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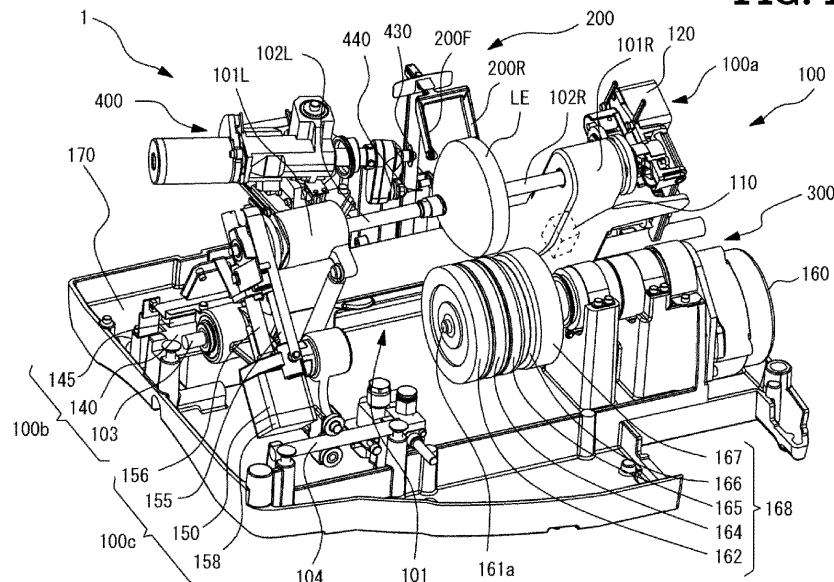
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(54) **METHOD OF PROCESSING INFORMATION FOR MACHINING AN EYEGGLASS LENS, EYEGGLASS LENS MACHINING APPARATUS, AND COMPUTER PROGRAM**

(57) An eyeglass lens machining apparatus includes a machining tool, a machining drive unit, and an information processing apparatus. The machining tool includes a peripheral edge machining tool that machines a peripheral edge of an eyeglass lens. The machining drive unit includes a peripheral edge machining drive unit that drives the peripheral edge machining tool. The informa-

tion processing apparatus acquires machining information which indicates at least one of machining details and machining period of time for machining an eyeglass lens by the machining tool, and processes the acquired machining information to generate status information which indicates a usage state of the eyeglass lens machining apparatus.

FIG. 1



Description

TECHNICAL FIELD

[0001] The present disclosure relates to a method of processing information for machining an eyeglass lens, an eyeglass lens machining apparatus, and a computer program.

BACKGROUND

[0002] An eyeglass lens machining apparatus for machining an eyeglass lens is widely used in an eyeglass store and the like. For example, the eyeglass lens machining apparatus described in JP-A-2018-004930 holds an eyeglass lens by mounting a lens holding shaft on a cup attached to the eyeglass lens. The eyeglass lens machining apparatus can machine a peripheral edge of the held eyeglass lens with a peripheral edge machining tool. Further, the eyeglass lens machining apparatus described in JP-A-2018-004930 can also form a hole in the held eyeglass lens with a drilling tool.

[0003] A user (for example, an operator and a manager) of an eyeglass lens machining apparatus needs to appropriately know a usage state of the eyeglass lens machining apparatus in order to appropriately carry out a work. However, under the present circumstances, the user has no choice but to guess the usage state from a situation and the like of machining by the eyeglass lens machining apparatus based on the user's own experience. Therefore, in a technique of the related art, it is difficult for a user to appropriately know a usage state of an eyeglass lens machining apparatus.

SUMMARY

[0004] An object of the present disclosure is to provide a method of processing information for machining an eyeglass lens, an eyeglass lens machining apparatus, and a computer program, with which a user of the eyeglass lens machining apparatus enables to appropriately know a usage state of the eyeglass lens machining apparatus.

(1) A method of processing information for machining an eye glass lens in an information processing apparatus that processes information on an eyeglass lens machining apparatus, the eyeglass lens machining apparatus having a machining tool including a peripheral edge machining tool that machines a peripheral edge of an eyeglass lens, and a machining drive unit including a peripheral edge machining tool, the method including:

an acquisition step of acquiring machining information which indicates at least one of machining details and machining period of time for machining an eyeglass lens by the machining tool; and

a generation step of generating status information which indicates a usage state of the eyeglass lens machining apparatus, by processing the machining information acquired in the acquisition step.

(2) In the method according to the above-described (1),

in the acquisition step, the machining information in each of a plurality of measurement periods different from each other is acquired, and in the generation step, the machining information in each of the plurality of measurement periods is processed to generate the status information which indicates a time-dependent change of a usage state for each of the measurement periods.

(3) The method according to the above-described (1) or (2), further includes:

an output step of outputting the status information, which is generated in the generation step, in a predetermined report format for reporting a processing result of the machining information to a user.

(4) In the method according to any one of the above-described (1) to (3),

in the acquisition step, the machining information including information on machining period of time while an eyeglass lens is actually machined by the machining tool and information on energized period of time while a power is applied to the eyeglass lens machining apparatus is acquired, and

in the generation step, the status information indicating a ratio of the machining period of time with respect to the energized period of time is generated.

(5) In the method according to any one of the above-described (1) to (3),

in the acquisition step, information on the machining period of time required for machining each of a plurality of eyeglass lenses is acquired, and

in the generation step, the status information indicating a number of machined eyeglass lenses for each length of the machining period of time is generated.

(6) In the method according to any one of the above-described (1) to (3),

in the acquisition step, for each of a plurality of eyeglass lenses, data of a pre-machined eyeglass lens and data of a machined eyeglass lens

are acquired as the machining information indicating machining details, and
 in the generation step, the status information indicating an estimated amount of machining debris quantity of an eyeglass lens generated by machining is generated based on the data of the pre-machined eyeglass lens and the data of the machined eyeglass lens.

(7) In the method according to any one of the above-described (1) to (3),

in the generation step, consumption rate information indicating a consumption rate of at least one member of the machining tool of the eyeglass lens machining apparatus and a consumable used in the eyeglass lens machining apparatus is generated as the status information, by processing the machining information acquired in the acquisition step.

(8) In the method according to the above-described (7),

in the generation step, based on consumption rate information generated in the past for a predetermined member and information on timing when the member is actually replaced, replacement recommendation information indicating a consumption rate for which replacement of the member is recommended is generated as the status information together with the consumption rate information.

(9) In the method according to the above-described (7) or (8),

in the acquisition step, information on a machining distance in which the peripheral edge machining tool relatively moves with respect to the eyeglass lens while machining in contact with the eyeglass lens is acquired as the machining information, and

in the generation step, the consumption rate information of the peripheral edge machining tool is generated based on the information on the machining distance.

(10) In the method according to the above-described (7) or (8),

in the acquisition step, information on at least one of a depth of a hole and a diameter of the hole formed in the eyeglass lens by a drilling tool that is the machining tool for making the hole on the eyeglass lens is acquired as the machining information, and

in the generation step, the consumption rate information of the drilling tool is generated based on the information on at least one of the depth of the hole and the diameter of the hole.

(11) The method according to the above-described (7) or (8),

in the acquisition step, information on machining period of time while an eyeglass lens is machined by the machining tool is acquired, and
 in the generation step, the consumption rate information on an activated carbon material of a deodorization apparatus driven in conjunction with a machining operation by the eyeglass lens machining apparatus is generated based on information on the machining period of time.

(12) In the method according to the above-described (7) or (8),

in the acquisition step, information on a number of uses of a cup which is attached to an eyeglass lens and on which a lens holding shaft of the eyeglass lens machining apparatus is mounted, and information on a number of the cups included in a cup unit in which a plurality of the cups are set as one unit, are acquired as the machining information, and

in the generation step, the consumption rate information on the cup unit is generated based on the information on the number of uses of the cup and the information on the number of the cups.

(13) The method according to any one of the above-described (1) to (12), further including:

an integration step of integrating a plurality of pieces of the status information generated for each of a plurality of the eyeglass lens machining apparatuses, and outputting the integrated status information.

(14) An eyeglass lens machining apparatus that machines an eyeglass lens, including:

a machining tool including a peripheral edge machining tool that machines a peripheral edge of an eyeglass lens;

a machining drive unit including a peripheral edge machining drive unit that drives the peripheral edge machining tool; and

an information processing apparatus configured to:

acquire machining information which indicates at least one of machining details and machining period of time for machining an eyeglass lens by the machining tool; and
 generate status information which indicates a usage state of the eyeglass lens machining apparatus, by processing the acquired machining information.

(15) A computer program including instructions to cause the information processing apparatus of the above-described (14) to execute the steps of the method of any one of the above-described (1) to (13).

[0005] According to the method of processing information for machining the eyeglass lens, the eyeglass lens machining apparatus, and the computer program of the present disclosure, the user of the eyeglass lens machining apparatus enables to appropriately know the usage state of the eyeglass lens machining apparatus.

BRIEF DESCRIPTION OF DRAWINGS

[0006]

FIG. 1 is a schematic configuration view of a machining mechanism of an eyeglass lens machining apparatus 1.

FIG. 2 is a block diagram illustrating an electrical configuration of the eyeglass lens machining apparatus 1.

FIG. 3 is a diagram illustrating an example of a report screen on which status information is displayed.

FIG. 4 is a flowchart of running ratio information generation processing.

FIG. 5 is a flowchart of machining time distribution information generation processing.

FIG. 6 is a flowchart of machining debris quantity information generation processing.

FIG. 7 is a flowchart of peripheral edge machining tool consumption rate calculation processing.

FIG. 8 is a flowchart of drilling tool consumption rate calculation processing.

FIG. 9 is a flowchart of activated carbon material consumption rate calculation processing.

FIG. 10 is a flowchart of cup unit consumption rate calculation processing.

DETAILED DESCRIPTION

<Overview>

[0007] An information processing apparatus exemplified in the present disclosure processes information regarding an eyeglass lens machining apparatus. The eyeglass lens machining apparatus includes a machining tool, a machining drive unit, and the information processing apparatus. The machining tool includes a peripheral edge machining tool for machining a peripheral edge of an eyeglass lens. The machining drive unit includes a peripheral edge machining drive unit that drives the peripheral edge machining tool. The information processing apparatus (control unit) causes the information processing apparatus to perform a machining information acquisition step and a status information generation step by executing a computer program (eyeglass lens machining information processing program), stored in a memory of the eyeglass lens machining apparatus, for processing information for machining an eyeglass lens. In the machining information acquisition step, the information processing apparatus (control unit) acquires machining information indicating at least one of machining details

and machining period of time for machining the eyeglass lens by the machining tool. In the status information generation step, the information processing apparatus (control unit) generates status information indicating a usage state of the eyeglass lens machining apparatus by processing the machining information acquired in the machining information acquisition step.

[0008] According to a technique exemplified in the present disclosure, status information indicating the usage state of the eyeglass lens machining apparatus is generated based on the machining information indicating at least one of the machining details and the machining period of time of the eyeglass lens by the machining tool. Therefore, a user (for example, an operator and a manager) can objectively know the usage state of the eyeglass lens machining apparatus according to the status information without guessing the usage state of the apparatus by himself/herself based on the machining situation. Therefore, the user can appropriately increase productivity and the like of a subsequent machining work based on the usage state of the eyeglass lens machining apparatus determined according to the status information.

[0009] In addition, various devices can be used for the information processing apparatus that executes the eyeglass lens machining information processing program. For example, the control unit of the eyeglass lens machining apparatus may execute the eyeglass lens machining information processing program. That is, the eyeglass lens machining apparatus may include an information processing apparatus that processes information on the eyeglass lens machining apparatus. Further, a device (for example, a personal computer, a server, a mobile terminal, a smartphone, or the like) capable of acquiring and processing various types of information about the eyeglass lens machining apparatus may function as the information processing apparatus. Further, a plurality of devices (for example, an eyeglass lens machining apparatus, a personal computer of a manager, and the like) may function as the information processing apparatus. That is, control units of the plurality of devices may cooperate to execute the eyeglass lens machining information processing program.

[0010] Further, machining information indicating the machining details includes at least one of multiple pieces of information, for example, "number of machined lenses", "diopter of machined lens", "data of pre-machined lens", "data of machined lens", and "machining distance", "thickness of machined lens", "material of machined lens", "diameter of machined hole", "depth of machined hole", and the like.

[0011] In the machining information acquisition step, the control unit may acquire each machining information within a plurality of measurement periods different from each other. In the status information generation step, the control unit may generate status information indicating a time-dependent change in the usage state for each measurement period by processing each machining in-

formation in the plurality of measurement periods. In this case, a user can appropriately know the time-dependent change in the usage state of the eyeglass lens machining apparatus according to the status information. Therefore, the user can efficiently increase productivity and the like by adjusting a subsequent usage aspect of the eyeglass lens machining apparatus, arrangement of personnel, and the like according to time, according to the checked time-dependent change which the user has appropriately gotten to know.

