 2019, which is hereby incorporated by reference herein in its entirety.

## Claims

- [Claim 1] A management system configured to manage a record of a sterilization process that is performed by a sterilization processing apparatus on a set including at least one sterilization target, and an indicator that has a discoloration area whose color changes in accordance with an achievement degree of the sterilization process, the management system comprising:  
retaining means for retaining sterilization record information including an achievement degree of the sterilization process that is determined based on a color of the discoloration area of the indicator of the set, and identification information for specifying a packaging member for packaging the set, for each sterilization process performed on the set; and  
generating means for generating information for determining the relationship between a usage count of the packaging member used in the sterilization process and the achievement degree of the sterilization process based on the sterilization record information.
- [Claim 2] The management system according to claim 1, wherein the sterilization record information further includes information indicating a type of the packaging member, for each sterilization process performed on the set, and the generating means generates information for determining the relationship between the usage count and the achievement degree of the sterilization process, for each type of the packaging member.
- [Claim 3] The management system according to claim 2, wherein the retaining means retains an upper limit value of the usage count, for each type of the packaging member.
- [Claim 4] The management system according to claim 3, wherein the generating means obtains the upper limit value for each type of the packaging member based on the information for determining the relationship between the usage count and the achievement degree of the sterilization process for each type of the packaging member.
- [Claim 5] The management system according to claim 3 or 4, further comprising determining means for determining, when the identification information of the packaging member is input to the sterilization record information, the usage count of the packaging member indicated by the input identification information based on the sterilization record in-

formation, and determines whether or not the packaging member indicated by the input identification information can be used for packaging the set by comparing the determined usage count with the upper limit value of the type of the packaging member.

[Claim 6] The management system according to claim 5, further comprising notifying means for notifying, in response to the determining means determining that the packaging member cannot be used for packaging the set, a user of a fact that the packaging member cannot be used for packaging the set

[Claim 7] The management system according to claim 5, further comprising notifying means for notifying, in response to the determining means determining that the packaging member can be used for packaging the set, but the usage is the final usage, a user of a fact that this usage is the final usage of the packaging member.

[Claim 8] The management system according to claim 3 or 4, further comprising: determining means for determining, when the identification information of the packaging member is input to the sterilization record information, the usage count of the packaging member indicated by the input identification information based on the sterilization record information; and notifying means for notifying the usage count determined by the determining means.

[Claim 9] The management system according to claim 3 or 4, further comprising: determining means for determining, when the identification information of the packaging member is input to the sterilization record information, the usage count of the packaging member indicated by the input identification information based on the sterilization record information; and notifying means for notifying a count obtained by subtracting the usage count determined by the determining means with respect to the packaging member indicated by the input identification information from the upper limit value of a type of the packaging member.

[Claim 10] The management system according to claim 3 or 4, further comprising: determining means for determining, when the identification information of the packaging member is input to the sterilization record information, the usage count of the packaging member indicated by the input identification information based on the sterilization record information; and

- notifying means for notifying, if a remaining usage count obtained by subtracting the usage count determined by the determining means with respect to the packaging member indicated by the input identification information from the upper limit value of a type of the packaging member is less than a predetermined value, the remaining usage count.
- [Claim 11] The management system according to claim 3 or 4, further comprising: determining means for determining, when the identification information of the packaging member to be confirmed is input in order to confirm a usage condition of the packaging member, the usage count of the packaging member to be confirmed based on the sterilization record information; and notifying means for notifying the usage count determined by the determining means as the usage condition.
- [Claim 12] The management system according to claim 3 or 4, further comprising: determining means for determining, when the identification information of the packaging member to be confirmed is input in order to confirm a usage condition of the packaging member, the usage count of the packaging member to be confirmed based on the sterilization record information, and determining a remaining usage count of the packaging member by subtracting the usage count from the upper limit value of a type of the packaging member to be confirmed; and notifying means for notifying the remaining usage count determined by the determining means or whether or not the packaging member can further be used for packaging the set, as the usage condition.
- [Claim 13] The management system according to claim 3 or 4, further comprising notifying means for notifying, when a type of the packaging member to be confirmed is input in order to confirm the upper limit value, the upper limit value of the type of the packaging member to be confirmed.
- [Claim 14] An information processing apparatus that generates information based on a record of a sterilization process that is performed by a sterilization processing apparatus on a set including at least one sterilization target, and an indicator that has a discoloration area whose color changes in accordance with an achievement degree of the sterilization process, the information processing apparatus comprising: accessing means for accessing an apparatus that retains sterilization record information including an achievement degree of the sterilization process that is determined based on a color of the discoloration area of the indicator of the set, and identification information for specifying a

