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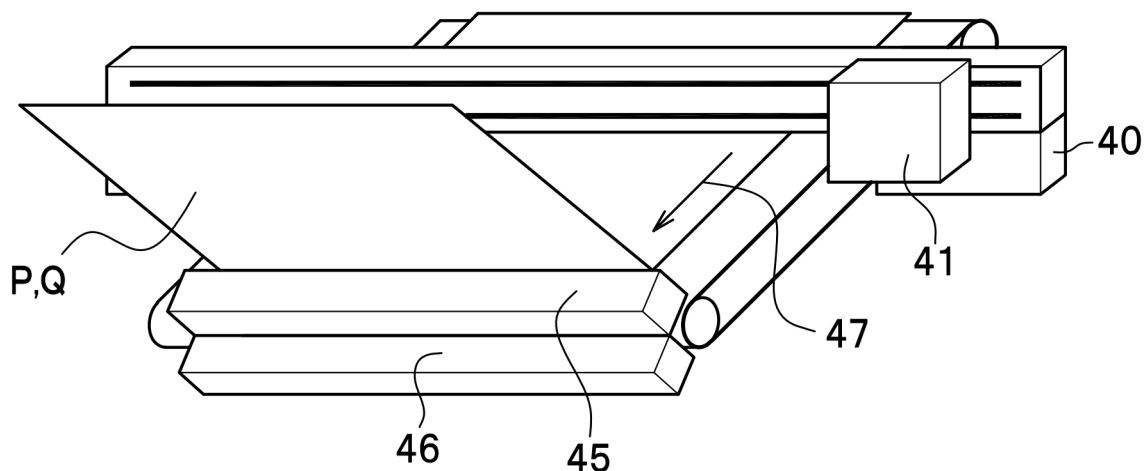
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(54) **IMAGE FORMATION DEVICE, IMAGE PROCESSING METHOD, AND IMAGE PROCESSING PROGRAM**

(57) Provided is an image formation device (100) comprising: an image former (40) that discharges liquid droplets onto a recording surface of a medium to form an image; a reader (45) that reads an opposite surface image on a side opposite to the recording surface of an image formation medium (Q) on which the image is

formed on the recording surface of the medium (P) by the image former (40); and a determiner (13) that determines pass/fail of the image formation medium (Q) based on the opposite surface image read by the reader (45).

FIG. 2



Description

BACKGROUND OF THE INVENTION

Technical Field

[0001] The present invention relates to an image formation device, an image processing method, and an image processing program, and for example, relates to an image formation device that forms an image on a fabric by an inkjet method.

Description of Related Art

[0002] In a case of printing on a fabric, a defect may occur during printing. However, automatic detection of the defective medium in real time during printing (during medium transport) has not been performed. That is, after a manufacturing process such as color development after printing or washing is completed, a fabric inspection process by visual observation is performed. For this reason, detection of a printing defect is delayed, and the number of defective portions increases. Furthermore, because of a human-dependent technique of visual observation, there are problems such as a risk of oversight by an unskilled worker and variation in pass/fail determination among workers.

[0003] JP2020-046932A discloses an inspection device that determines presence or absence of an image defect by comparing image data of a comparison target image with image data of a reference image.

[0004] The inspection device described in JP2020-046932A can perform the inspection process automatically. However, the inspection device described in JP2020-046932A performs pass/fail determination on the premise of image formation of a repetitive pattern. For this reason, there is a problem that defect detection cannot be performed in a single printing of a non-repetitive pattern. Then, there is a possibility that accuracy of correction or defect detection becomes an issue depending on the pattern. When one pitch of the repetitive pattern is large, there is a risk that processing increases. Then, since timing control related to repetition of the pattern and correction processing for displacement are required, the processing becomes complicated.

SUMMARY OF THE INVENTION

[0005] The present invention has been made in view of the above problems, and an object thereof is to provide an image formation device, a pass/fail determining method, and a pass/fail determining program capable of determining pass/fail of an image formation medium regardless of an image to be formed on the medium.

[0006] The above problems of the present invention are solved by the following means.

[0007] An image formation device comprising:

an image former that discharges liquid droplets onto a recording surface of a medium to form an image;

a reader that reads an opposite surface image on a side opposite to the recording surface of an image formation medium on which the image is formed on the recording surface of the medium by the image former; and

a determiner that determines pass/fail of the image formation medium based on the opposite surface image read by the reader.

[0008] According to the present invention, pass/fail of an image formation medium can be determined regardless of an image to be formed on the medium.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] The advantages and features provided by one or more embodiments of the invention will become more fully understood from the detailed description given hereinbelow and the appended drawings which are given by way of illustration only, and thus are not intended as a definition of the limits of the present invention:

FIG. 1 is a configuration diagram of an image formation device according to a first embodiment of the present invention.

FIG. 2 is a schematic view showing the periphery of an image former.

FIG. 3A is a diagram showing a state in which liquid droplets are discharged onto a recording surface of a medium.

FIG. 3B is a diagram showing an example of a recording surface image and an opposite surface image of an image formation medium.

FIG. 3C is a diagram showing an example of a color solid of a recording surface image and an opposite surface image of the image formation medium.

FIG. 4 is an example of an opposite surface image of the image formation medium, showing an abnormal state in which a large amount of liquid droplets are discharged to one location.

FIG. 5 is a diagram showing an example of a color solid of an opposite surface image in an abnormal state.

FIG. 6A is a flowchart (1) for explaining an operation of the image formation device of the present embodiment.

FIG. 6B is a flowchart (2) for explaining an operation of the image formation device of the present embodiment.

FIG. 7 is an explanatory diagram for explaining a method of generating a color solid.

FIG. 8 is a diagram (1) showing an example of a display screen displayed on a display operation

panel.

FIG. 9 is a diagram (2) showing an example of a display screen displayed on a display operation panel.

FIG. 10 is an explanatory diagram for explaining a method of determining a detection area.

FIG. 11A is a flowchart (1) for explaining an operation of a second embodiment of the present invention.

FIG. 11B is a flowchart (2) for explaining an operation of the second embodiment of the present invention.

FIG. 12A is a flowchart (1) for explaining an operation of a third embodiment of the present invention.

FIG. 12B is a flowchart (2) for explaining an operation of the third embodiment of the present invention.

DETAILED DESCRIPTION

[0010] In the following embodiments, embodiments of the present invention will be described in detail with reference to the drawings. Note that each drawing is merely shown schematically to an extent that the present invention can be sufficiently understood. Therefore, the present invention is not limited only to the illustrated examples. In addition, in each drawing, common constituent elements or similar constituent elements are denoted by the same reference numerals, and redundant description thereof will be omitted.

[0011] An image formation device of the present invention comprises, for example, an image former that discharges liquid droplets onto a recording surface of a medium represented by a fabric to form an image, a reader that reads an opposite surface image on a side opposite to the recording surface of an image formation medium on which the image is formed by the image former, and a determiner that determines pass/fail of the image formation medium based on the opposite surface image read by the reader.

[0012] Various printing defects in inkjet printing are known, but in the present invention, an unintended large liquid droplet of ink suddenly falling onto a medium during a printing operation, commonly called "dripping", is targeted. "Dripping" is a defect in which a large ink stain occurs on a printing surface (recording surface).

(First Embodiment)

[0013] FIG. 1 is a configuration diagram of an image formation device according to a first embodiment of the present invention.

[0014] An image formation device 100 has a function of determining pass/fail of a fabric when abnormal and large amount of liquid droplets are discharged onto a medium P (FIG. 2, FIG. 3A) which is the fabric. The image formation device 100 comprises a controller 10,

a volatile memory 20, a non-volatile memory 30, an image former 40, a reader 45, and a display operation panel 50. The display operation panel 50 is a touch-type LCD (Liquid Crystal Display) panel.

[0015] FIG. 2 is a schematic view showing the periphery of the image former 40.

[0016] The image former 40 forms an image on a recording surface of the medium P being transported by discharging liquid droplets from nozzles onto the medium P which is a fabric. The medium P is transported in a transport direction 47 which is a sub-scanning direction. The image former 40 is moved by a carriage 41 in a main scanning direction perpendicular to the transport direction 47 of the medium P. The reader 45 is, for example, a line sensor, and is disposed so as to be able to read an opposite surface (rear surface) on a side opposite to the recording surface (front surface) of the medium P. The reader 45 reads an opposite surface image of an image formation medium Q. The reader 45 is disposed on a downstream side of the image former 40. Note that another reader (not shown) is also disposed on the recording surface side of the medium P. A light source 46 is a linear light source that uniformly illuminates the medium P photographed by the reader 45.