[0012] However, the control unit can also generate status information indicating the usage state of the eyeglass lens machining apparatus within a specific measurement period by processing the machining information within the specific measurement period. Further, the control unit may set a length of the measurement period according to an instruction input by a user. In this case, the user can more appropriately know the usage state of the eyeglass lens machining apparatus by inputting the length of the measurement period of which the user wants to know the status information. For example, the control unit may receive an input of the length of the measurement period in a unit of at least one of a day, a week, a month, a year, and the like. The length of the measurement period may be set when the machining information in one measurement period is processed or may be set when each machining information in a plurality of measurement periods is processed.

[0013] Status information may include at least parameter related to time. The status information may indicate a correlation between the time and a processing result of the machining information. In this case, the user can appropriately know the processing result of the machining information corresponding to the time.

[0014] The information processing apparatus (control unit) may further perform an output step of outputting the status information generated in the status information generation step in a predetermined report format for reporting the processing result of the machining information to the user. In this case, the user can easily check content of the status information in a predetermined report format.

[0015] In addition, the report format may be a format including a graph of the status information. Further, the report format may be a format including a graph of the status information and item names. The report format may be a format in which a graph of a plurality of pieces of status information and item names are arranged side by side. Further, the report format may be a format in which the generated status information is applied to a template having a previously determined display method. In this case, a user can easily check a usage situation by looking at the status information displayed by the predetermined method as compared with a case where the display method is not determined. Further, the control unit may set content (for example, at least one of the number and type of status information to be output, a position, a size, and a color of displaying the status in-

formation, and the like) of the template according to an instruction input by the user. In this case, the user can confirm content of the status information according to the template desired by the user. Further, a method of outputting the status information may be, for example, a method of displaying the status information on a display unit, or a method of printing the status information on a printing apparatus.

[0016] In the machining information acquisition step, the control unit acquires machining information including information on machining period of time while an eyeglass lens is actually machined by a machining tool and information on energized period of time while a power is applied to the eyeglass lens machining apparatus. In the status information generation step, the control unit may generate status information (hereinafter, may be referred to as "running ratio information") indicating a ratio of the machining period of time with respect to the energized period of time. The higher the ratio of the machining period of time with respect to the energized period of time, the smaller the wasted power for the eyeglass lens machining apparatus, and thus, work efficiency is increased. Therefore, a user accurately understands appropriateness of a machining work of an eyeglass lens according to the running ratio information, and then can perform various measures (for example, adjustment of a usage aspect of the eyeglass lens machining apparatus, adjustment of arrangement of personnel, or the like) for increasing productivity of a subsequent machining work.

[0017] In addition, the machining period of time while the eyeglass lens is actually machined by a machining tool may be time from start to stop of supply of a drive power to a machining drive unit. In this case, actual machining period of time is appropriately calculated based on a drive power supplied to the machining drive unit.

[0018] The control unit may separately generate running ratio information for each of a plurality of time zones. In this case, a user can understand a ratio of the machining period of time with respect to the energized period of time according to the time zones. Therefore, appropriateness of a machining work can be understood more accurately.

[0019] Further, in the status information generation step, the control unit may generate status information indicating at least one of a power consumption quantity and a carbon dioxide emission quantity in the eyeglass lens machining apparatus based on at least one (preferably both) of the machining period of time and the energized period of time.

[0020] In the machining information acquisition step, the control unit may acquire information on the machining period of time required for machining each of a plurality of eyeglass lenses. In the status information generation step, the control unit may generate status information (hereinafter, may be referred to as "machining time distribution information") indicating the number of machined eyeglass lenses for each length of the machining period of time. In this case, a user can appropriately know a

distribution of the machining period of time required for machining the eyeglass lens according to the machining time distribution information. Therefore, the user can appropriately increase productivity and the like of a subsequent machining work based on the distribution of the machining period of time which the user got.

[0021] In addition, as described above, the machining period of time acquired for generating the machining time distribution information may be time from start to stop of supply of a drive power to the machining drive unit. Further, the machining period of time may be time from an input of a machining start instruction to an end of a series of machining operations.

[0022] The control unit may calculate prediction time predicted to be required for machining a plurality of eyeglass lenses based on information (that is, information on machining period of time required for machining each of the plurality of eyeglass lenses) of machining period of time acquired in the past. In this case, a user can appropriately perform a work after getting the prediction time.

[0023] Further, the control unit may calculate the number of eyeglass lenses which are predicted to be machinable within a predetermined time based on information (that is, information on the machining period of time required for machining each of a plurality of eyeglass lenses) of the machining period of time acquired in the past. In this case, a user can appropriately perform a work after getting the predicted number of eyeglass lenses that can be machined within a predetermined time.

[0024] In the machining information acquisition step, the control unit may acquire data of a pre-machined eyeglass lens and data of a machined eyeglass lens as machining information for each of a plurality of eyeglass lenses. In the status information generation step, the control unit may generate status information (hereinafter, may be referred to as "machining debris quantity information") indicating an estimated amount of machining debris quantity of the eyeglass lens generated by machining, based on the data of the pre-machined eyeglass lens and the data of the machined eyeglass lens. In this case, a user can appropriately perform a work after understanding the estimated amount of the machining debris quantity. A waste disposal quantity can also be understood easily.

[0025] In the machining information acquisition step, the control unit may acquire information on each diopter of a plurality of machined eyeglass lenses as machining information indicating machining details. In the status information generation step, the control unit may generate status information (hereinafter, may be referred to as "diopter distribution information") indicating the number of machined eyeglass lenses for each diopter. In this case, a user can appropriately know a diopter distribution of the plurality of machined eyeglass lenses.

[0026] In the status information generation step, the control unit may generate consumption rate information indicating a consumption rate of at least one of a machin-

ing tool of the eyeglass lens machining apparatus and a consumable used in the eyeglass lens machining apparatus as status information. In this case, consumption rate information on at least one member of the machining tool and the consumable is generated based on machining information in the eyeglass lens machining apparatus. Therefore, a user can appropriately know the consumption rate of at least one of the machining tool and the consumable.

[0027] In the status information generation step, the control unit may generate replacement recommendation information indicating a consumption rate for recommending replacement of a member as the status information together with the consumption rate information, based on consumption rate information generated in the past for a predetermined member and information on timing when the member is actually replaced. In this case, the replacement recommendation information is generated by considering timing when the member was actually replaced in the past and consumption rate information at that time. Therefore, a user can more appropriately know a time when replacement of the member is recommended.

[0028] In addition, the control unit may display the consumption rate information and the replacement recommendation information on the member on a display unit at the same time. In this case, a user can appropriately determine a replacement time period of the member by comparing the replacement recommendation information with the consumption rate information. For example, the control unit may display, on the display unit, a ratio of a value of the consumption rate of the member at that time with respect to a value of the consumption rate indicated by the replacement recommendation information.

[0029] In the machining information acquisition step, the control unit may acquire information on a machining distance in which a peripheral edge machining tool relatively moves with respect to an eyeglass lens while machining in contact with the eyeglass lens as machining information. In the status information generation step, consumption rate information on a peripheral edge machining tool may be generated based on the information on the machining distance. In this case, a consumption rate of the peripheral edge machining tool is estimated more accurately than in a case where the consumption rate information is generated based only on the number of eyeglass lenses machined by the peripheral edge machining tool.

[0030] In addition, in the machining information acquisition step, the control unit may acquire information on at least one of a thickness of an eyeglass lens machined by a peripheral edge machining tool and a material of the eyeglass lens machined by the peripheral edge machining tool, together with the above-described information on the machining distance. In the status information generation step, the control unit may generate consumption rate information of the peripheral edge machining tool by

considering information on at least one of the thickness and the material of the eyeglass lens. In this case, a consumption rate of the peripheral edge machining tool is estimated more accurately.

[0031] In the machining information acquisition step, the control unit may acquire information on at least one of a depth of a hole, which is formed by a drilling tool that is a machining tool for making a hole on the eyeglass lens, in the eyeglass lens and a diameter of the hole, as machining information. In the status information generation step, the control unit may generate consumption rate information of the drilling tool based on information on at least one of the depth and the diameter of the hole. In this case, a consumption rate of the drilling tool is estimated more accurately than in a case where the consumption rate information is generated based only on the number of eyeglass lenses machined by the drilling tool.

[0032] In addition, in the machining information acquisition step, the control unit may acquire information on a material of the eyeglass lens machined by the drilling tool together with the above-described information on the depth and diameter of the hole. In the status information generation step, the control unit may generate the consumption rate information of the drilling tool by considering the information on the material of the eyeglass lens. In this case, the consumption rate of the drilling tool is estimated more accurately.

[0033] In the machining information acquisition step, the control unit may acquire information on machining period of time while an eyeglass lens is machined by a machining tool. In the status information generation step, the control unit may generate consumption rate information on an activated carbon material of a deodorization apparatus driven in conjunction with machining operation by the eyeglass lens machining apparatus, based on the information on machining period of time. In this case, a consumption rate of a consumable of the deodorization apparatus used in association with the eyeglass lens machining apparatus is appropriately generated based on the information on machining period of time of the eyeglass lens machining apparatus.

[0034] In the machining information acquisition step, the control unit may acquire information on the number of uses of a cup which is attached to an eyeglass lens and on which a lens holding shaft of the eyeglass lens machining apparatus is mounted, and information on the number of cups included in a cup unit that uses a plurality of cups as one unit, as machining information. In the status information generation step, the control unit may generate consumption rate information on the cup unit based on the information on the number of uses and the information on the number of cups. When using a cup, a user often randomly selects and uses one cup from among cups in the cup unit that uses a plurality of cups as one unit, each time. Therefore, by using the information on the number of uses of a cup in the eyeglass lens machining apparatus and the information on the number of cups included in the cup unit, an average consumption rate of

a plurality of cups included in the cup unit can be estimated. Therefore, a user can appropriately determine a replacement time period of the entire cup unit based on the consumption rate information on the cup unit.

[0035] In the machining information acquisition step, the control unit may acquire information on the number of times at which an auto mode in which an eyeglass lens is automatically machined is performed and information on the number of times at which a manual mode in which the eyeglass lens is machined according to an operation instruction by an operator is performed, as machining information. In the status information generation step, the control unit may generate status information indicating a ratio between the number of times at which the auto mode is performed and the number of times at which the manual mode is performed. In this case, a user can appropriately distinguish a use ratio between the auto mode and the manual mode, and thus, measures and the like for increasing efficiency of a work can be appropriately performed.

[0036] In the machining information acquisition step, the control unit may acquire information on a type of a frame on which the machined eyeglass lens is mounted as machining information indicating machining details. In the status information generation step, the control unit may generate status information indicating a ratio of the number of frames. In this case, a user can appropriately know the ratio of the number of frames.

[0037] The information processing apparatus (control unit) may perform an integration step of integrating a plurality of pieces of status information generated for each of a plurality of eyeglass lens machining apparatuses and outputting the integrated status information. In this case, a user (for example, a manager or the like) can efficiently know a usage state of the plurality of eyeglass lens machining apparatuses according to the integrated status information.

[0038] A specific method for integrating the plurality of pieces of status information can be appropriately selected. When the status information indicates some value, the control unit may integrate the plurality of pieces of status information by calculating a total value, an average value, or the like of the plurality of values indicated by the plurality of pieces of status information. For example, by calculating a total value of the estimated amounts of machining debris quantity for a plurality of eyeglass lens machining apparatuses, a user can easily estimate the total amount of machining debris quantity by the plurality of eyeglass lens machining apparatuses. Further, the control unit may integrate the plurality of pieces of status information by outputting the status information for the plurality of eyeglass lens machining apparatuses side by side. In this case, a user can take measures for increasing productivity and the like after appropriately comparing usage states of each eyeglass lens machining apparatus. Further, the control unit may unify and output the status information on a plurality of eyeglass lens machining apparatuses belonging to the same group (for example, in

the same factory, in the same store, in a plurality of factories and stores in the same area, or the like) designated by a user. In this case, by designating the group, the user can appropriately know the usage states of the plurality of eyeglass lens machining apparatuses in the designated group. Further, the control unit that performs the integration step and the control unit that performs the status information generation step may be different from each other. For example, the control unit of the eyeglass lens machining apparatus may perform the status information generation step, and a control unit of a PC or the like of a manager that manages the plurality of eyeglass lens machining apparatuses may perform the integration step.