packaging member for packaging the set, for each sterilization process performed on the set; and

generating means for generating information for determining the relationship between a usage count of the packaging member used in the sterilization process and the achievement degree of the sterilization process based on the sterilization record information.

[Claim 15]

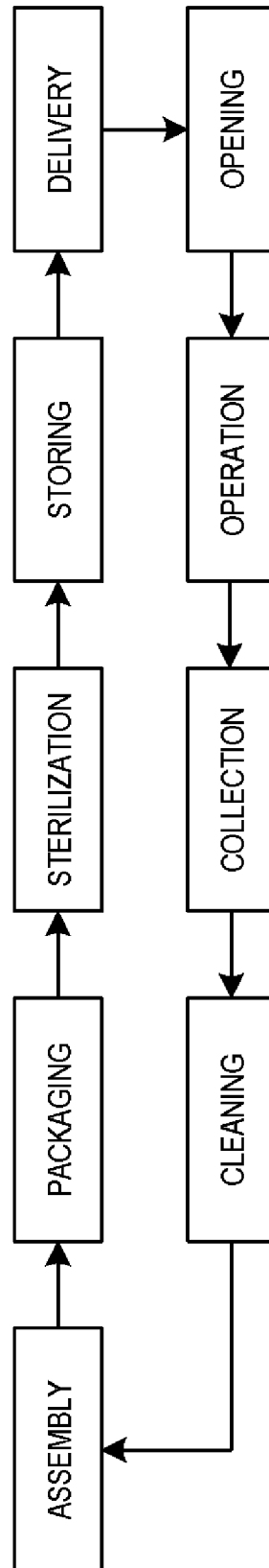
A computer-readable storage medium storing a program, wherein the program causes a computer to function as the information processing apparatus according to claim 14.

[Claim 16]