[0017] The controller 10 is a CPU (Central Processing Unit) and executes a pass/fail determining program 31. Thereby, the controller 10 realizes functions of an image formation controller 11, a color solid generator 12, a determiner 13, a detection area creator 14, a fail operator 15, a log manager 16, and a display controller 17. Note that the detection area creator 14 indicated by a broken line will be described in a second embodiment (image formation device 101).

[0018] The image formation controller 11 controls the image former 40, the reader 45, and the like. The image formation controller 11 causes the image former 40 to execute a preliminary preparation process of forming an image of a color chart (first image) on the recording surface of the medium P (FIG. 2, FIG. 3A) which is a fabric, and an image formation process of forming a second image on the medium P according to a print job. This image formation process is also a pass/fail determination process in which the determiner 13 performs pass/fail determination of the image formation medium Q (FIG. 2, 4, 5). Here, for the color chart, for example, one in which single and mixed colors of YMCK are randomly and two-dimensionally arranged is used.

[0019] The color solid generator 12 generates a color solid of an opposite surface image (first opposite surface image) obtained by the reader 45 reading the image formation medium Q (first image formation medium) on which the image of the color chart (first image) is formed. The color solid is, for example, one in which color coordinates of each pixel are three-dimensionally expressed by an L*a*b* color system. Note that this color solid may be expressed by an RGB color system

or may be expressed by an XYZ color system.

[0020] The determiner 13 determines that it is a non-defective product when color coordinates of all pixels in the opposite surface image (second opposite surface image) of the image formation medium Q (second image formation medium) for which the image is formed in the pass/fail determination process are inside the color solid. Conversely, the determiner 13 determines that it is a defective product when color coordinates of any pixel of the opposite surface image (second opposite surface image) of the image formation medium Q (second image formation medium) are outside the color solid.

[0021] The fail operator 15 comprises a temporary stopper 15a and a notifier 15b. The temporary stopper 15a temporarily stops image formation when the determiner 13 determines a failure. The notifier 15b notifies a user of occurrence of a failure when the determiner 13 determines a failure. Further, the fail operator 15 temporarily stops image formation when a degree of abnormality is large, and notifies the user of occurrence of a failure when the degree of abnormality is small. The fail operator 15 causes the temporary stopper 15a or the notifier 15b to function according to a selection by the user. The log manager 16 records and outputs, for example, a log including an abnormality occurrence position. The display controller 17 controls a display (display operation panel 50). For example, the display controller 17 causes the display operation panel 50 to display a defect detection result and a defective portion.

[0022] The volatile memory 20 is a RAM (Random Access Memory) and is used as a working memory. The volatile memory 20 stores, for example, an opposite surface image (first opposite surface image 21, second opposite surface image 22) read by the reader 45 and a color solid 23. Note that a color range 24 indicated by a broken line will be described in a third embodiment. The non-volatile memory 30 stores, for example, the pass/fail determining program 31 to be executed by the controller 10. Further, the non-volatile memory 30 also stores a color solid 32, a color range 34 described in the third embodiment, and a detection area 33 described in the second embodiment.

[0023] FIG. 3A is a diagram showing a state in which liquid droplets are discharged onto the recording surface of the medium P.

[0024] The medium P is one in which a pretreatment material Pb is applied to (impregnated into) a fabric Pa. The pretreatment material Pb adjusts a penetration amount of the liquid droplets 60 discharged onto the fabric Pa. By the pretreatment material Pb, the penetration amount into the opposite surface is reduced as compared with an impregnation amount of the liquid droplets 60 on the recording surface of the fabric Pa. Note that the medium P on which an image is formed is referred to as the image formation medium Q.

[0025] FIG. 3B is a diagram showing an example of a

recording surface image and an opposite surface image of the image formation medium Q.

[0026] On the recording surface of the image formation medium Q, the image of the above-described color chart (first image) is formed. In the recording surface image 61, pixels of a plurality of colors (YMCK) are randomly and two-dimensionally arranged. The opposite surface image 62 in which the liquid droplets 60 (FIG. 3A) have permeated to the opposite surface of the medium P has a lighter color and a narrower color range than the recording surface image 61 observed on the recording surface of the image formation medium Q (first image formation medium).

[0027] In inkjet printing, printing is performed by discharging minute ink droplets onto a fabric. A fabric, which is a recording medium printed by an inkjet method, is usually coated with a chemical called a pretreatment agent. This pretreatment agent adjusts the penetration amount of ink discharged onto the fabric to prevent bleeding. By this pretreatment, the ink on the fabric has a smaller penetration amount to the opposite surface as compared with the penetration amount to the recording surface. Therefore, it is known that the pattern of the printing surface permeating from the opposite surface becomes lighter in color and narrower in color range than the pattern of the printing surface observed from the recording surface of the fabric.

[0028] FIG. 3C is a diagram showing an example of a color solid of the recording surface image and the opposite surface image of the image formation medium Q.

[0029] The color solid is, for example, a three-dimensional plot of color coordinates (a^* , b^* , L^*) of pixels. A color solid 611 of the recording surface image 61 (upper part of FIG. 3B) is shown by a thin line, and color coordinates of pixels are within a closed space. A color solid 621 of the opposite surface coordinates 62 (lower part of FIG. 3B) is shown by a thick line and is arranged outside the color solid shown by the thin line. Note that a chromaticity function a^* is calculated using luminance values of green (G) and red (R). Further, a chromaticity function b^* is calculated using luminance values of blue (B) and yellow (Y).

[0030] FIG. 4 is an example of the opposite surface image of the image formation medium Q, showing an abnormal state in which a large amount of liquid droplets are discharged to one location of the recording surface of the medium.

[0031] A central portion 63 is an abnormal portion where a large amount of liquid droplets have bled out to the opposite surface. An outer peripheral portion 64 of the abnormal portion is a normally printed part, and the recording surface image 61 is only bled out slightly.

[0032] Dripping of ink occurs when a large ink droplet condensed and grown on an inkjet head suddenly falls onto a fabric. The liquid droplet amount of this large liquid droplet is much larger than the liquid droplet amount discharged during a normal printing operation, exceeds an allowable amount of pretreatment applied

to the fabric, and penetrates and bleeds into the opposite surface. Therefore, on the opposite surface, there is a characteristic that the color of the dripping occurrence part protrudes from the color range of the normally printed part.

[0033] In the present invention, in order to solve the above problems, characteristics of an image of the opposite surface on the side opposite to the recording surface of the fabric are used without using the image of the recording surface as a teacher. The image formation device 100 prints in advance a color chart that can express the color range of the printer, and acquires the color range and the color solid of the opposite surface of the chart. Thereafter, the image formation device 100 executes a print job. When an image of the print job is normally formed, the color range of the opposite surface image, which is the side opposite to the recording surface, does not go out of the color range of the opposite surface image of the color chart acquired in advance. On the other hand, when dripping of ink to the fabric occurs, it has a feature of being outside the color range of the opposite surface image acquired by printing the color chart in advance. The image formation device 100 can detect a printing abnormality on the fabric by determining this.

[0034] By the way, it is also possible to detect a printing abnormality based on the recording surface image of the medium (fabric). However, in the case of a fabric, a pattern may be drawn before image formation. For example, it is a case where the image formation device 100 newly forms an image of a character, a characteristic, or the like on a fabric on which a pattern (first image) is drawn. In such a case, even if dripping occurs, a color difference between the dripping image and the original pattern is small, and the controller 10 cannot detect the dripping on the recording surface. Even in a fabric on which a pattern is printed on the recording surface, the pattern on the opposite surface is thin or almost plain. Therefore, the controller 10 easily detects a printing abnormality due to dripping based on the opposite surface image.

[0035] FIG. 5 is a diagram showing an example of a color solid of the opposite surface image in an abnormal state.

[0036] The left diagram is an opposite surface image similar to FIG. 4, and the central portion 63 (FIG. 4) is an abnormal portion where a large amount of liquid droplets have bled out. Its outer peripheral portion 64 (FIG. 4) is a normally printed part, and the recording surface image is slightly bled out. The thick line in the right diagram is a color solid of the normally printed part, which is similar to the thick line in FIG. 3C. A black dot (a^* approx. -100, b^* approx. 50, L^* approx. 55) in the right diagram is color coordinates (representative value) of the abnormal portion, and is arranged outside the color solid of the thick line. That is, the controller 10 of the image formation device 100 can determine pass/fail of the image formation medium based on

whether it is inside or outside the color solid.