<Embodiment>

[0039] Hereinafter, one of typical embodiments in the present disclosure will be described with reference to the drawings. First, an eyeglass lens machining apparatus 1 of the present embodiment will be described. The eyeglass lens machining apparatus 1 machines an eyeglass lens LE and processes various types of information on the eyeglass lens machining apparatus 1 itself. That is, the eyeglass lens machining apparatus 1 of the present embodiment includes an information processing apparatus that processes information on the eyeglass lens machining apparatus 1. However, a device (for example, a personal computer, a server, a mobile terminal, a smartphone, or the like) different from the eyeglass lens machining apparatus 1 may be used as the information processing apparatus. That is, a device that executes a computer program for processing information for machining an eyeglass lens described below is not limited to the eyeglass lens machining apparatus 1.

(Mechanical Configuration)

[0040] As illustrated in FIG. 1, the eyeglass lens machining apparatus 1 of the present embodiment includes a lens holding unit 100, a lens shape measurement unit 200, a first machining tool unit 300, and a second machining tool unit 400. The lens holding unit 100 includes lens holding shafts (lens chuck shafts) 102R and 102L that pinch and hold a lens LE. Furthermore, the lens holding unit 100 includes a lens rotating unit 100a, a holding shaft moving unit 100b, and an inter-axis distance change unit 100c.

[0041] The lens rotating unit 100a rotates a pair of lens holding shafts 102R and 102L therearound. The holding shaft moving unit 100b moves the lens holding shafts 102R and 102L in an axial direction (this is referred to as the X direction). The inter-axis distance change unit 100c moves the lens holding shafts 102R and 102L in a direction (this is referred to as the Y direction) of approaching or being separated from a rotation shaft of a machining tool (details are described below) provided in each of the first machining tool unit 300 and the second machining

tool unit 400. Further, the inter-axis distance change unit 100c changes a distance between the lens shape measurement unit 200 and the lens holding shafts 102R and 102L.

[0042] Hereinafter, specific examples of each configuration in the eyeglass lens machining apparatus 1 will be described in detail. The lens holding unit 100 is mounted on a base 170 of a main body of the eyeglass lens machining apparatus 1.

[0043] The lens rotating unit 100a will be described. The lens holding shaft 102R is held on a right arm 101R of a carriage 101 of the lens holding unit 100, and the lens holding shaft 102L is held on a left arm 101L so as to be rotatable and coaxial with each other. When the lens holding shaft 102R is moved to the lens holding shaft 102L side by a motor 110 attached to the right arm 101R, the lens LE is pinched and held between the two lens holding shafts 102R and 102L. The two lens holding shafts 102R and 102L are rotated synchronously by the motor 120 attached to the right arm 101R. In addition, in the present embodiment, a cup is attached to a predetermined position of the lens LE. One of the lens holding shafts 102R and 102L is mounted on a cup attached to the lens LE.

[0044] The holding shaft moving unit 100b will be described. An X-axis movement support base 140 is provided on the lens holding shafts 102R and 102L and shafts 103 and 104 extending in parallel with a grindstone rotation shaft 161a. The X-axis movement support base 140 can be moved in the X-axis direction along the shafts 103 and 104 by a power of an X-axis movement motor 145. The carriage 101 is mounted on the X-axis movement support base 140. In addition, an encoder 146 (see FIG. 2) is provided on a rotation shaft of the X-axis movement motor 145. In the present embodiment, positions of the lens holding shafts 102R and 102L detected by the encoder 146 in the X direction are used to measure shapes of front and rear surfaces of the lens LE.

[0045] The inter-axis distance change unit 100c will be described. A shaft 156 extending in a direction of connecting the lens holding shafts 102R and 102L to the grindstone rotation shaft 161a is fixed to the X-axis movement support base 140. When the Y-axis movement motor 150 rotates, a ball screw 155 extending in the Y direction rotates. As a result, the carriage 101 moves along the shaft 156 in the Y-axis direction. The encoder 158 for detecting a position of the carriage 101 in the Y direction is provided on a rotation shaft of the Y-axis movement motor 150.

[0046] The lens shape measurement unit 200 will be described. The lens shape measurement unit 200 of the present embodiment is fixed to the base 170 at a position opposite to the first machining tool unit 300 through the carriage 101. The lens shape measurement unit 200 includes a lens edge position measurement unit 200F and a lens edge position measurement unit 200R. The lens edge position measurement unit 200F has a tracing stylus that comes into contact with a front surface of the lens

LE. The lens edge position measurement unit 200R has a tracing stylus that comes into contact with a rear surface of the lens LE. In a state where each of the tracing styluses of the lens edge position measurement units 200F and 200R is in contact with the front and rear surfaces of the lens LE, the carriage 101 moves in the Y-axis direction based on target lens shape data, and the lens holding shaft 102R and 102L rotate, and thus, edge positions of the front surface and the rear surface of the lens LE are measured simultaneously. For example, a configuration and the like described in JP-A-2003-145328 can be used for configurations of the lens edge position measurement units 200F and 200R.

[0047] The first machining tool unit 300 will be described. The first machining tool unit 300 includes a peripheral edge machining tool 168 which is one of lens machining tools. The peripheral edge machining tool 168 of the present embodiment includes a glass rough grindstone 162, a finishing grindstone 164 having a V-groove (bevel groove) making a bevel on a lens and a flat machining surface, a flat finishing grindstone 165, a high-curve lens finishing grindstone 166, a plastic rough grindstone 167, and the like. A plurality of grindstones of the peripheral edge machining tool 168 are coaxially attached to the grindstone rotation shaft grindstone spindle) 161a. The grindstone rotation shaft 161a is rotated by a motor (peripheral edge machining drive unit) 160. A peripheral edge of the lens LE held by the lens holding shafts 102L and 102R is pressed against the peripheral edge machining tool 168 and machined.

[0048] The second machining tool unit 400 will be described. The second machining tool unit 400 includes a finishing tool, a drilling tool, a motor 421, a motor 471, and the like. The finishing tool rotates around a rotation shaft, thereby performing finishing (for example, at least one of grooving, bevel forming, step difference forming, and the like) of the peripheral edge of the lens LE. A drilling tool forms a hole in the lens LE. The drilling tool of the present embodiment forms a hole extending in an axial direction in the lens LE by moving in the axial direction while rotating about the rotation shaft. The motor 421 rotates the finishing tool and the drilling tool. The motor 471 turns the finishing tool and the drilling tool.

(Electrical Configuration)

[0049] An electrical configuration of the eyeglass lens machining apparatus (information processing apparatus) 1 will be described with reference to FIG. 2. The eyeglass lens machining apparatus 1 includes a CPU (processor) 2 that controls the eyeglass lens machining apparatus 1. The CPU 2 is connected to a RAM 3, a ROM 4, a non-volatile memory 5, an operation unit 6, a display unit (display) 7, and an external communication I/F 8 through a bus. Furthermore, the CPU 2 is connected to various devices such as the above-described motors (the motor 110, the motor 120, the X-axis movement motor 145, the Y-axis movement motor 150, the motor 160, the

motor 421, the motor 471, the encoder 146, and the encoder 158) through the bus.

[0050] The RAM 3 temporarily stores various types of information. The ROM 4 stores various programs, an initial value, and the like. The non-volatile memory 5 is a non-transitory storage medium (for example, a flash ROM, a hard disk drive, and the like) that can retain storage content even when supply of a power is blocked. The non-volatile memory 5 may store a control program (for example, an eyeglass lens machining information processing program) for controlling an operation of the eyeglass lens machining apparatus (information processing apparatus) 1. The operation unit 6 receives inputs of various instructions from an operator. For example, a touch panel, operation buttons, or the like provided on a surface of the display unit 7 may be used as the operation unit 6. The display unit 7 can display various types of information such as a shape of the lens LE and a shape of a frame. Further, the eyeglass lens machining apparatus 1 can also display (output) status information to be described below on the display unit 7. The external communication I/F 8 connects the eyeglass lens machining apparatus 1 to an external apparatus.

[0051] The eyeglass lens machining apparatus 1 of the present embodiment is connected to a deodorization apparatus 9 through an external communication I/F 8. The deodorization apparatus 9 drives a deodorization function in conjunction with a machining operation (specifically, a machining operation by the peripheral edge machining tool 168) by the eyeglass lens machining apparatus 1. The deodorization apparatus 9 is provided with an activated carbon material for deodorization. A deodorization effect of the activated carbon material is reduced according to drive time of a deodorization function. When the deodorization effect of the activated carbon material is reduced, a user needs to replace the activated carbon material with a new one.

(Overview of Status Information)

[0052] An overview of status information generated and output by the eyeglass lens machining apparatus (information processing apparatus) 1 will be described with reference to FIG. 3. The eyeglass lens machining apparatus 1 of the present embodiment generates and outputs status information indicating a usage state of the eyeglass lens machining apparatus 1 by processing machining information indicating at least one of machining details and machining period of time of an eyeglass lens. Therefore, a user can objectively know the usage state of the eyeglass lens machining apparatus according to the status information without guessing a usage state of an apparatus by himself/herself based on a machining situation.

[0053] In the example illustrated in FIG. 3, the eyeglass lens machining apparatus 1 outputs a plurality of pieces of status information by displaying the status information on the display unit 55. However, a method of outputting

the status information can also be changed. For example, the eyeglass lens machining apparatus 1 may output the status information by transmitting the status information to a device of a manager who manages a machining work of an eyeglass lens by using the external communication I/F 8 (see FIG. 2). In this case, the manager can objectively confirm the usage state of the eyeglass lens machining apparatus 1 by using the device used by himself/herself.

[0054] Further, as illustrated in FIG. 3, the eyeglass lens machining apparatus 1 of the present embodiment outputs the generated status information in a predetermined report format for reporting a processing result (analysis result) of machining information to a user. Therefore, the user can easily understand content of the status information as compared with a case where an output format of information is changed each time. The report format of the status information according to the present embodiment is a format including a graph and item names of the status information. Therefore, the user can appropriately know the status information from the graph and the item name. Further, the report format of the status information according to the present embodiment is a format in which a graph and item names of a plurality of pieces of status information are arranged side by side. Therefore, the user can easily know the plurality of pieces of status information and easily compare the plurality of pieces of status information. Furthermore, the report format of the status information according to the present embodiment is a format in which the generated status information (graph) is applied to a template having a previously determined display method (including a display position of each information in the present embodiment). Therefore, the user can easily understand a usage situation of the eyeglass lens machining apparatus 1 as compared with a case where a display method or the like is not determined. A control unit (for example, the CPU 2 or the like) sets content (at least one of, for example, the number and type of status information to be output, a position, a size, and a color that display the status information, and the like) of a template according to an instruction input by a user. Therefore, the user can confirm the content of the status information according to the template desired by himself/herself. Hereinafter, content, a generation method, and the like of each piece of status information will be described in detail.

(Running ratio information)

[0055] Running ratio information will be described. The running ratio information is information indicating a ratio of machining period of time with respect to energized period of time, in the eyeglass lens machining apparatus 1. The energized period of time is time while a power is applied to the eyeglass lens machining apparatus 1. The machining period of time is time while an eyeglass lens is actually machined by a machining tool (in the present embodiment, the peripheral edge machining tool 168, a

finishing tool, and a drilling tool). As illustrated in FIG. 3, in the present embodiment, the running ratio information is output (displayed or printed) by a running ratio graph ("Power ON / Operation Time" graph) 10. The higher the ratio of the machining period of time with respect to the energized period of time, the smaller the wasted power for the eyeglass lens machining apparatus, and thus, work efficiency is increased. Therefore, appropriateness of a work can be more appropriately understood by a user as compared with a case where only one of the energized period of time and the machining period of time is output as the running ratio information. The user accurately understands the appropriateness of work according to the running ratio information, thereby performing various measures (for example, adjustment of a usage aspect of the eyeglass lens machining apparatus 1, arrangement of personnel, or the like) for improving productivity of subsequent machining works. However, one of the energized period of time and the machining period of time can also be output as the running ratio information.

[0056] Running ratio information generation processing performed by the eyeglass lens machining apparatus (information processing apparatus) 1 of the present embodiment will be described with reference to FIG. 4. When receiving an instruction to start generation of status information, the CPU 2 of the eyeglass lens machining apparatus 1 performs running ratio information generation processing according to an eyeglass lens machining information processing program. In addition, processing after FIG. 5 is also performed by the CPU 2 according to the eyeglass lens machining information processing program in the same manner as the processing of FIG. 4.