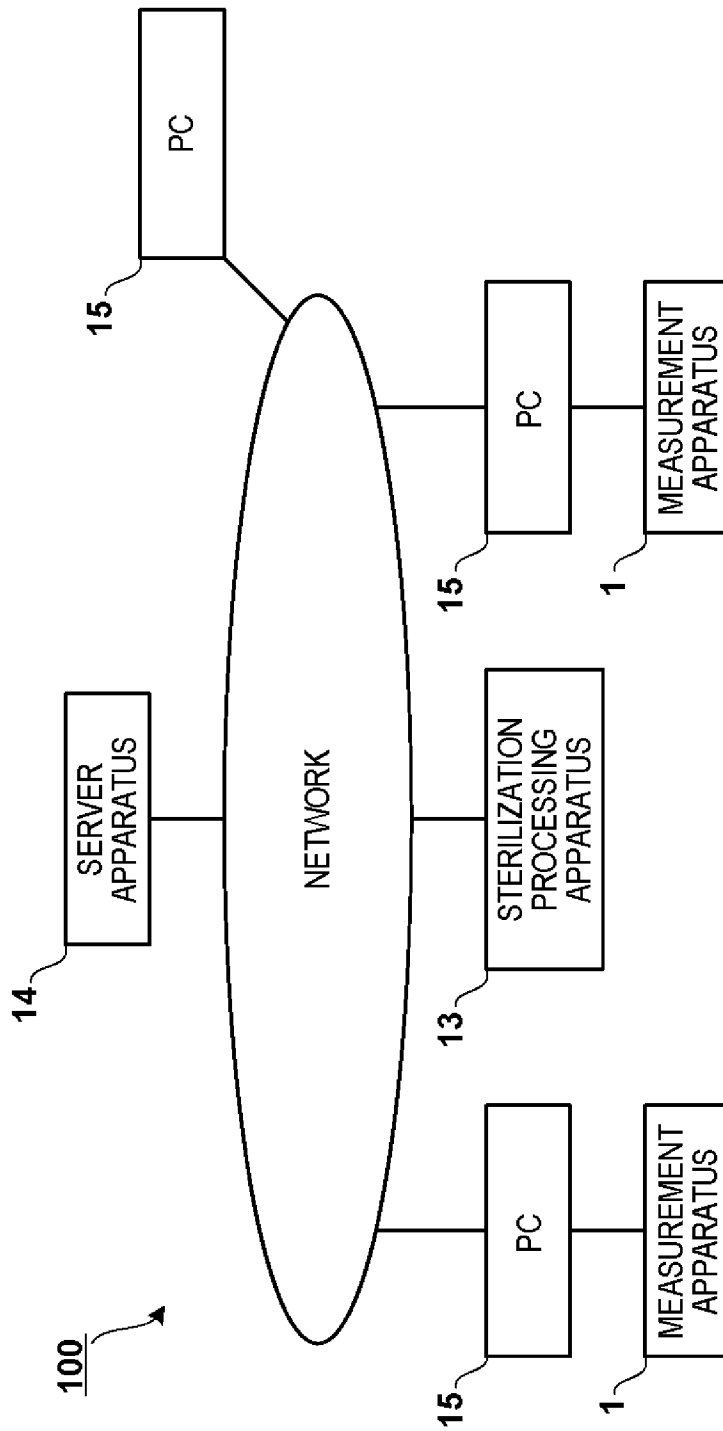
A management method in a management system configured to manage a record of a sterilization process that is performed by a sterilization processing apparatus on a set including at least one sterilization target, and an indicator that has a discoloration area whose color changes in accordance with an achievement degree of the sterilization process, the management method comprising:

recording sterilization record information including an achievement degree of the sterilization process that is determined based on a color of the discoloration area of the indicator of the set, and identification information for specifying a packaging member for packaging the set, for each sterilization process performed on the set; and  
generating information for determining the relationship between a usage count of the packaging member used in the sterilization process and the achievement degree of the sterilization process based on the sterilization record information.

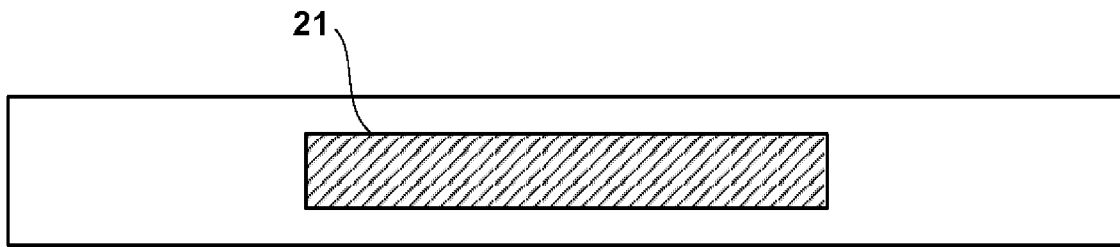
[Fig. 1]