[0037] FIGS. 6A and 6B are flowcharts for explaining the operation of the image formation device 100 of the present embodiment. FIG. 6A shows a flow of preliminary preparation, and FIG. 6B shows a flow of pass/fail determination.

[0038] In the preliminary preparation (FIG. 6A), the controller 10 of the image formation device 100 causes the image former 40 (FIG. 1) to form an image of a color chart (first image) (first image formation) (step S1). For this color chart, for example, one in which YMCK colors are randomly and two-dimensionally arranged is used. After the process of step S1, the controller 10 causes the reader 45 (FIG. 1) to read an opposite surface image (first opposite surface image) of the image formation medium Q (first image formation medium) (step S2). After the process of step S2, the controller 10 generates a color solid 23 (FIG. 1) of the read first opposite surface image (step S3) and stores it in the non-volatile memory 30 as a color solid 32.

[0039] FIG. 7 is an explanatory diagram for explaining a method of generating a color solid.

[0040] (a) is an opposite surface image (first opposite surface image) of the image formation medium Q (first image formation medium) in which the image of the color chart (first image) is formed on the medium P. (b) is a three-dimensional plot of color coordinates (a^* , b^* , L^*) of each pixel of the first opposite surface image. (c) is a closed curved surface of minimum size in which all three-dimensionally plotted pixels are included. This closed curved surface is the color solid 23, 32.

[0041] In the pass/fail determination (FIG. 6B), the controller 10 causes the image former 40 to form an image (second image) on the medium P with job data (second image formation) (step S11). Thereby, the image formation medium Q (second image formation medium) is created. After the process of step S11, the controller 10 causes the reader 45 to read an opposite surface image (second opposite surface image) of the image formation medium Q (second image formation medium) (step S12). After the process of step S12, the controller 10 determines whether all pixels of the second opposite surface image are inside the color solid 23, 32 generated in step S3 or whether a part of the second opposite surface image goes outside (step S13).

[0042] If all pixels of the second opposite surface image are inside the color solid ("inside color solid" in step S13), the controller 10 performs pass determination (step S14) and ends the process. On the other hand, if even a part of the second opposite surface image is outside the color solid ("outside color solid" in step S13), the controller 10 considers that a large amount of liquid droplets have been discharged and performs fail determination (step S15). Furthermore, the controller 10 performs a fail operation (step S16) and ends the process.

[0043] FIG. 8 is a diagram (1) showing an example of

a display screen displayed on the display operation panel.

[0044] A display screen 210 comprises a preview area 211, a log display 212, a past abnormality occurrence image confirmation window 213, and a setting window 214. The preview area 211 is a display area for displaying a photographing result (for example, an opposite surface image) read by the reader 45. The photographing result is updated in real time, and an abnormal portion is highlighted. The log display 212 displays a log regarding abnormality occurrence such as abnormality occurrence time, occurrence position, and degree of abnormality occurrence. The past abnormality occurrence image confirmation window 213 displays an abnormality occurrence image (for example, FIG. 4) when an abnormality occurred in the past. In the setting window 214, various settings are performed.

[0045] FIG. 9 is a diagram (2) showing an example of a display screen displayed on the display operation panel.

[0046] A display screen 220 comprises a preview area 221 and a status area 222. In the preview area 221, a preview of an abnormality that occurred in the past is displayed. In the status area 222, a status of an image being previewed is displayed.

[0047] As described above, the image formation device 100 of the present embodiment executes the pass/fail determination process after the preliminary preparation process. In the preliminary preparation, the image formation device 100 generates the color solid 23, 32 of the opposite surface image (first opposite surface image) of the image formation medium Q (first image formation medium) in which the image of the color chart (first image) is formed on the fabric (medium P). In the pass/fail determination, the image formation device 100 forms an image (second image) on the fabric (medium P) by a print job, and acquires the opposite surface image (second opposite surface image) of the image formation medium Q (second image formation medium). Furthermore, the image formation device 100 considers as an abnormal state in which a large amount of liquid droplets are discharged when color coordinates of any pixel of the second opposite surface image are outside the color solid 23, 32, and determines that a defective product has occurred. Conversely, the image formation device 100 determines that it is a non-defective product when color coordinates in all pixels of the second opposite surface image are inside the color solid 23, 32.

(Second Embodiment)

[0048] In the first embodiment, when color coordinates of an opposite surface image exist outside a color solid, it was considered as an abnormal state in which a large amount of liquid droplets were discharged. Therefore, even when color coordinates ex-

isted slightly outside the color solid, it was considered as an abnormal state. In the present embodiment, when color coordinates exist slightly outside the color solid, it is determined as a normal state.

[0049] The configuration of an image formation device 101 (FIG. 1) of the present embodiment is similar to the configuration of the first embodiment. However, the image formation device 101 is different in that a controller 10 comprises a detection area creator 14 (FIG. 1) indicated by a broken line, and a non-volatile memory 30 is provided with a storage area for a detection area 33. The detection area creator 14 slightly expands the color solid 23, 32 (FIG. 1) generated by the color solid generator 12. Thereby, a determination criterion (threshold) of a determiner 13 is moved slightly outside the color solid 23, 32. The detection area creator 14 creates the detection area 33 using a threshold of a degree of abnormality that can be set by a user. Note that this threshold (not shown) is stored in the non-volatile memory 30.

[0050] FIG. 10 is an explanatory diagram for explaining a method of determining the detection area 33.

[0051] (a) is the color solid 23, 32 (color solid of opposite surface image) described in the first embodiment. The detection area 33 is obtained by expanding and swelling the color solid 23, 32 at a predetermined magnification K (for example, $K = 1.1$ to 1.2). When color coordinates of a pixel of a second opposite surface image are outside the detection area 33, it is considered that a large amount of liquid droplets have been discharged, and it is determined to be an abnormal state. On the other hand, the present embodiment is different from the first embodiment in that even if it is outside the color solid 23, 32, it is determined to be normal when it is inside the detection area 33.

[0052] FIGS. 11A and 11B are flowcharts for explaining an operation of a second embodiment of the present invention.

[0053] Steps S21 to S23 of the preliminary preparation (FIG. 11A) are the same as steps S1 to S3 of the above embodiment. After the process of step S23 (that is, after color solid generation), the controller 10 determines a detection area (step S24) and stores it in the non-volatile memory 30 as a detection area 33 (FIG. 1).

[0054] Steps S31, S32, S34, S35, and S36 of the pass/fail determination (FIG. 11B) are similar to steps S11, S12, S14, S15, and S16 of the above embodiment. However, after the process of step S32 (after reading the second opposite surface image), the controller 10 is different in that it determines whether the second opposite surface image is inside or outside the detection area 33. That is, when color coordinates of the second opposite surface image are inside the detection area ("inside detection area" in step S33), the controller 10 performs pass determination of the image formation medium Q (step S34). On the other hand, when the color coordinates of the second opposite surface image are outside the detection area ("outside de-

tection area" in step S33), the controller 10 performs fail determination of the image formation medium Q (step S35) and performs a fail operation (step S36).

[0055] As described above, in the image formation device 101 (FIG. 1) of the present embodiment, when the color coordinates of the second opposite surface image are outside the color solid 23, 32 and inside the detection area 33, it is determined to be normal. Further, the detection area 33 is obtained by expanding and swelling the color solid 23, 32 at a predetermined magnification (for example, 1.1 to 1.2 times). Therefore, even if there is an error in photographing the first opposite surface image or the second opposite surface image, the image formation medium Q that should be determined as a non-defective product is not determined as a defective product.

(Third Embodiment)

[0056] In each of the above embodiments, the color solid 23, 32 of the opposite surface image of the image formation medium Q in which the image of the color chart (first image) was formed was generated. In the present embodiment, a color range is used instead of the color solid.

[0057] The configuration of an image formation device 102 (FIG. 1) of the present embodiment is similar to that of the first embodiment. However, a volatile memory 20 has an area for storing a color range 24 instead of the color solid 23. Further, a non-volatile memory 30 has an area for storing a color range 34 instead of the color solid 23. Here, the color range is often expressed as an area in a CIE 1931 xy chromaticity diagram or as an RGB color range. However, since an actual color range also relates to brightness, a complete color range may be expressed in a three-dimensional space.

[0058] FIGS. 12A and 12B are flowcharts for explaining an operation of the image formation device in a third embodiment of the present invention.