[0057] First, the CPU 2 sets an analysis target period (S10). The analysis target period is a period that becomes a target for processing (analyzing) machining information to generate status information. The analysis target period may be, for example, a period such as a day, a week, a month, or a year. Further, the analysis target period may be a period from a time point when analysis is performed to a recent day, week, or the like or may be a period of a past day, week, or the like. The CPU 2 may set the analysis target period according to an instruction (for example, an instruction input by operating the operation unit 6) input by a user. Further, a plurality of analysis target periods may be set. In this case, processes of S11 to S13 to be described below are performed for each of the plurality of analysis target periods. For example, the running ratio graph 10 illustrated in FIG. 3 is generated with the analysis target period as any day in the past. Further, in the example illustrated in FIG. 3, running ratio information is previously generated for each of the plurality of analysis target periods, and "Day" which is an analysis target period change button is operated by a user, and thus, the analysis target period (at least one of a length of the period and start and end of the period) in which the running ratio graph 10 is displayed is changed. In addition, all the graphs illustrated in FIG. 3 are merely examples, and it goes without saying that details of the

graphs may be changed.

[0058] Next, the CPU 2 sets a plurality of measurement periods within the analysis target period set in S10 (S11). A length of each of the measurement periods may be determined according to the length of the analysis target period. For example, as illustrated in the running ratio graph 10 of FIG. 3, when the analysis target period is a day, the length of the measurement period may be one hour. Further, when the analysis target period is a week or a month, the length of the measurement period may be one day. Further, the CPU 2 may set the length of each of the measurement periods according to an instruction (for example, an instruction input by operating the operation unit 6) input by a user.

[0059] The CPU 2 acquires information on machining period of time and energized period of time as machining information for each of a plurality of measurement periods set within the analysis target period (S12). In the present embodiment, the information on the machining period of time and the energized period of time is previously stored in the non-volatile memory 5. In addition, the machining period of time according to the present embodiment is a length of time from start to stop of supply of a drive power to a machining drive unit (for example, the motor 160, the motor 421, or the like) that drives a machining tool. Therefore, an actual machining period of time is appropriately calculated based on the drive power supplied to the machining drive unit. However, a method of acquiring the machining period of time can also be changed. For example, the machining drive unit that monitors the supply time of the drive power may also include a drive unit (for example, the X-axis movement motor 145, the Y-axis movement motor 150, or the like) for moving each unit. Further, time from an input of a machining start instruction of an eyeglass lens to an end of a machining operation of the eyeglass lens of one example may be acquired as the machining period of time.

[0060] The CPU 2 processes the machining period of time and the energized period of time and generates running ratio information for each measurement period (S13). For example, the machining period of time and the energized period of time may be processed such that "length of measurement period: length of machining period of time: length of energized period of time = 60 minutes: 10 minutes: 30 minutes". The CPU 2 generates the running ratio graph 10 based on the running ratio information generated for each measurement period, and outputs (for example, displays or prints) the running ratio graph (S14).

[0061] In the running ratio graph 10 illustrated in FIG. 3, one day is set as an analysis target period, and a ratio of running period of time with respect to the energized period of time is illustrated for each of a plurality of measurement periods (in FIG. 3, an hourly measurement period from 8:00 to 18:00) included in the analysis target period. As described above, the CPU 2 processes each machining information in the plurality of measurement periods, thereby generating status information (running

ratio information in FIG. 3) indicating a time-dependent change of a usage state of the eyeglass lens machining apparatus 1 for each measurement period. That is, the CPU 2 separately generates the status information for each of a plurality of time zones. In other words, the running ratio information on the present embodiment includes at least a parameter related to time, and a correlation between the time and a processing result of the machining information is indicated according to the running ratio information. Therefore, a user can take various measures after appropriately understanding the time-dependent change in the usage state. For example, during a time zone in which a ratio of a length of the machining period of time with respect to a length of the energized period of time is extremely low, a supply of power to a device is blocked, and personnel are adjusted so as not to be arranged, and thus, productivity can be increased.

[0062] However, the CPU 2 may generate running ratio information within a specific measurement period by processing machining information within a specific measurement period. In this case, in S11, the CPU 2 may set the analysis target period itself to one measurement period. Further, the CPU 2 may calculate an average value, a total value, or the like of running ratios of the same measurement period within a plurality of analysis target periods. In this case, tendency of the running ratio over the plurality of analysis target periods is easily understood. Further, the CPU 2 may calculate (integrate) the average value, the total value, and the like of the running ratios in the same measurement period for a plurality of eyeglass lens machining apparatuses 1.

(Machining Time Distribution Information)

[0063] Machining time distribution information will be described. The machining time distribution information is information indicating the number of eyeglass lenses machined by the eyeglass lens machining apparatus 1 for each length of machining period of time required for machining each eyeglass lens. As illustrated in FIG. 3, in the present embodiment, the machining time distribution information is output (displayed or printed) by the machining (process) time distribution graph 20. A user can appropriately know a distribution of the machining period of time required for machining the eyeglass lens according to the machining time distribution information.

[0064] A machining time distribution information generation processing performed by the eyeglass lens machining apparatus (information processing apparatus) 1 of the present embodiment will be described with reference to FIG. 5. First, the CPU 2 sets an analysis target period (S20). The analysis target period is a period that becomes a target for processing (analyzing) machining information to generate status information. Details of the analysis target period are the same as in S10 (see FIG. 4) described above. The CPU 2 may set the analysis target period according to an instruction input by a user or may set a plurality of analysis target periods. In addition,

tion, in the machining time distribution graph 20 illustrated in FIG. 3, the analysis target period is generated as any of the past days. Further, in the example illustrated in FIG. 3, the machining time distribution information is previously generated for each of the plurality of analysis target periods, and "Day" which is an analysis target period change button is operated by a user, and thus, the analysis target period in which the machining time distribution graph 20 is displayed is changed.

[0065] The CPU 2 acquires information on the machining period of time required for machining for each eyeglass lens machined by the eyeglass lens machining apparatus 1 within the analysis target period (S21). In the present embodiment, information on machining period of time for each eyeglass lens is previously stored in the non-volatile memory 5. In addition, as described above, the machining period of time acquired in S21 may be time from start to stop of supply of a drive power to the machining drive unit or may be time from an input of a machining start instruction to an end of a machining operation.

[0066] The CPU 2 processes the information on machining period of time and information on the number of machining, thereby generating the machining time distribution information indicating the number of machined eyeglass lenses for each length of machining periods of time (S22). The CPU 2 generates and outputs the machining time distribution graph 20 based on the generated machining time distribution information (S23). The machining time distribution graph 20 illustrated in FIG. 3 sets a certain day as an analysis target period and illustrates the number of machined eyeglass lenses within the analysis target period for each machining period of time. The machining time distribution information on the present embodiment includes at least a parameter related to time, and a correlation between the machining period of time and the number is indicated according to the machining time distribution information. A user can appropriately increase productivity and the like of a subsequent machining work based on the distribution of the machining time which the user got.

[0067] Further, the CPU 2 calculates at least one of a prediction time and the number of machinable pieces based on the information on machining period of time acquired in the past (S24). The prediction time is time predicted to be required for machining a plurality of eyeglass lenses. Further, the number of machinable pieces is the number of eyeglass lenses that are predicted to be machinable within a predetermined time. A user can perform a work more appropriately based on information on the prediction time and the number of machinable pieces.

(Diopter Distribution Information)

[0068] Diopter distribution information will be described. The diopter distribution information is information indicating the number of eyeglass lenses machined by the eyeglass lens machining apparatus 1 for each

prescription of the machined eyeglass lens. As illustrated in FIG. 3, in the present embodiment, the diopter distribution information is output (displayed or printed) by a diopter distribution graph 30. A user can appropriately know a distribution of diopters of a plurality of machined eyeglass lenses according to the diopter distribution information.

[0069] A flow of diopter distribution information generation processing performed by the eyeglass lens machining apparatus (information processing apparatus) 1 of the present embodiment is similar to part of the machining time distribution information generation processing described above. First, the CPU 2 sets an analysis target period. In addition, in the diopter distribution graph 30 illustrated in FIG. 3, the analysis target period is generated as any of the past days. Further, in the example illustrated in FIG. 3, the diopter distribution information is previously generated for each of a plurality of analysis target periods, and "Day" which is an analysis target period change button is operated by a user, and thus, the analysis target period in which the diopter distribution graph 30 is changed.

[0070] The CPU 2 acquires information on diopter of an eyeglass lens for each eyeglass lens machined by the eyeglass lens machining apparatus 1 within the analysis target period. The CPU 2 generates the diopter distribution information by processing information on the number of machining and diopter. The CPU 2 generates and outputs the diopter distribution graph 30 based on the generated diopter distribution information.

(Machining Debris Quantity Information)

[0071] Machining debris quantity information will be described. The machining debris quantity information is information indicating an estimated amount of machining debris quantity of an eyeglass lens generated by machining. As illustrated in FIG. 3, in the present embodiment, the machining debris quantity information is output by a machining debris quantity graph 40. A user can appropriately know the estimated amount of the machining debris quantity according to the machining debris quantity information.

[0072] Machining debris quantity information generation processing performed by the eyeglass lens machining apparatus (information processing apparatus) 1 of the present embodiment will be described with reference to FIG. 6. A flow of the machining debris quantity information generation processing is similar to part of the running ratio information generation processing described above. First, the CPU 2 sets an analysis target period (S40). Details of the analysis target period are the same as in S10 (see FIG. 4) described above. For example, in the machining debris quantity graph 40 illustrated in FIG. 3, the analysis target period is generated as any of the past months. Further, in the example illustrated in FIG. 3, the machining debris quantity information is previously generated for each of a plurality of analysis target peri-

ods, and "Month" which is an analysis target period change button is operated by a user, and thus, the analysis target period (at least one of a length of the period and start and end of the period) in which the machining debris quantity graph 40 is displayed is changed.

[0073] Next, the CPU 2 sets a plurality of measurement periods within the analysis target period set in S40 (S41). As described above, a length of each of the measurement periods may be determined according to the length of the analysis target period. Further, the CPU 2 may set the length of each of the measurement periods according to an instruction input by the user.

[0074] The CPU 2 acquires data of a pre-machined eyeglass lens and data of the machined eyeglass lens for each of the machined eyeglass lenses for each of the plurality of measurement periods set within the analysis target period (S42). The data of the pre-machined eyeglass lens may be, for example, data and the like of a measurement result of a shape of the eyeglass lens. Further, the data of the machined eyeglass lens may be, for example, target lens shape data of the machined lens.

[0075] The CPU 2 processes the data of the pre-machined eyeglass lens and machined eyeglass lens and generates the machining debris quantity information for each measurement period (S43). The CPU 2 generates and outputs the machining debris quantity graph 40 based on the machining debris quantity information generated for each measurement period (S44).

[0076] The machining debris quantity graph 40 illustrated in FIG. 3 represents estimated amounts of the machining debris quantity for each of the plurality of measurement periods (in FIG. 3, measurement periods for each day) included in the analysis target period. As described above, the CPU 2 processes each machining information in the plurality of measurement periods, thereby generating status information (machining debris quantity information in FIG. 3) indicating a time-dependent change of a usage state of the eyeglass lens machining apparatus 1 for each measurement period. That is, the CPU 2 separately generates the status information for each of a plurality of time zones. In other words, the running ratio information on the present embodiment includes at least a parameter related to time, and a correlation between the time and a processing result of the machining information is indicated according to the running ratio information. Therefore, a user can appropriately understand the time-dependent change of the usage state.

[0077] However, the CPU 2 may generate the machining debris quantity information within a specific measurement period. Further, the CPU 2 may calculate an average value, a total value, or the like of the machining debris quantity in the same measurement periods within a plurality of analysis target periods.

[0078] Further, in the present embodiment, the status information generated by each of the plurality of eyeglass lens machining apparatuses 1 is transmitted to a PC (hereinafter, referred to as a "management PC") of a

manager. A CPU of the management PC integrates a plurality of pieces of status information generated for each of the plurality of eyeglass lens machining apparatuses 1 and outputs the integrated status information. Specifically, the CPU of the management PC integrates (in the present embodiment, calculates a total value of estimated amounts of machining debris quantity) and output machining debris quantity information on the plurality of eyeglass lens machining apparatuses 1 belonging to the same group (for example, in the same factory, in the same store, or in the same area) designated by the manager. Therefore, a user can efficiently understand the total amount of machining debris quantity generated by the plurality of eyeglass lens machining apparatuses 1.

(Peripheral Edge Machining Tool Consumption Rate Information)

[0079] Peripheral edge machining tool consumption rate information will be described. Consumption rate information on a peripheral edge machining tool is status information indicating a consumption rate of the peripheral edge machining tool 168. A user can appropriately know the consumption rate of the peripheral edge machining tool 168 according to the peripheral edge machining tool consumption rate information. Particularly, the eyeglass lens machining apparatus (information processing apparatus) 1 of the present embodiment generates replacement recommendation information indicating a consumption rate for recommending replacement of a member (in this case, a peripheral edge machining tool) as status information together with the consumption rate information. Therefore, a user can more appropriately check a time when replacement of the member is recommended.