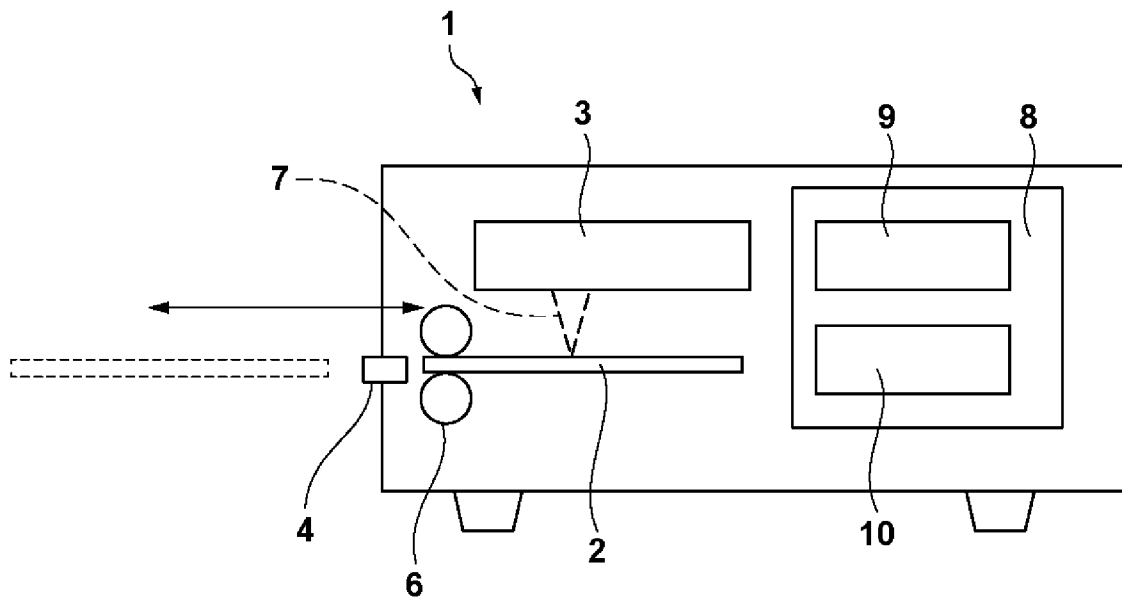
[Fig. 2]



[Fig. 3]