[0059] Steps S41 and S42 of a preparation stage (FIG. 12A) are the same as steps S1 and S2 of the above embodiment. After the process of step S42 (that is, after reading the first opposite surface image), the controller 10 determines a color range (step S43) and stores it in the non-volatile memory 30 as a color range 34.

[0060] Steps S51, S52, S54, S55, and S56 of the pass/fail determination (FIG. 12B) are similar to steps S11, S12, S14, S15, and S16 of the above embodiment. However, after the process of step S32, the controller 10 is different in that it determines whether or not the second opposite surface image read in step S32 is inside or outside the color range 34.

[0061] That is, when color coordinates of the second opposite surface image are inside the color range 34 ("inside color range" in step S53), the controller 10 determines that the image formation medium Q is a non-

defective product (step S54). On the other hand, when the color coordinates of the second opposite surface image are outside the color range 34 ("outside color range" in step S53), the controller 10 determines that the image formation medium Q is a defective product (step S55) and performs a fail operation (step S56).

[0062] As described above, when any pixel of the second opposite surface image is outside the color range 34, the image formation device 102 of the present embodiment considers as an abnormal state in which a large amount of liquid droplets are discharged, and determines that a defective product has occurred. Conversely, when all pixels of the second opposite surface image are inside the color range 34, the image formation device 102 performs pass determination.

(Modification)

[0063] The present invention is not limited to each of the above embodiments, and modifications can be made without departing from the spirit of the present invention. For example, there are modifications such as the following (a) to (c).

(a) In each of the above embodiments, on the premise that there is a large liquid droplet, it was determined to be abnormal when it was outside the color range or outside the color solid, but pass/fail determination can be performed based on a magnitude of a difference between the first opposite surface image and the second opposite surface image even if it is within the color range or inside the color solid.

(b) In the first and second embodiments, the first opposite surface image 21 and the color solid 23 were stored in the volatile memory 20 at the preliminary preparation stage. In contrast, at the preliminary preparation stage, an area for storing only the first opposite surface image 21 may be provided in the volatile memory 20, and the color solid 23 may be created using the first opposite surface image 21 when performing pass/fail determination. In other words, memories of the volatile memory 20 and the non-volatile memory 30 may be provided with an area for storing in advance any one or both of the first opposite surface image 21 and the color solid 23 thereof of the first image formation medium in which the first image (image of the color chart) is formed on the recording surface of the medium P.

(c) In the third embodiment, the controller 10 may be provided with a color range memory controller that saves any one or both of the first opposite surface image and the color range thereof for each of the medium P, the type of the liquid droplets, and the printing mode.

[0064] Although embodiments of the present inven-

tion have been described and illustrated in detail, the disclosed embodiments are made for purposes of illustration and example only and not limitation. The scope of the present invention should be interpreted by terms of the appended claims.

Claims

1. An image formation device (100) comprising:

an image former (40) that discharges liquid droplets onto a recording surface of a medium (P) to form an image;

a reader (45) that reads an opposite surface image on a side opposite to the recording surface of an image formation medium (Q) on which the image is formed on the recording surface of the medium (P) by the image former (40); and

a determiner (13) that determines pass/fail of the image formation medium (Q) based on the opposite surface image read by the reader (45).

2. The image formation device (100) according to claim 1, wherein

the reader (45) reads the opposite surface image on the side opposite to the recording surface during transport of the image formation medium (Q) on which the image is formed on the recording surface of the medium (P) by the image former (40).

3. The image formation device (100) according to claim 1, further comprising

a memory (20, 30) that stores in advance any one or both of a first opposite surface image (21) of a first image formation medium (Q) in which a first image is formed on the recording surface and a color range thereof, wherein the reader (45) reads a second opposite surface image (22) of a second image formation medium (Q) in which a second image is formed by the image former (40) on the recording surface of the medium (P), and the determiner (13) compares a color range of the first opposite surface image (21) with a color range of the second opposite surface image (22) to determine pass/fail of the second image formation medium (Q).

4. The image formation device (100) according to claim 3, wherein

the determiner (13) determines the second image formation medium (Q) to be a failure when the color range of the second opposite surface image (22) is not inside the color range of the first opposite

surface image (21).

5. The image formation device (100) according to claim 1, further comprising

a memory (20, 30) that stores in advance any one or both of a first opposite surface image (21) of a first image formation medium (Q) in which a first image is formed on the recording surface and a color solid thereof, wherein the reader (45) further reads a second opposite surface image (22) of a second image formation medium (Q) in which a second image is formed by the image former (40) on the recording surface of the medium (P), and the determiner (13) determines pass/fail of the second image formation medium (Q) based on whether or not color coordinates of the second opposite surface image (22) are inside the color solid of the first opposite surface image (21).

6. The image formation device (100) according to any one of claim 3 to claim 5, wherein the determiner (13) determines pass/fail of the second image formation medium (Q) being transported.

7. The image formation device (100) according to claim 5, further comprising a detection area creator (14) that creates a detection area which is an area for expanding the color solid of the first opposite surface image (21).

8. The image formation device (100) according to claim 7, wherein the memory (20, 30) stores a threshold of a degree of abnormality that can be set by a user, and the detection area creator (14) creates the detection area using the threshold.

9. The image formation device (100) according to claim 1, further comprising a fail operator (15) that temporarily stops image formation when the determiner (13) determines a failure.

10. The image formation device (100) according to claim 1, further comprising

a fail operator (15) comprising a temporary stopper (15a) that temporarily stops image formation and a notifier (15b) that notifies a user of occurrence of a failure when the determiner (13) determines a failure, wherein the fail operator (15) causes the temporary stopper (15a) to function when a degree of abnormality is large, and causes the notifier (15b) to function when the degree of abnormality is

small.

11. The image formation device (100) according to claim 1, further comprising
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a fail operator (15) comprising a temporary stopper (15a) that temporarily stops image formation and a notifier (15b) that notifies a user of occurrence of a failure when the determiner (13) determines a failure, wherein
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the fail operator (15) causes the temporary stopper (15a) to function when a degree of abnormality is large and causes the notifier (15b) to function when the degree of abnormality is small, and
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the fail operator (15) causes the temporary stopper (15a) or the notifier (15b) to function according to a selection by the user.
12. The image formation device (100) according to claim 1, further comprising a log manager (16) that records and outputs an abnormality occurrence position. 20
13. The image formation device (100) according to claim 2, further comprising a color range memory controller that saves any one or both of the first opposite surface image (21) and the color range thereof for each of the medium (P), a type of the liquid droplets, and a printing mode. 25
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14. A pass/fail determining method executed by a controller of an image formation device (100) comprising an image former (40) that discharges liquid droplets onto a recording surface of a medium (P) to form an image, and a reader (45) that reads an image of an image formation medium (Q) on which the image is formed by the image former (40), wherein
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the reader (45) reads an opposite surface image on a side opposite to the recording surface of the medium (P), and
pass/fail of the image formation medium (Q) is determined based on the opposite surface image read by the reader (45). 45
15. A pass/fail determining program (31) for causing a controller of an image formation device (100) comprising an image former (40) that discharges liquid droplets onto a recording surface of a medium (P) to form an image, and a reader (45) that reads an image of an image formation medium (Q) on which the image is formed by the image former (40), to execute steps of: 50
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causing the reader (45) to read an opposite surface image on a side opposite to the re-

cording surface of the medium (P); and causing pass/fail of the image formation medium (Q) to be determined based on the opposite surface image read by the reader (45).