[0080] As illustrated in FIG. 3, in the present embodiment, the consumption rate information and the replacement recommendation information on the peripheral edge machining tool 168 are output by a peripheral edge machining tool consumption rate graph 50. According to the graph illustrated in FIG. 3, the consumption rate information and the replacement recommendation information are illustrated at the same time, and thus, a replacement time period can be determined more appropriately. All the consumption rate graphs according to the present embodiment display a ratio of values indicated by the consumption rate information on a circle graph in which a value indicated by the replacement recommendation information is 100%. However, it goes without saying that details of the consumption rate graph can be changed. For example, a bar graph may be used instead of the circle graph.

[0081] Peripheral edge machining tool consumption rate calculation processing performed by the eyeglass lens machining apparatus (information processing apparatus) 1 of the present embodiment will be described with reference to FIG. 7. The CPU 2 acquires information on

a machining distance when an eyeglass lens is machined by the peripheral edge machining tool 168 used at that time (S50). The information on machining distance is information on a distance that the peripheral edge machining tool 168 relatively moves with respect to an eyeglass lens while machining in contact with the eyeglass lens. Therefore, the consumption rate can be estimated more accurately than when the information on consumption rate is generated based only on the number of machined lenses. In addition, the information on machining distance is acquired for each of a plurality of times of machining after the peripheral edge machining tool 168 used at that time is mounted on the eyeglass lens machining apparatus 1.

[0082] The CPU 2 acquires at least one piece of information (both pieces of information in the present embodiment) of a thickness and a material of the machined eyeglass lens for each of the plurality of times of machining (S51). Next, the CPU 2 processes the information on machining distance acquired in S50 and information on the thickness and material acquired in S51 for each of the plurality of times of machining, thereby calculating the consumption rate of the peripheral edge machining tool 168 at each machining time (S52). For example, in the present embodiment, the CPU 2 multiplies the machining distance acquired in S50 by a coefficient according to the thickness and material, thereby calculating the consumption rate of the peripheral edge machining tool 168 at each machining time. The larger the thickness, the larger the coefficient, and the smaller the thickness, the smaller the coefficient. Further, the higher a hardness of the material, the larger the coefficient. The CPU 2 accumulates the consumption rates at each machining time after the peripheral edge machining tool 168 used at that time is mounted on the eyeglass lens machining apparatus 1 and generates consumption rate information on the peripheral edge machining tool 168 (S53).

[0083] The CPU 2 generates the replacement recommendation information based on information on timing when a peripheral edge machining tool used in the past is replaced with a new peripheral edge machining tool and the consumption rate information generated for the peripheral edge machining tool used in the past (S54). As described above, the replacement recommendation information is information indicating the consumption rate for recommending replacement of a member. In the present embodiment, the past consumption rate information and the information on replacement timing are stored in the non-volatile memory 5. For example, in the present embodiment, the consumption rate information itself at the timing when the peripheral edge machining tool used in the past is replaced with a new peripheral edge machining tool is used as the replacement recommendation information. In addition, when a plurality of peripheral edge machining tools were replaced in the past, an average value of values of the replacement recommendation information regarding the plurality of peripheral edge machining tools may be calculated. Further, the replace-

ment recommendation information in other eyeglass lens machining apparatuses may be used. Further, a previously determined value may be used as the replacement recommendation information. Thereafter, the CPU 2 generates and outputs the peripheral edge machining tool consumption rate graph 50 (S55).

(Drilling Tool Consumption Rate Information)

[0084] Drilling tool consumption rate information will be described. The drilling tool consumption rate information is status information indicating a consumption rate of a drilling tool. A user can appropriately know the consumption rate of the drilling tool according to the drilling tool consumption rate information. The eyeglass lens machining apparatus (information processing apparatus) 1 of the present embodiment generates replacement recommendation information indicating a consumption rate for replacing the drilling tool as status information together with the consumption rate information, in the same manner as the peripheral edge machining tool. As illustrated in FIG. 3, in the present embodiment, the consumption rate information and the replacement recommendation information on the drilling tool are output by a drilling tool consumption rate graph 60.

[0085] Drilling tool consumption rate calculation processing performed by the eyeglass lens machining apparatus (information processing apparatus) 1 of the present embodiment will be described with reference to FIG. 8. The CPU 2 acquires information on at least one of a depth of a formed hole and a diameter of the hole (both in the present embodiment) when an eyeglass lens is machined by a drilling tool used at that time (S60). In addition, the information on the depth and diameter of the holes is acquired for each of a plurality of times of drilling after the drilling tool used at that time is mounted on the eyeglass lens machining apparatus 1.

[0086] The CPU 2 acquires information on a material of the machined eyeglass lens for each of the plurality of times of machining (S61). Next, the CPU 2 processes the information on the depth and diameter of the hole acquired in S60 and the material information acquired in S61 for each of a plurality of times of machining, thereby calculating a consumption rate of a drilling tool at each machining time (S62). For example, in the present embodiment, the CPU 2 multiplies the value according to the depth and diameter of the hole acquired in S60 by a coefficient according to the material, thereby calculating the consumption rate of the drilling tool at each machining time. The higher a hardness of the material, the larger the coefficient. The CPU 2 accumulates the consumption rates at each machining time after the drilling tool used at that time is mounted on the eyeglass lens machining apparatus 1, and generates the consumption rate information on the peripheral edge machining tool 168 (S63).

[0087] The CPU 2 generates replacement recommendation information based on information on timing when the drilling tool used in the past is replaced with a new

drilling tool and the consumption rate information generated for the peripheral edge machining tool used in the past (S64). Since a flow of the processing is the same as the flow of the processing of S54 described above, detailed description thereof is omitted. Thereafter, the CPU 2 generates and outputs the drilling tool consumption rate graph 60 (S65).

(Activated Carbon Material Consumption Rate Information)

[0088] Consumption rate information on an activated carbon material of the deodorization apparatus 9 will be described. As described above, the deodorization apparatus 9 of the present embodiment is driven in conjunction with a machining operation (specifically, a machining operation by the peripheral edge machining tool 168) by the eyeglass lens machining apparatus 1. Since a deodorizing effect of the activated carbon material of the deodorization apparatus 9 is reduced according to drive time of a deodorizing operation, replacement is required as necessary. The eyeglass lens machining apparatus (information processing apparatus) 1 of the present embodiment generates replacement recommendation information indicating a consumption rate for recommending replacement of the activated carbon material as status information together with the consumption rate information. As illustrated in FIG. 3, in the present embodiment, the consumption rate information and the replacement recommendation information on the activated carbon material are output by an activated carbon material consumption rate graph 70.

[0089] Activated carbon material consumption rate calculation processing performed by the eyeglass lens machining apparatus (information processing apparatus) 1 of the present embodiment will be described with reference to FIG. 9. The CPU 2 acquires a cumulative value of machining periods of time in the eyeglass lens machining apparatus 1 after use of the activated carbon material used at that time starts (S70). In S70 of the present embodiment, the cumulative value of the machining periods of time by the peripheral edge machining tool 168 is acquired.

[0090] The CPU 2 generates consumption rate information on an activated carbon material used at that time based on the cumulative value of the machining periods of time acquired in S70 (S71). As described above, the deodorization apparatus 9 of the present embodiment drives a deodorization function in conjunction with a machining operation (specifically, a machining operation by the peripheral edge machining tool 168) by the eyeglass lens machining apparatus 1. Therefore, in S71 of the present embodiment, a value proportional to the cumulative value of the machining periods of time acquired in S70 is generated as the consumption rate information on the activated carbon material.

[0091] The CPU 2 generates replacement recommendation information based on information on timing when

the activated carbon material used in the past is replaced with a new material and the consumption rate information generated for the activated carbon material used in the past (S72). A flow of this processing is the same as the flow of the processing of S54 described above. Thereafter, the CPU 2 generates and outputs the activated carbon material consumption rate graph 70 (S73).

(Cup Unit Consumption Rate Information)

[0092] Cup unit consumption rate information will be described. As described above, in the present embodiment, after a cup is attached to a predetermined position of an eyeglass lens, one of the lens holding shafts 102R and 102L is mounted on the cup attached to the lens LE. When using a cup, a user often randomly selects and uses one cup from among cups in the cup unit that uses a plurality of cups as one unit, each time. Therefore, when the cup is used many times, the entire cup unit is replaced. As illustrated in FIG. 3, in the present embodiment, the consumption rate information and replacement recommendation information on the cup unit are output by a cup unit consumption rate graph 80.

[0093] Cup unit consumption rate calculation processing performed by the eyeglass lens machining apparatus (information processing apparatus) 1 of the present embodiment will be described with reference to FIG. 10. The CPU 2 acquires information on the number of uses of a cup after use of a cup unit used at that time starts (S80). In the present embodiment, the number of uses of a cup corresponds to the number of machined eyeglass lenses. Next, the CPU 2 acquires information on the number of cups included in the cup unit used at that time (S81).

[0094] The CPU 2 generates the consumption rate information on the cup unit in use based on the information on the number of uses of a cup acquired in S80 and the information on the number of cups acquired in S81 (S82). As described above, a user often randomly selects and uses one cup from among cups in the cup unit each time. Therefore, for example, a value or the like obtained by dividing the number of uses of a cup by the number of cups included in the cup unit may be generated as the cup unit consumption rate information.

[0095] The CPU 2 generates replacement recommendation information based on information on timing when the cup unit used in the past is replaced with a new cup unit and the consumption rate information generated for the cup unit used in the past (S83). Since a flow of the processing is the same as the flow of the processing of S54 described above, detailed description thereof is omitted. Thereafter, the CPU 2 generates and outputs the cup unit consumption rate graph 80 (S84).

(Auto and Manual Ratio Information)

[0096] Auto and manual ratio information is status information indicating a ratio between the number of times when an auto mode is performed and the number of times

when a manual mode is performed in the eyeglass lens machining apparatus 1. The auto mode is a mode in which an eyeglass lens is automatically machined. The manual mode is a mode in which the eyeglass lens is machined according to an operation instruction by an operator. The CPU 2 acquires the information on the number of times when the auto mode is performed and the information on the number of times when the manual mode is performed and acquires the auto and manual ratio information based on the information on the acquired number of times. As illustrated in FIG. 3, in the present embodiment, the auto and manual ratio information is output by an auto and manual ratio graph 90.

(Frame Type Ratio Information)

[0097] Frame type ratio information is status information indicating a ratio between types (for example, a metal frame, a cell, a nylon frame, rimless, and the like) of frames on which eyeglass lenses machined by the eyeglass lens machining apparatus 1 is mounted. The CPU 2 acquires information indicating the number of frames on which the machined eyeglass lenses are mounted for each type as machining information indicating machining details. The CPU 2 generates the frame type ratio information based on the acquired information. As illustrated in FIG. 3, in the present embodiment, the frame type ratio information is output by a frame type ratio graph 99.

[0098] Techniques disclosed in the above-described embodiments are merely examples. Therefore, the techniques exemplified in the above-described embodiments can also be changed. For example, only part of the plurality of times of processing exemplified in the above-described embodiments can also be performed. Further, the above-described embodiment exemplifies a case where a plurality of pieces of machining debris quantity information are integrated and output. However, status information other than the machining debris quantity information can also be integrated. A method of integrating the plurality of status quantities is not limited to a method of calculating a total value. For example, an average value or the like may be calculated. Further, a plurality of pieces of status information may be integrated by outputting the plurality of pieces of status information side by side.

[0099] In addition, processing of acquiring machining information in S12 of FIG. 4, S21 of FIG. 5, S42 of FIG. 6, S50 and S51 of FIG. 7, S60 and S61 of FIG. 8, S70 of FIG. 9, and S80 and S81 of FIG. 10 is an example of a "machining information acquisition step". Processing of generating status information in S13 of FIG. 4, S22 in FIG. 5, S43 of FIG. 6, S52, S53, and S54 of FIG. 7, S62, S63, and S64 of FIG. 8, S71 and S72 of FIG. 9, and S82 and S83 of FIG. 10 is an example of a "status information generation step".

Claims

1. A method of processing information for machining an eye glass lens in an information processing apparatus that processes information on an eyeglass lens machining apparatus, the eyeglass lens machining apparatus having a machining tool including a peripheral edge machining tool that machines a peripheral edge of an eyeglass lens, and a machining drive unit including a peripheral edge machining drive unit that drives the peripheral edge machining tool, the method comprising:

an acquisition step of acquiring machining information which indicates at least one of machining details and machining period of time for machining an eyeglass lens by the machining tool; and a generation step of generating status information which indicates a usage state of the eyeglass lens machining apparatus, by processing the machining information acquired in the acquisition step.