[Fig. 4]



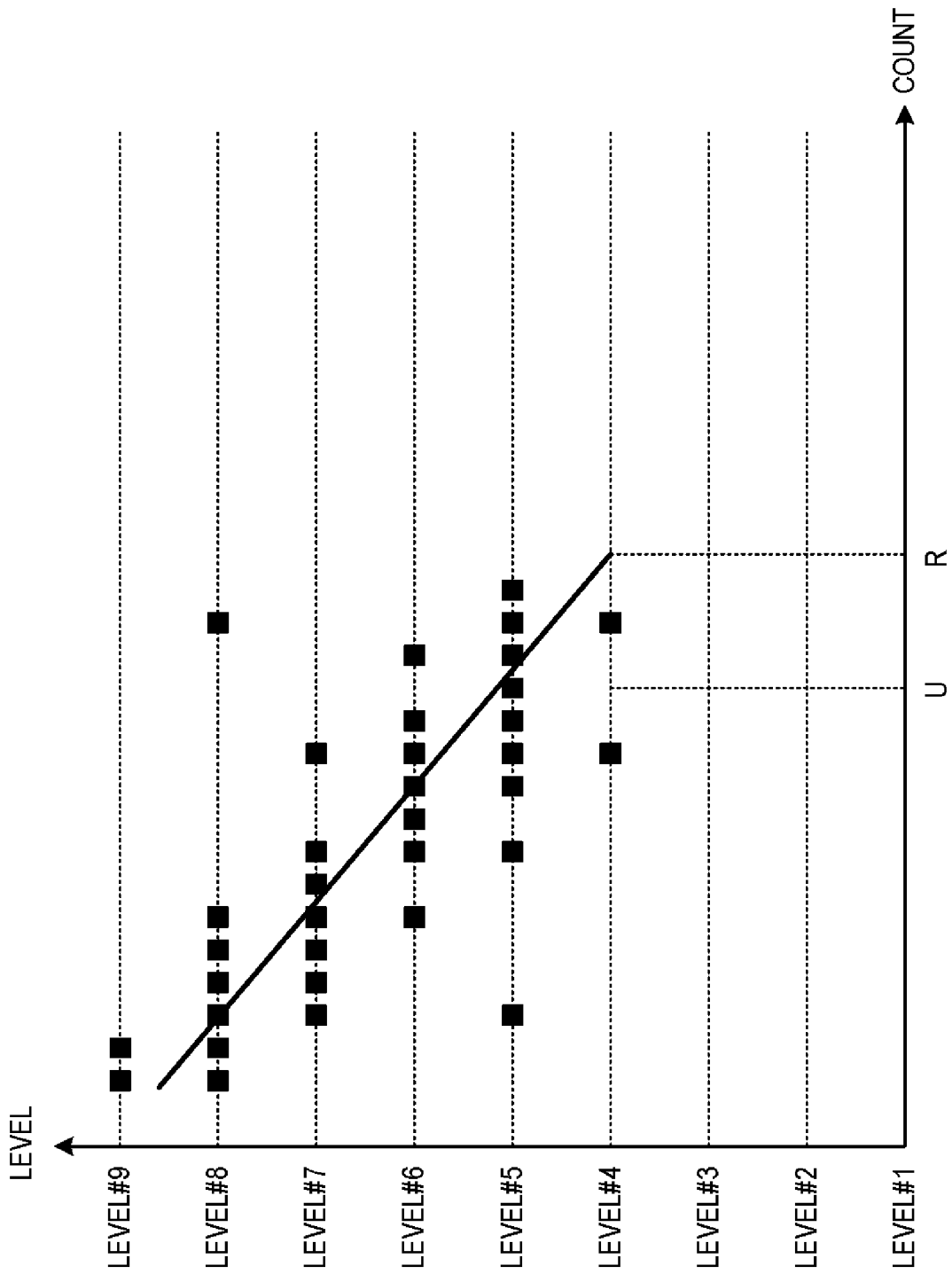
[Fig. 5]