FIG. 1
100,101,102

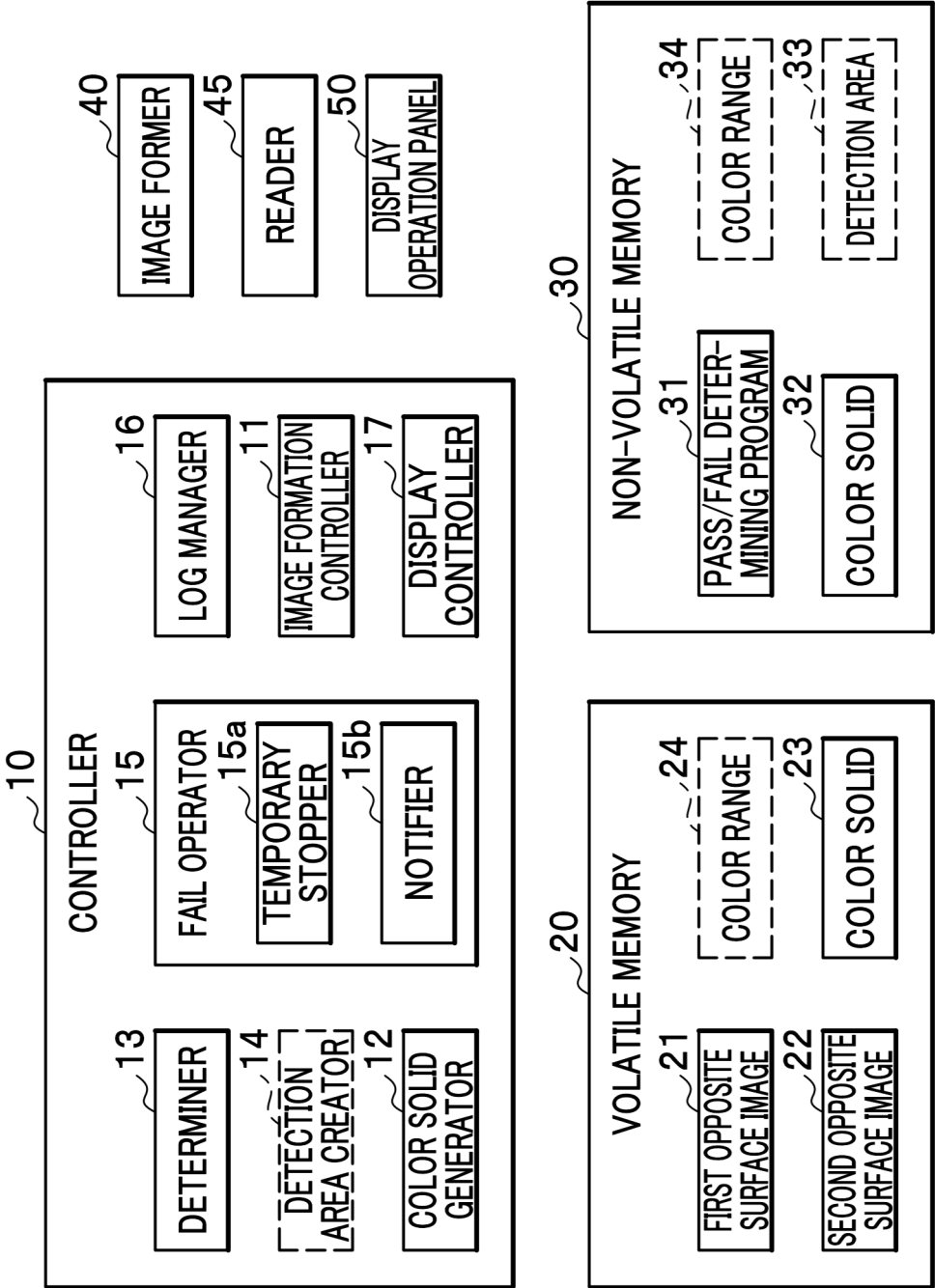


FIG. 2

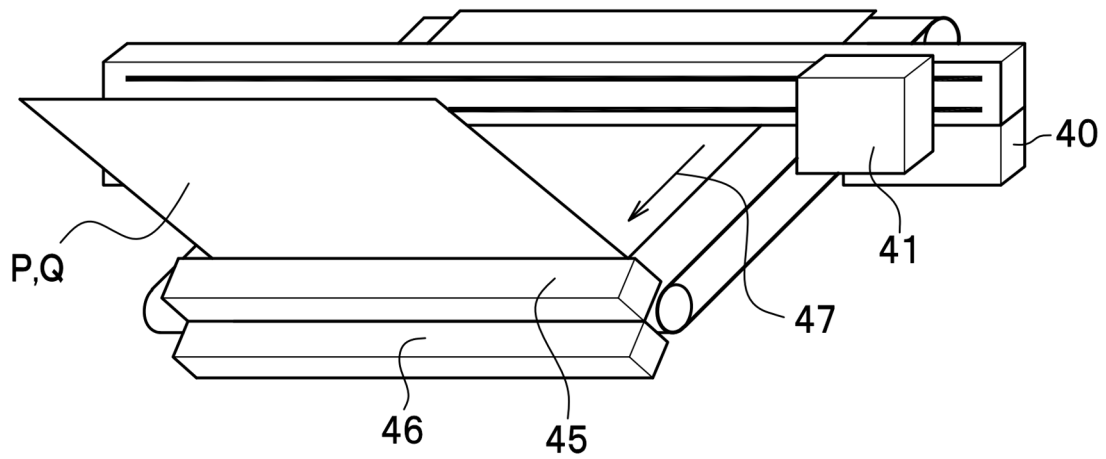


FIG. 3A

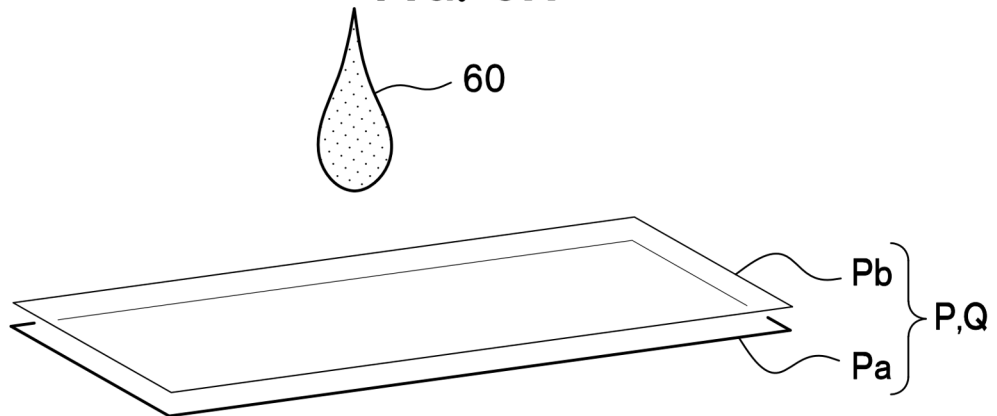


FIG. 3B

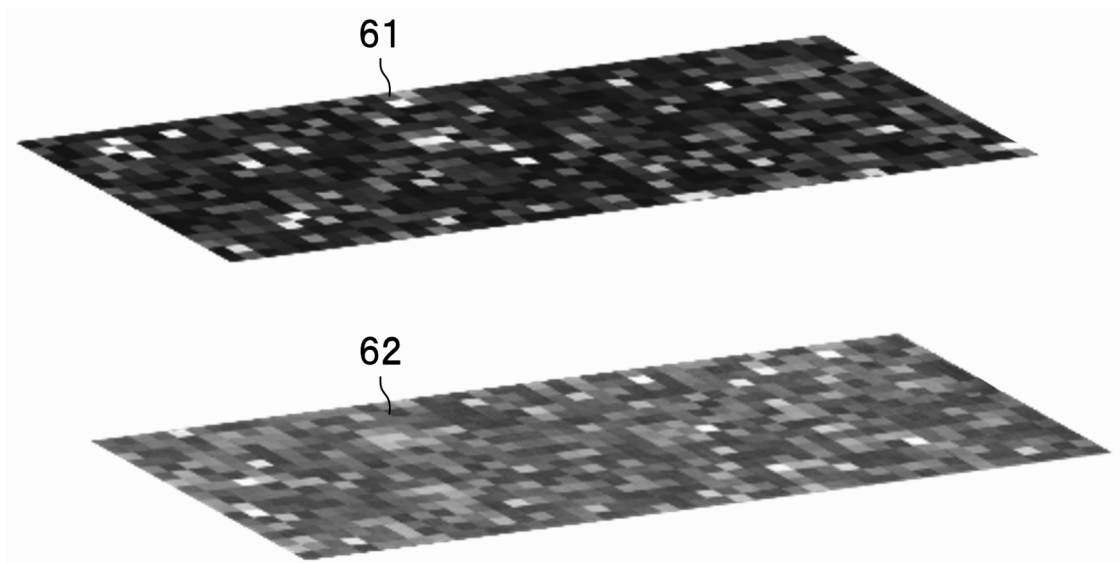


FIG. 3C