2. The method according to claim 1,

wherein in the acquisition step, the machining information in each of a plurality of measurement periods different from each other is acquired, and

in the generation step, the machining information in each of the plurality of measurement periods is processed to generate the status information which indicates a time-dependent change of a usage state for each of the measurement periods.

3. The method according to claim 1 or 2, further comprising:

an output step of outputting the status information, which is generated in the generation step, in a predetermined report format for reporting a processing result of the machining information to a user.

4. The method according to any one of claims 1 to 3,

wherein in the acquisition step, the machining information including information on machining period of time while an eyeglass lens is actually machined by the machining tool and information on energized period of time while a power is applied to the eyeglass lens machining apparatus is acquired, and

in the generation step, the status information indicating a ratio of the machining period of time with respect to the energized period of time is generated.

5. The method according to any one of claims 1 to 3,

- wherein in the acquisition step, information on the machining period of time required for machining each of a plurality of eyeglass lenses is acquired, and
 in the generation step, the status information indicating a number of machined eyeglass lenses for each length of the machining period of time is generated. 5
6. The method according to any one of claims 1 to 3, 10
 wherein in the acquisition step, for each of a plurality of eyeglass lenses, data of a pre-machined eyeglass lens and data of a machined eyeglass lens are acquired as the machining information indicating machining details, and
 in the generation step, the status information indicating an estimated amount of machining debris quantity of an eyeglass lens generated by machining is generated based on the data of the pre-machined eyeglass lens and the data of the machined eyeglass lens. 15 20
7. The method according to any one of claims 1 to 3, 25
 wherein in the generation step, consumption rate information indicating a consumption rate of at least one member of the machining tool of the eyeglass lens machining apparatus and a consumable used in the eyeglass lens machining apparatus is generated as the status information, by processing the machining information acquired in the acquisition step. 30
8. The method according to claim 7, 35
 wherein in the generation step, based on consumption rate information generated in the past for a predetermined member and information on timing when the member is actually replaced, replacement recommendation information indicating a consumption rate for which replacement of the member is recommended is generated as the status information together with the consumption rate information. 40
9. The method according to claim 7 or 8, 45
 wherein in the acquisition step, information on a machining distance in which the peripheral edge machining tool relatively moves with respect to the eyeglass lens while machining in contact with the eyeglass lens is acquired as the machining information, and
 in the generation step, the consumption rate information of the peripheral edge machining tool is generated based on the information on the machining distance. 50 55
10. The method according to claim 7 or 8,
 wherein in the acquisition step, information on
 at least one of a depth of a hole and a diameter of the hole formed in the eyeglass lens by a drilling tool that is the machining tool for making the hole on the eyeglass lens is acquired as the machining information, and
 in the generation step, the consumption rate information of the drilling tool is generated based on the information on at least one of the depth of the hole and the diameter of the hole.
11. The method according to claim 7 or 8,
 wherein in the acquisition step, information on machining period of time while an eyeglass lens is machined by the machining tool is acquired, and
 in the generation step, the consumption rate information on an activated carbon material of a deodorization apparatus driven in conjunction with a machining operation by the eyeglass lens machining apparatus is generated based on information on the machining period of time.
12. The method according to claim 7 or 8,
 wherein in the acquisition step, information on a number of uses of a cup which is attached to an eyeglass lens and on which a lens holding shaft of the eyeglass lens machining apparatus is mounted, and information on a number of the cups included in a cup unit in which a plurality of the cups are set as one unit, are acquired as the machining information, and
 in the generation step, the consumption rate information on the cup unit is generated based on the information on the number of uses of the cup and the information on the number of the cups.
13. The method according to any one of claims 1 to 12, further comprising:
 an integration step of integrating a plurality of pieces of the status information generated for each of a plurality of the eyeglass lens machining apparatuses, and outputting the integrated status information.
14. An eyeglass lens machining apparatus that machines an eyeglass lens, comprising:
 a machining tool including a peripheral edge machining tool that machines a peripheral edge of an eyeglass lens;
 a machining drive unit including a peripheral edge machining drive unit that drives the peripheral edge machining tool; and
 an information processing apparatus configured to:
 acquire machining information which indi-

cates at least one of machining details and machining period of time for machining an eyeglass lens by the machining tool; and generate status information which indicates a usage state of the eyeglass lens machining apparatus, by processing the acquired machining information. 5

15. A computer program comprising instructions to cause the information processing apparatus of claim 14 to execute the steps of the method of any one of claims 1 to 13. 10