NUMBER	SET	CONTAINER IDENTIFIER	CONTAINER TYPE	STERILIZATION PROCESSING APPARATUS	OPERATOR	STERILIZATION DATE AND TIME	ACHIEVEMENT LEVEL
...	...	...	...	...	...	...	...
100	X1	M12345	C1	Y1	Z1	2018/12/01 12:00	LEVEL#8
...	...	...	...	...	...	...	...
205	X1	M12345	C1	Y2	Z3	2018/12/02 09:30	LEVEL#9
206	X2	N56789	C2	Y2	Z3	2018/12/02 10:30	LEVEL#7
207	X1	M12346	C1	Y2	Z3	2018/12/02 09:30	LEVEL#8

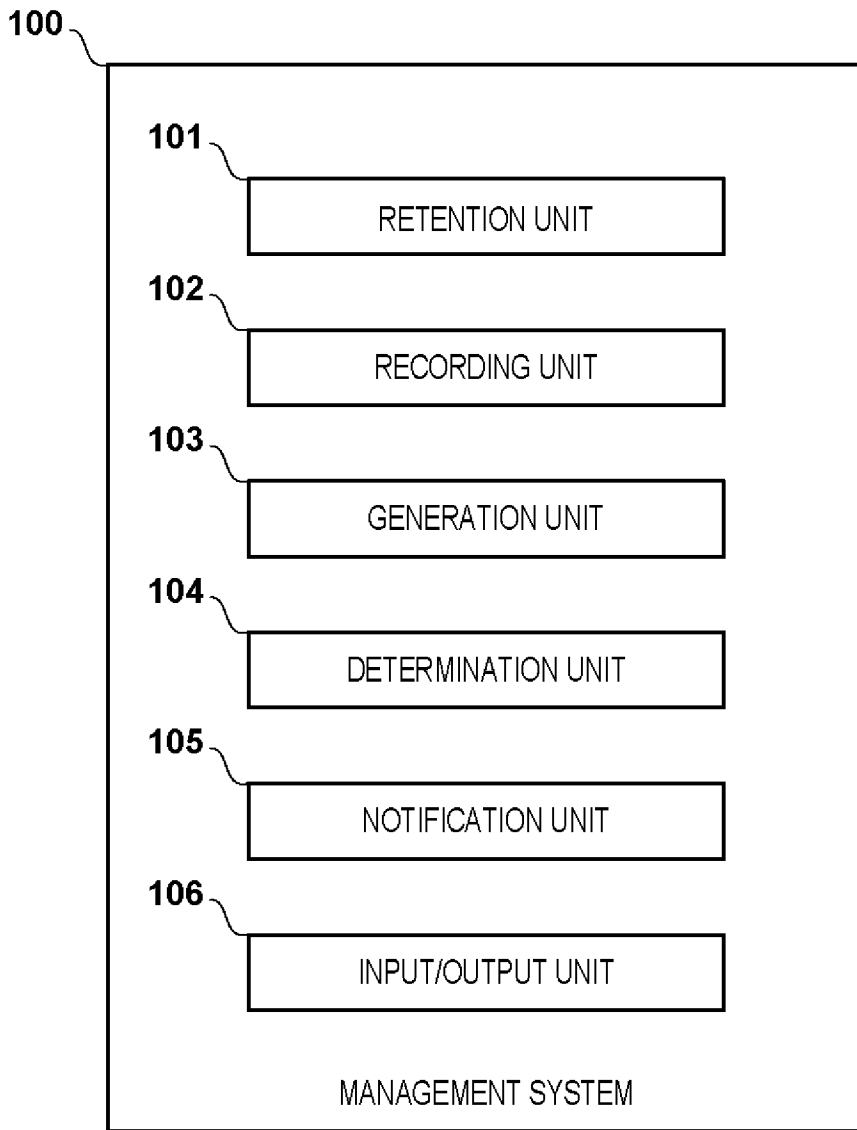
[Fig. 6]

CONTAINER TYPE	CONTAINER IDENTIFIER	COUNT	ACHIEVEMENT LEVEL	
C1	M12345	1	LEVEL#8	
		2	LEVEL#7	
		...	...	
		40	LEVEL#4	
	M12346	1	LEVEL#9	
		2	LEVEL#9	
		...	...	
	...	...	...	
	C2	N56789	...	...
		...	...	...

[Fig. 7]



[Fig. 8]



INTERNATIONAL SEARCH REPORT

International application No  
PCT/JP2020/024634

A. CLASSIFICATION OF SUBJECT MATTER  
INV. A61L2/26 A61B90/00 G06Q10/00  
ADD.  
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)  
A61L A61B G06Q  
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
E	WO 2020/175287 A1 (CANON KK [JP]) 3 September 2020 (2020-09-03) the whole document	1
X A	EP 2 340 853 A1 (3M INNOVATIVE PROPERTIES CO [US]) 6 July 2011 (2011-07-06) abstract; figures paragraphs [0001], [0022] - [0023], [0027], [0029], [0036], [0091] - [0100] paragraphs [0107] - [0109], [0114] - [0115], [0117], [0124] - [0132]	1-4,8,9, 11,13-16 5-7,10, 12
X	WO 2005/048041 A2 (SCICAN A DIVISION OF LUX AND Z [US]; ZWINGENBERGER ARTHUR [US] ET AL.) 26 May 2005 (2005-05-26) abstract; figures paragraphs [0008] - [0010], [0013] - [0018], [0046] - [0051]	1,14-16
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Further documents are listed in the continuation of Box C.

See patent family annex.

\* Special categories of cited documents :

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"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  29 September 2020	Date of mailing of the international search report  08/10/2020
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Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Authorized officer  Varga, Viktoria
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## INTERNATIONAL SEARCH REPORT

International application No  
PCT/JP2020/024634

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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			JP 2009169990 A
			KR 20050027207 A
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			US 2009313071 A1
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