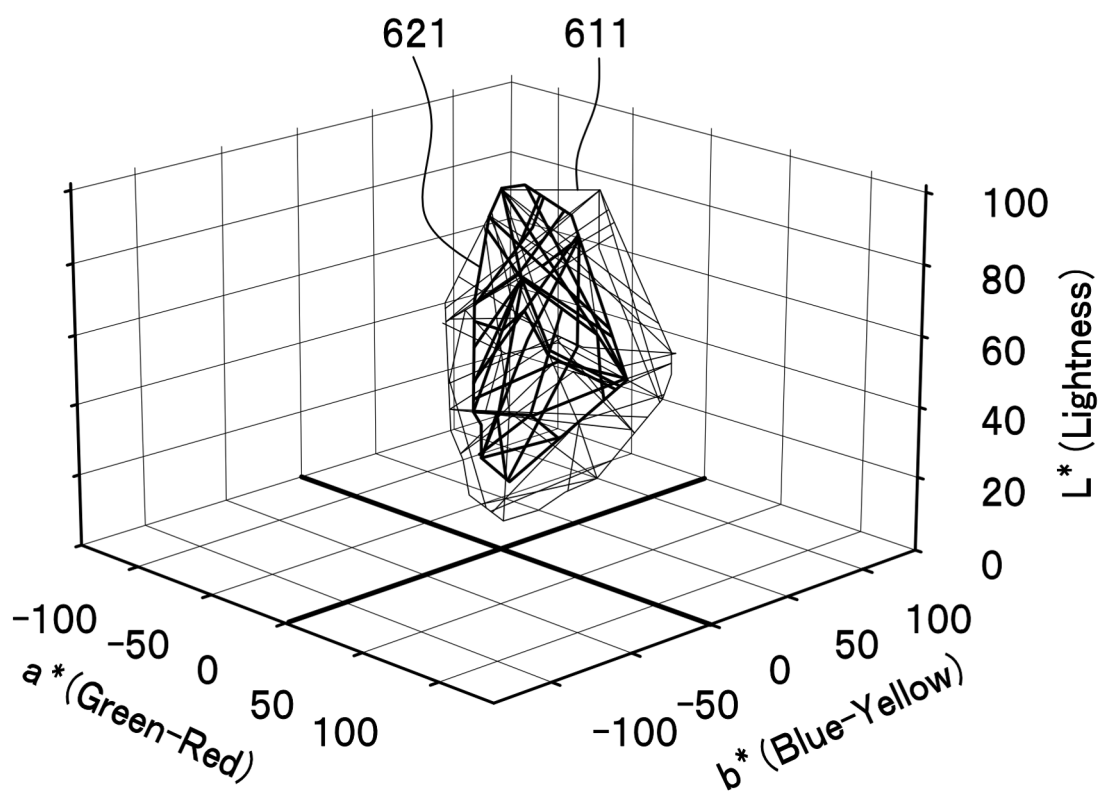


FIG. 4

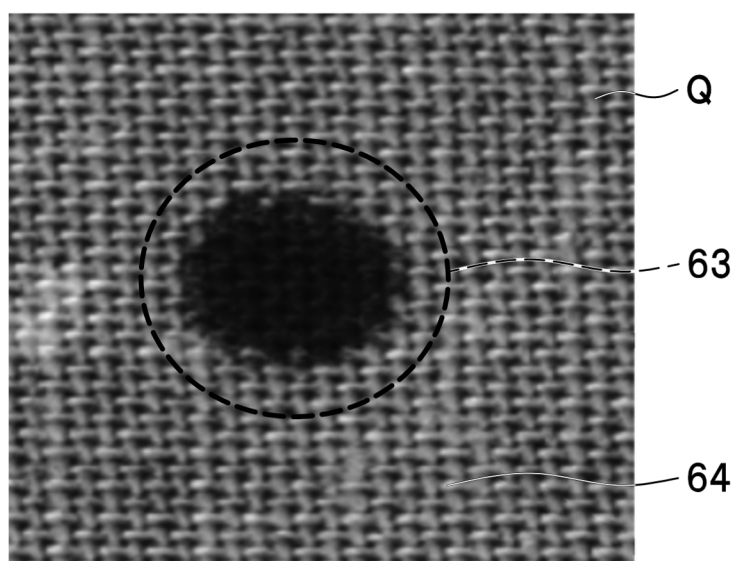


FIG. 5

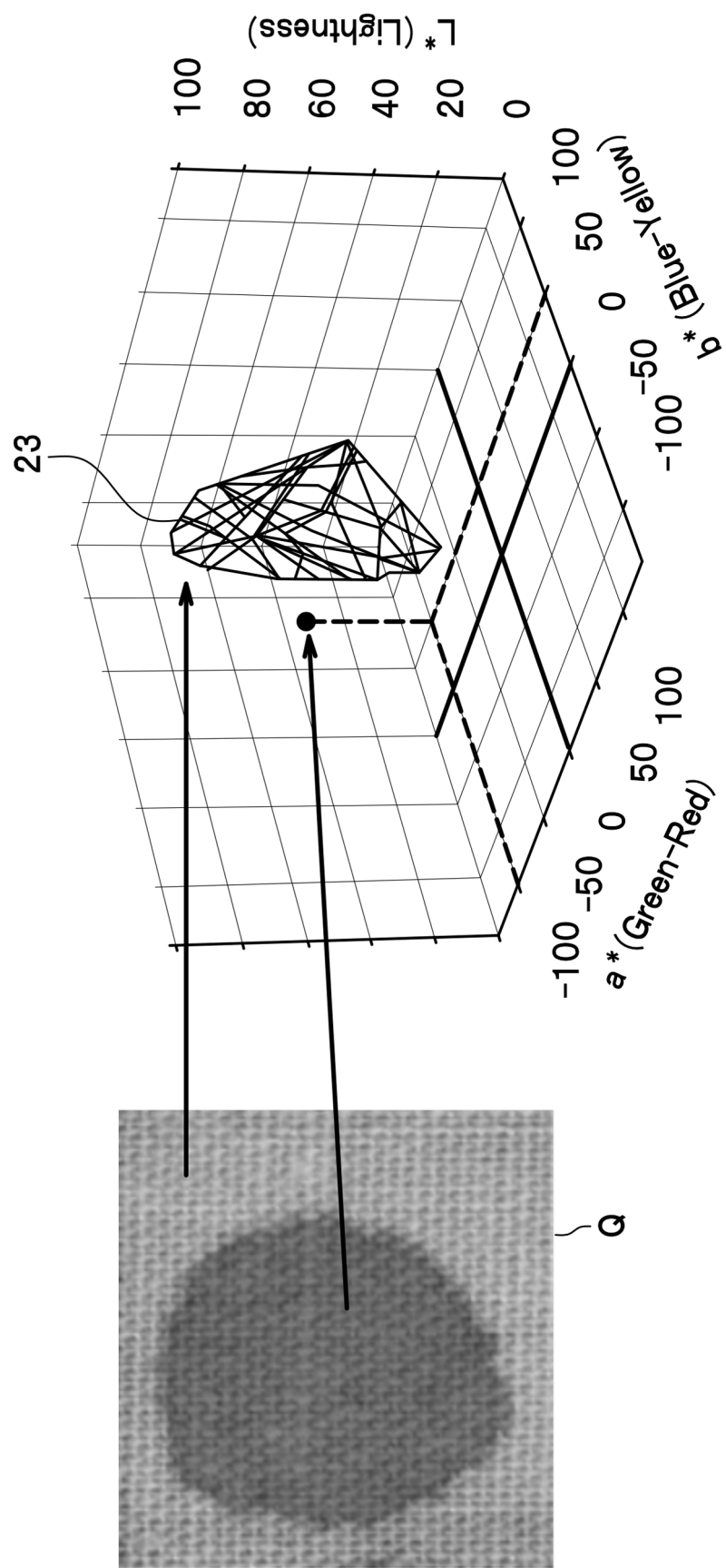


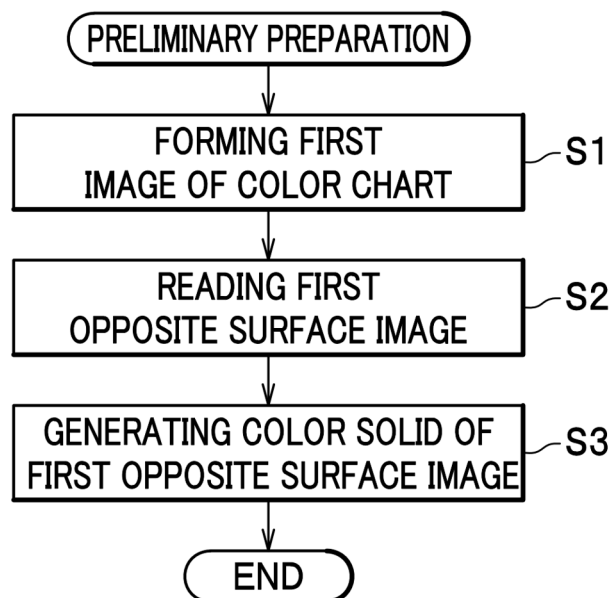
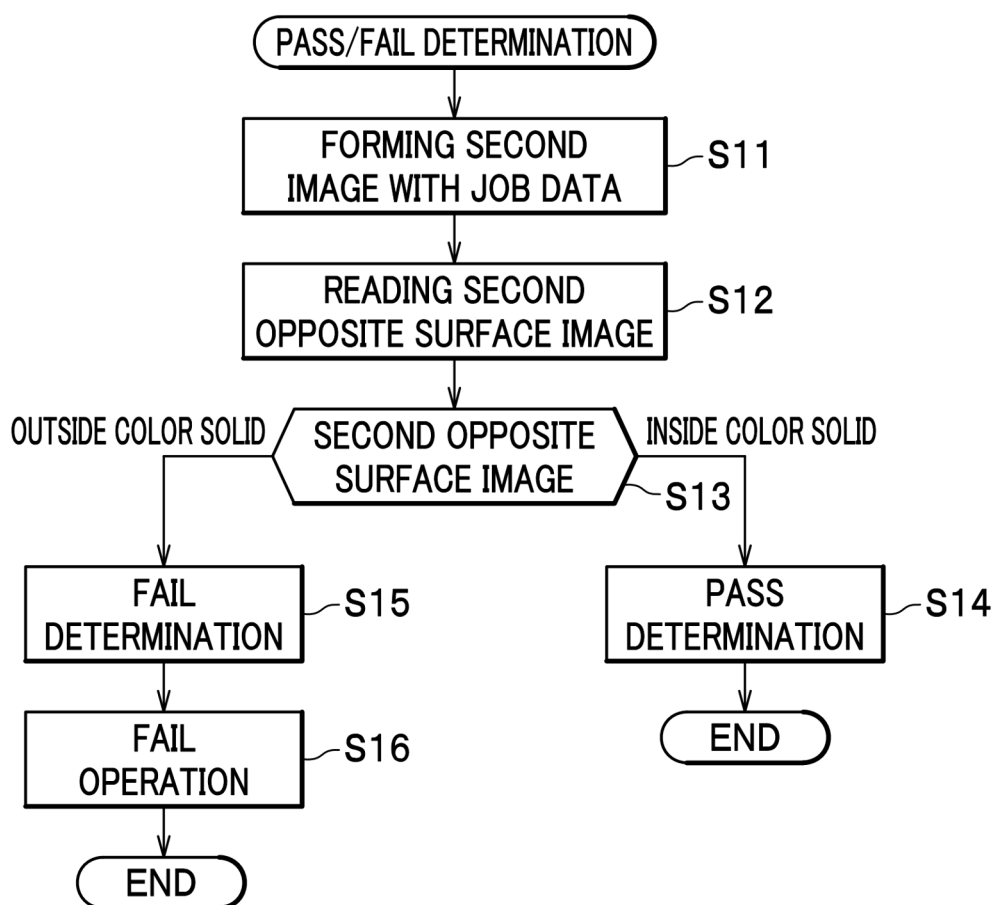
FIG. 6A**FIG. 6B**