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FIG. 2

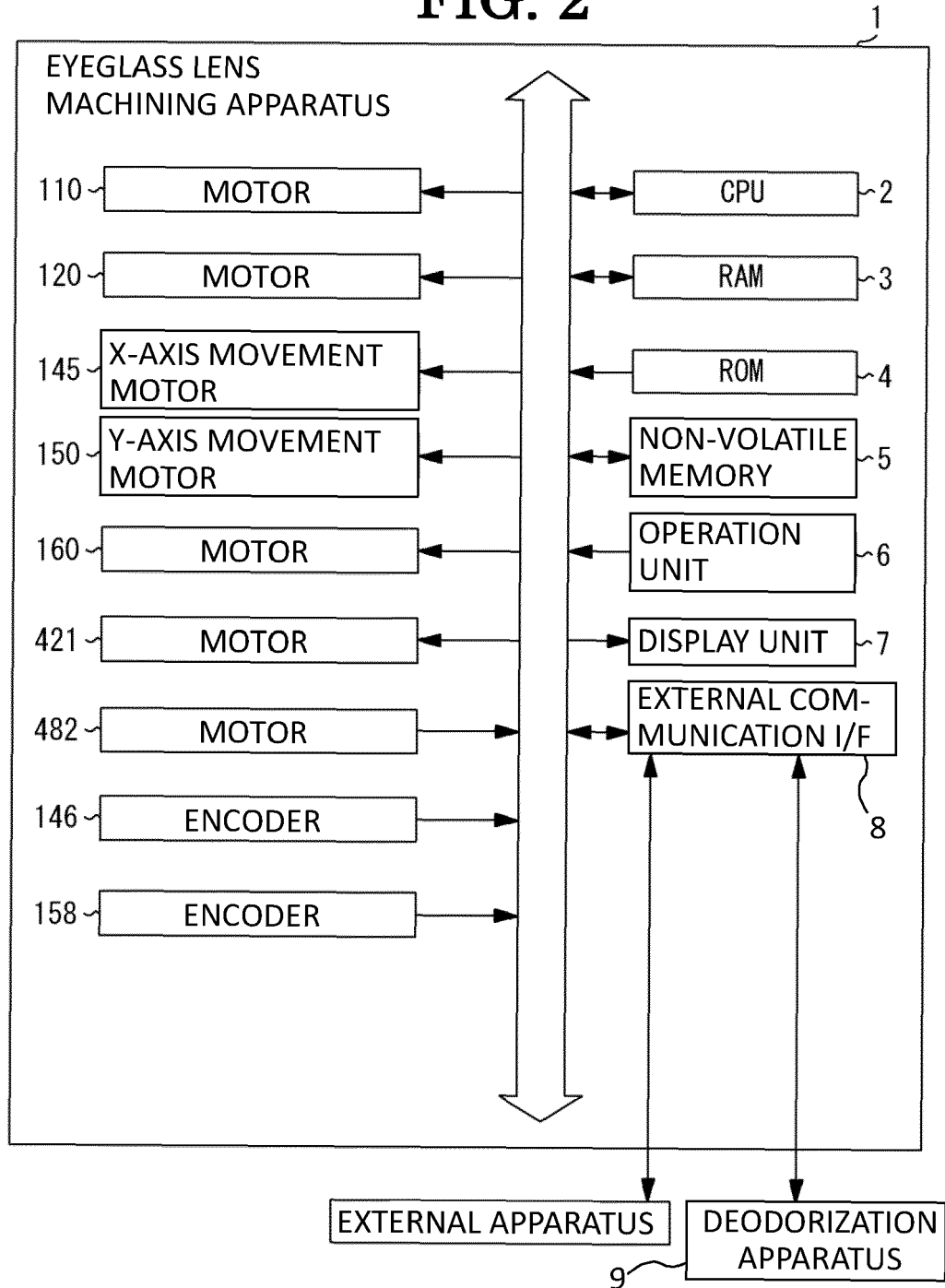


FIG. 3

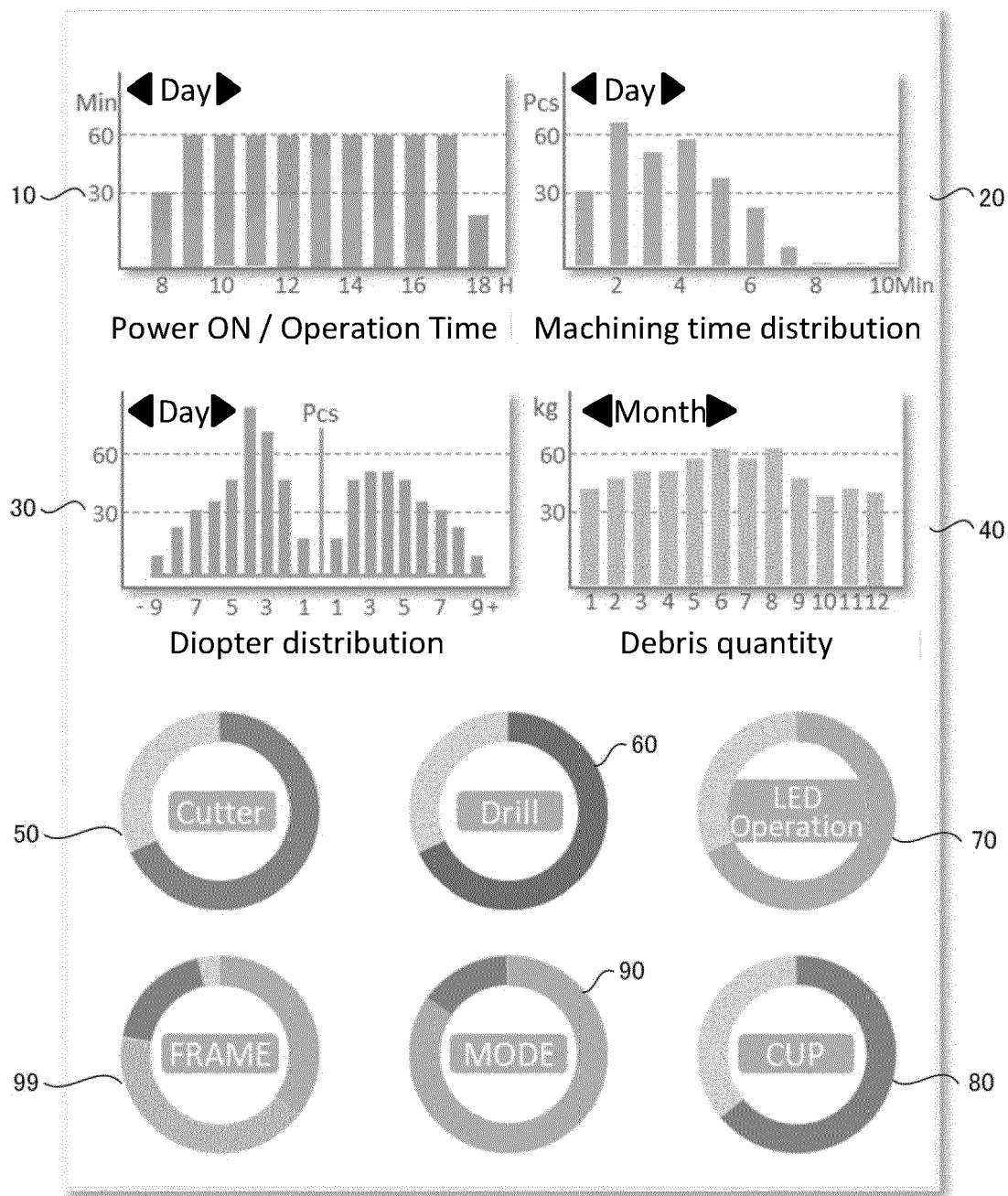


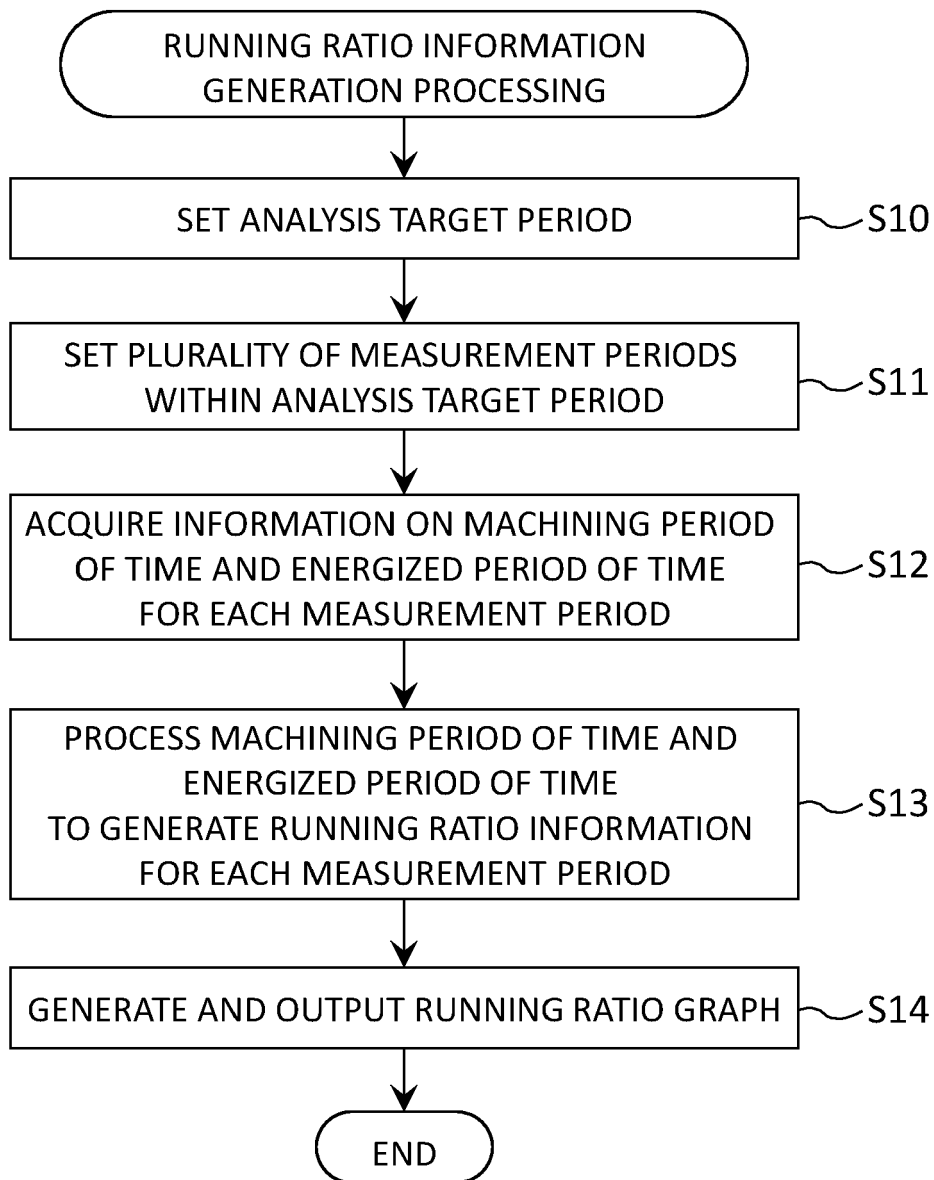
FIG. 4

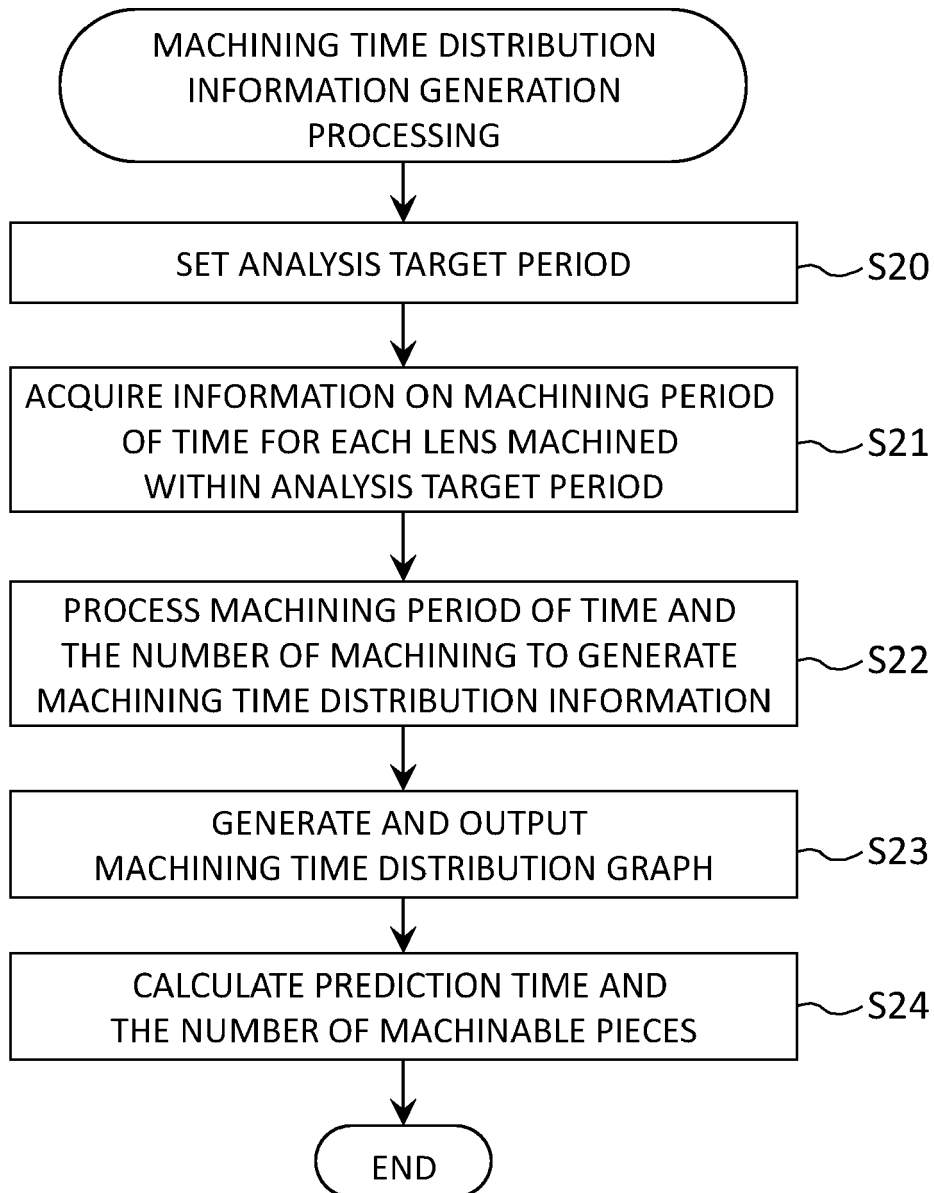
FIG. 5

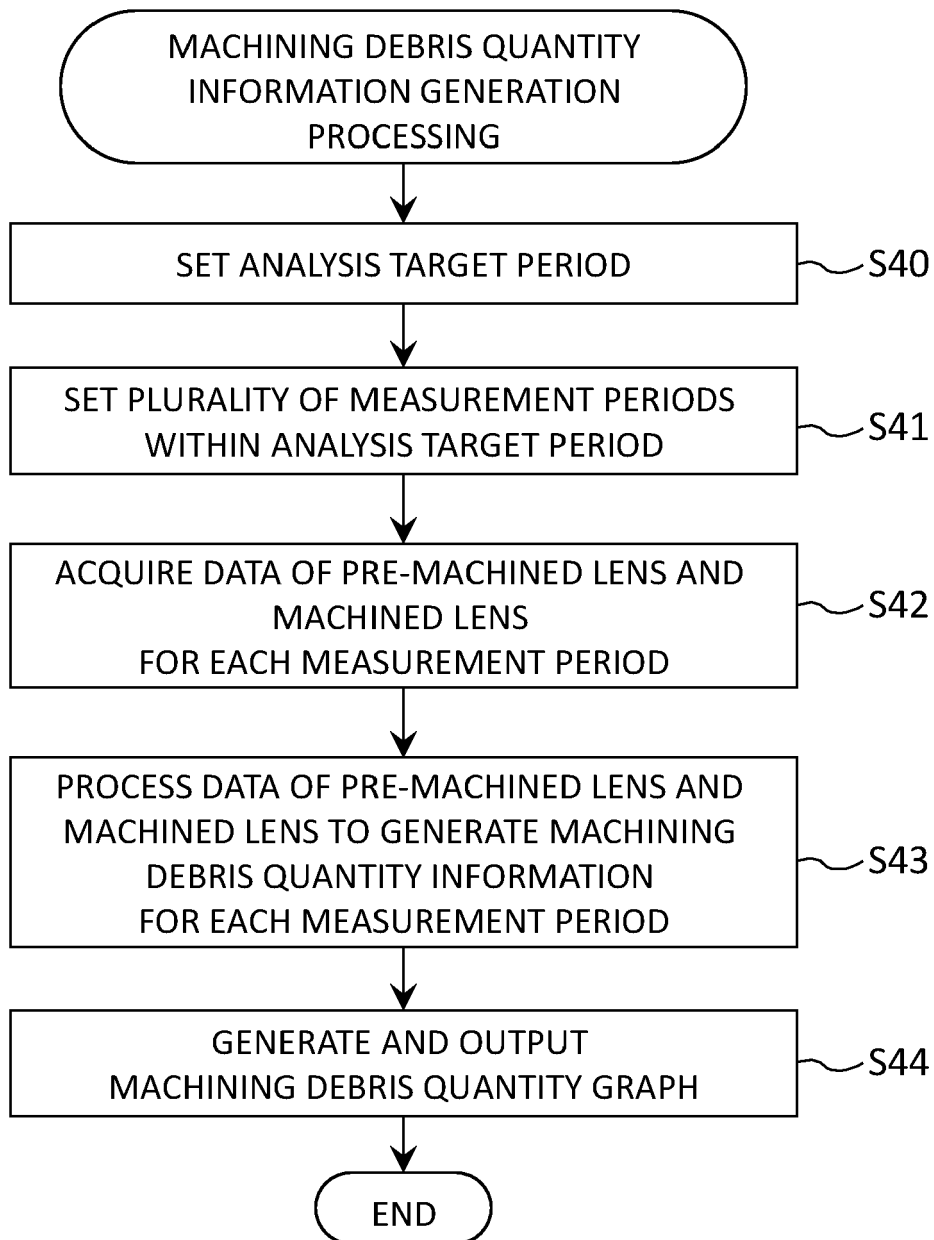
FIG. 6

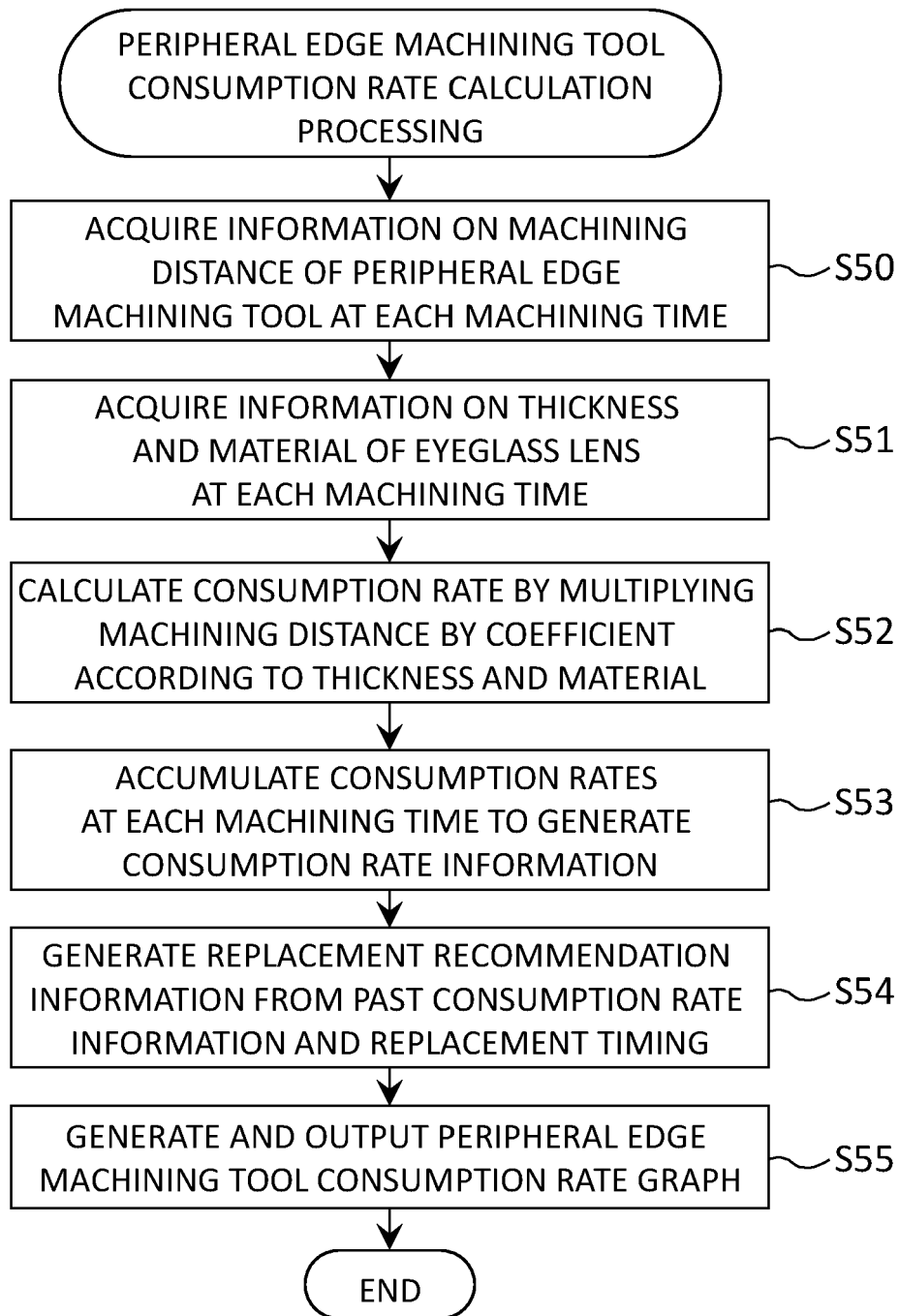
FIG. 7

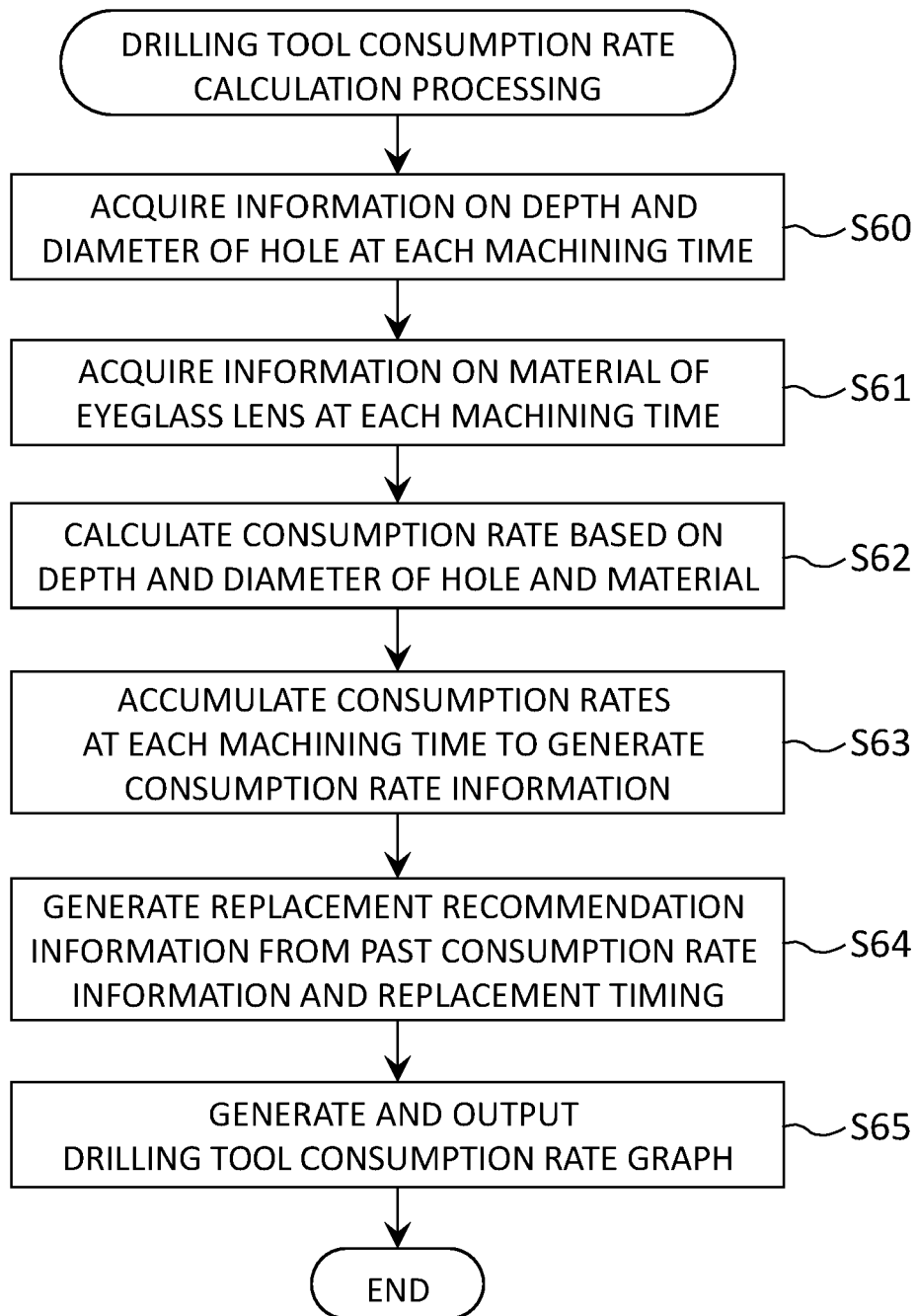
FIG. 8

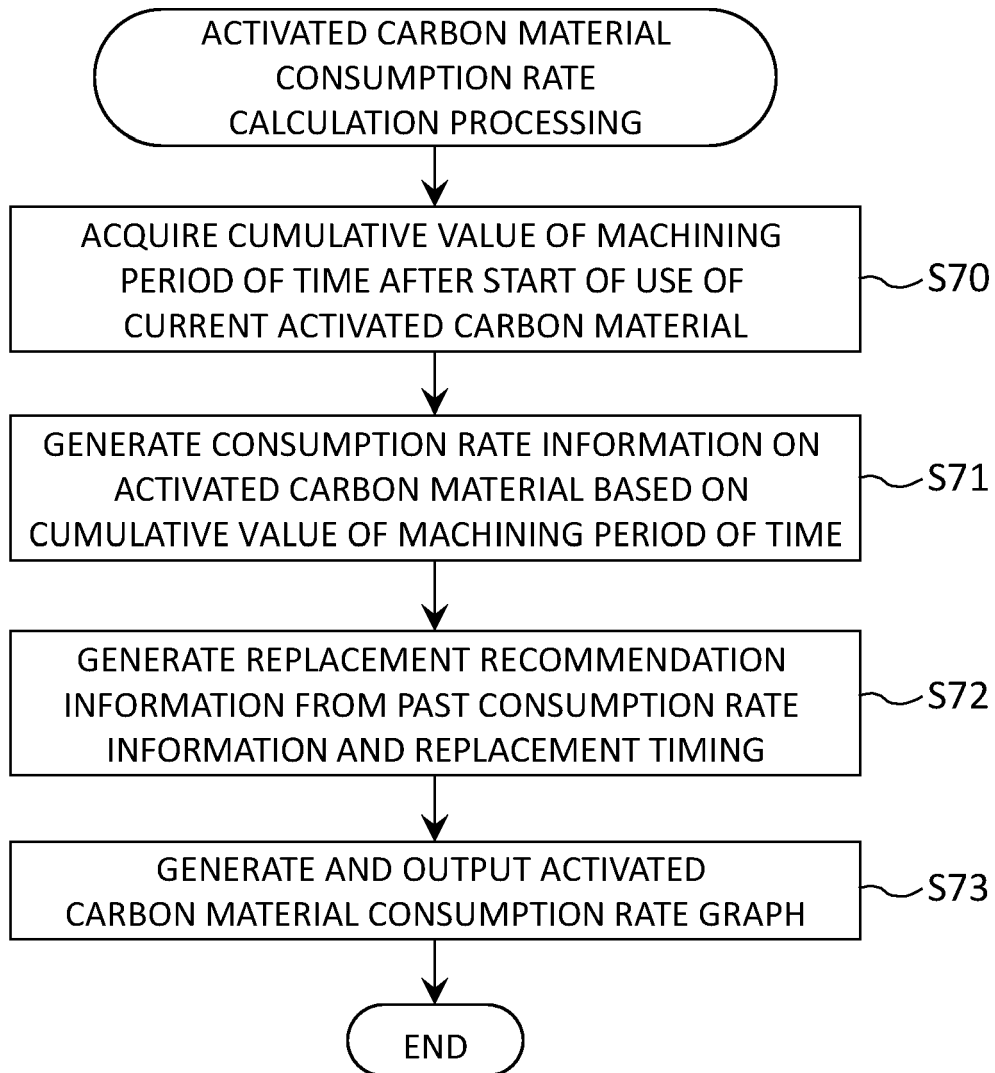
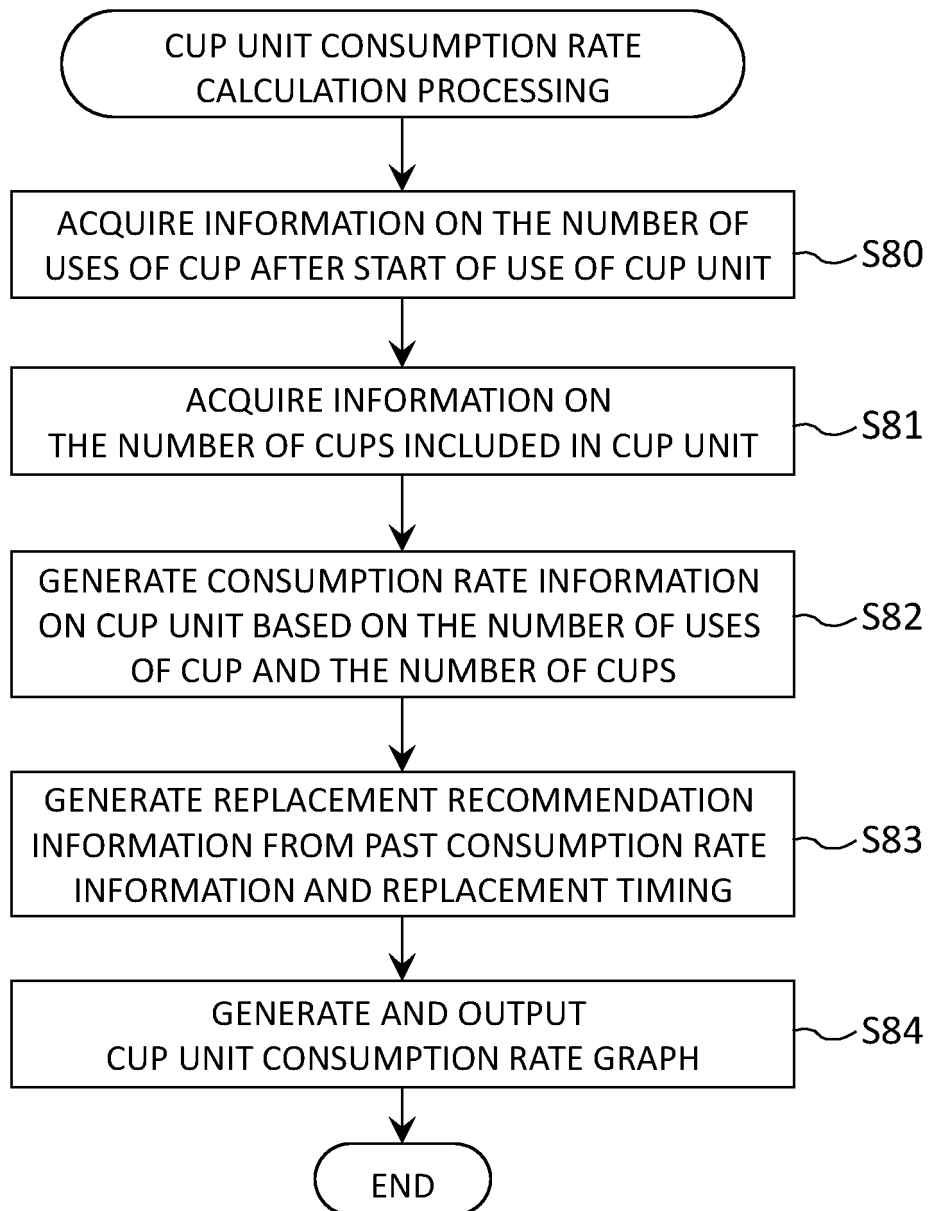
FIG. 9

FIG. 10



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Place of search Munich		Date of completion of the search 20 December 2021	Examiner Endres, Mirja
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Place of search Munich		Date of completion of the search 20 December 2021	Examiner Endres, Mirja
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X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document			

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