FIG. 7

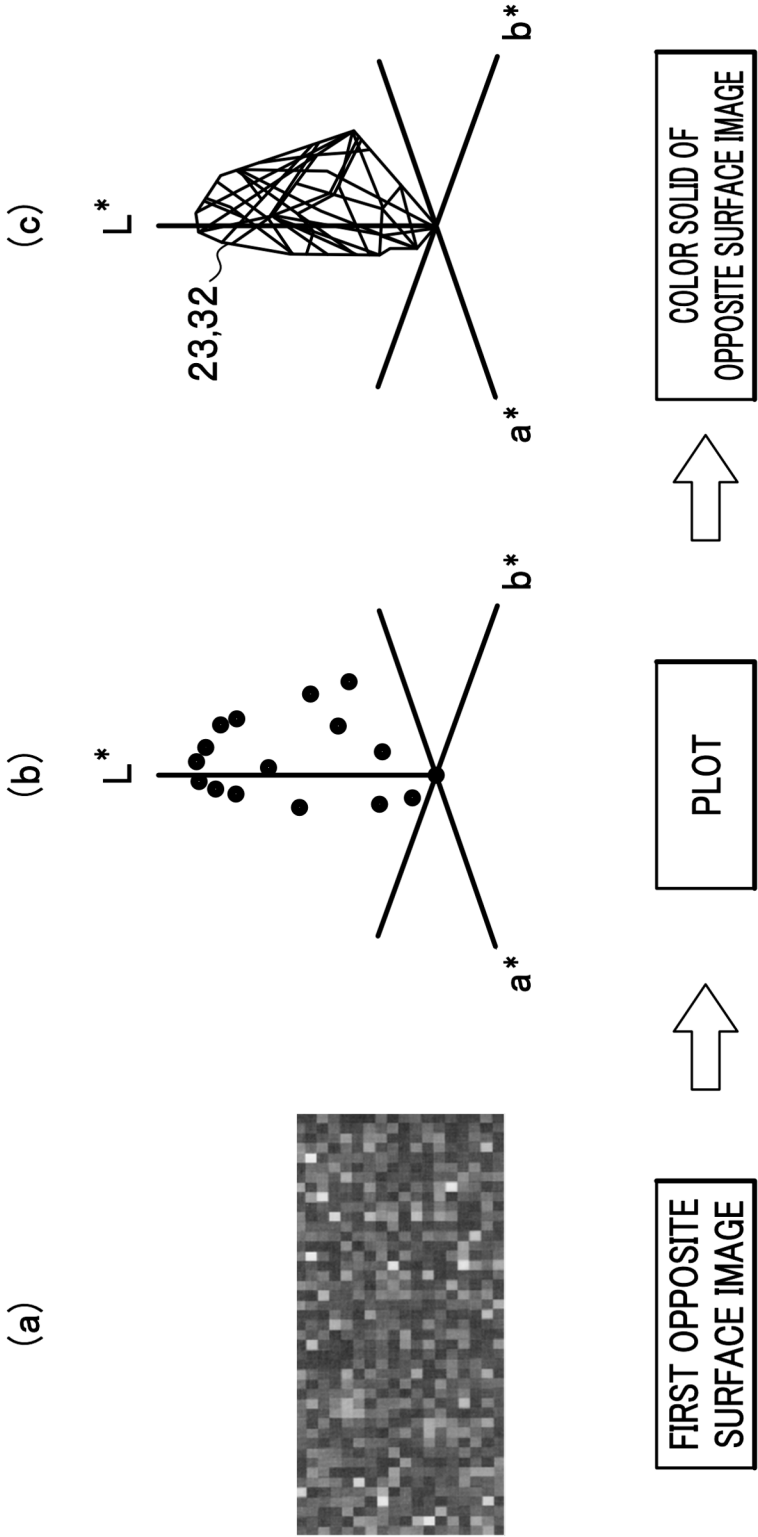


FIG. 8

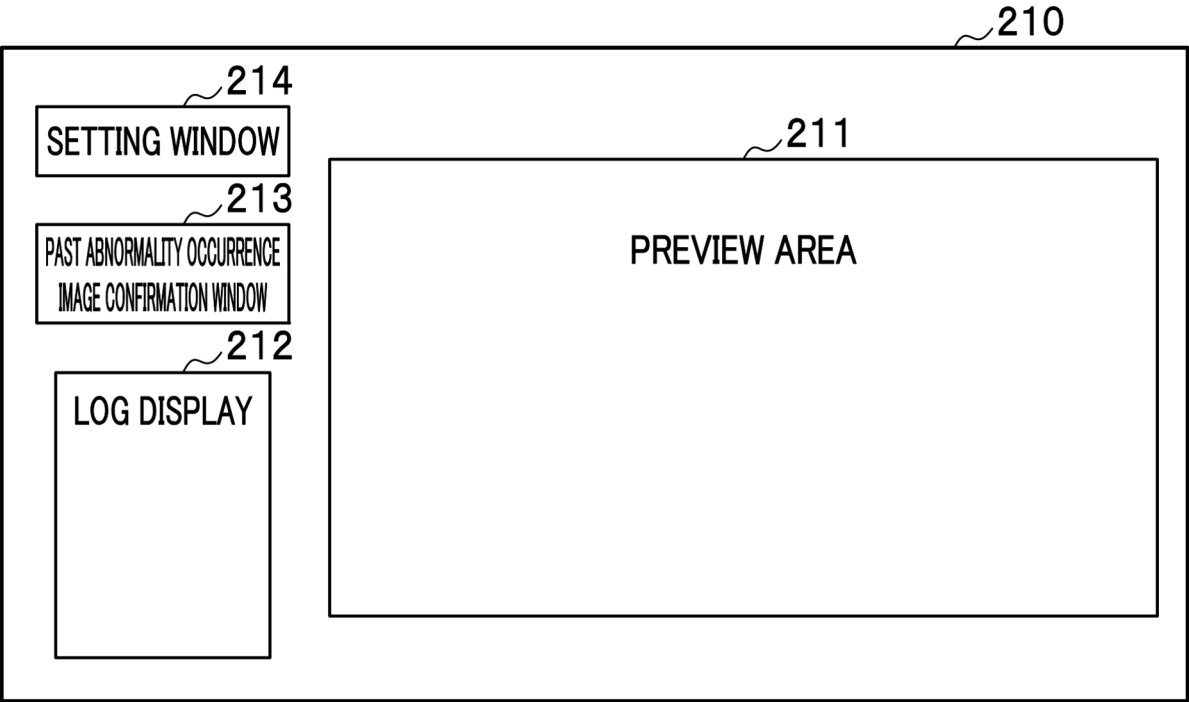


FIG. 9

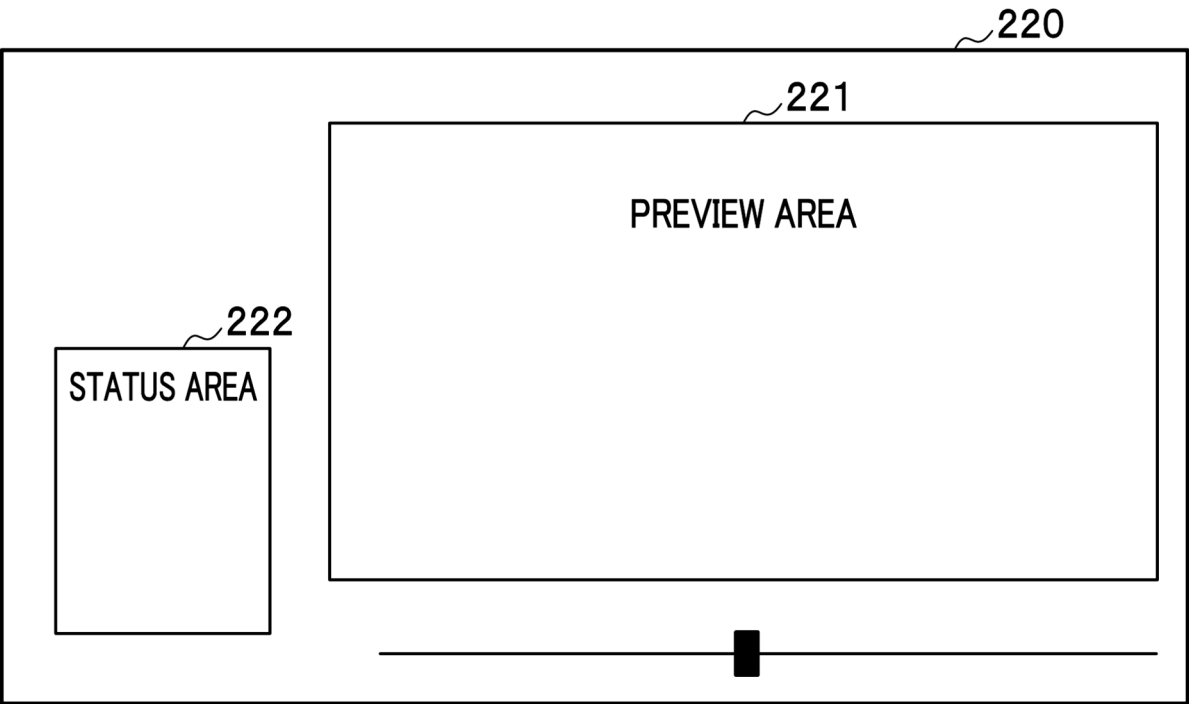


FIG. 10

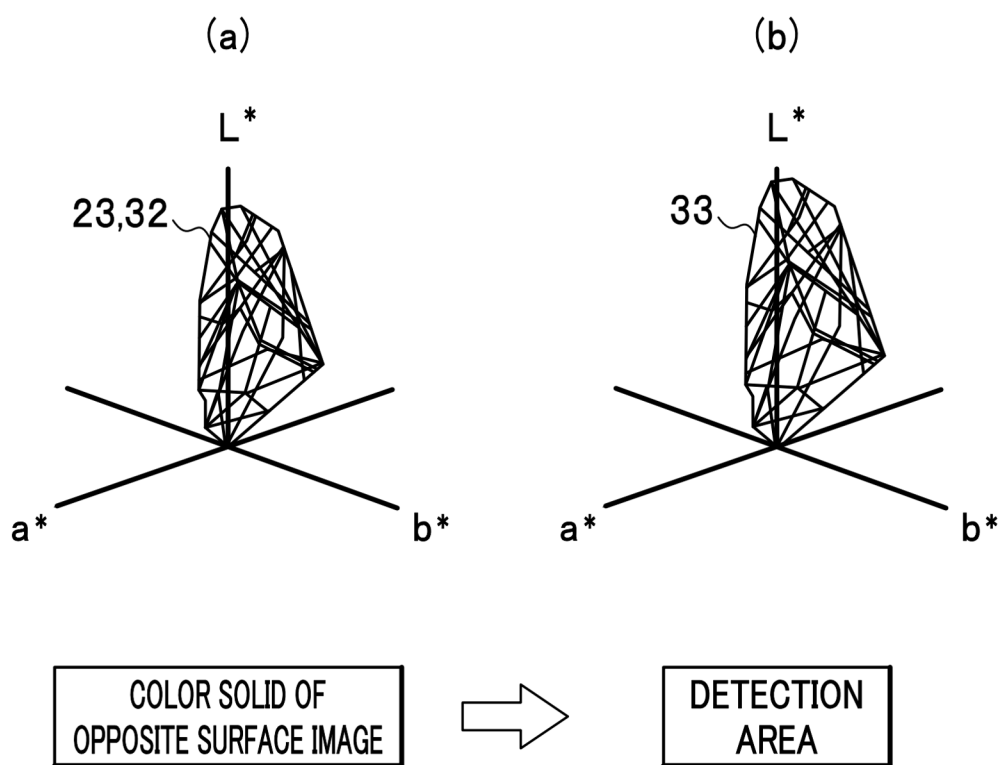


FIG. 11A

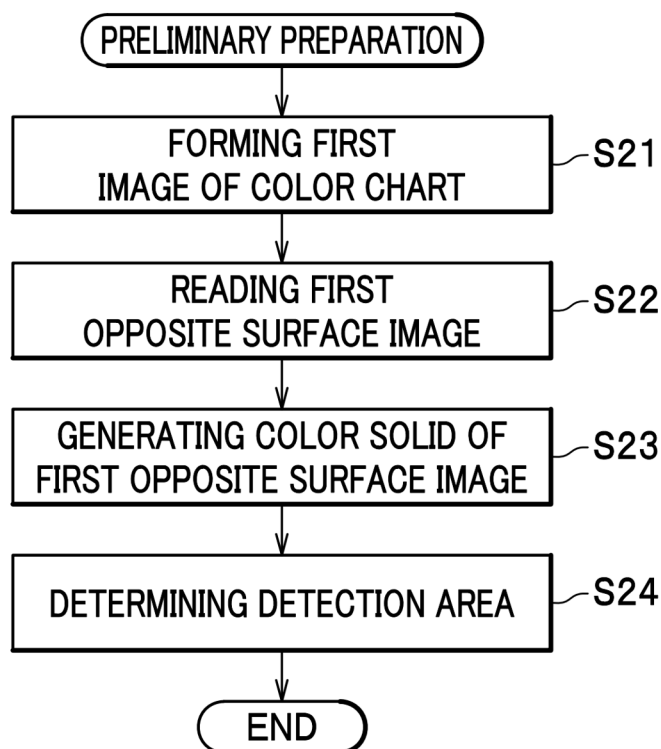


FIG. 11B

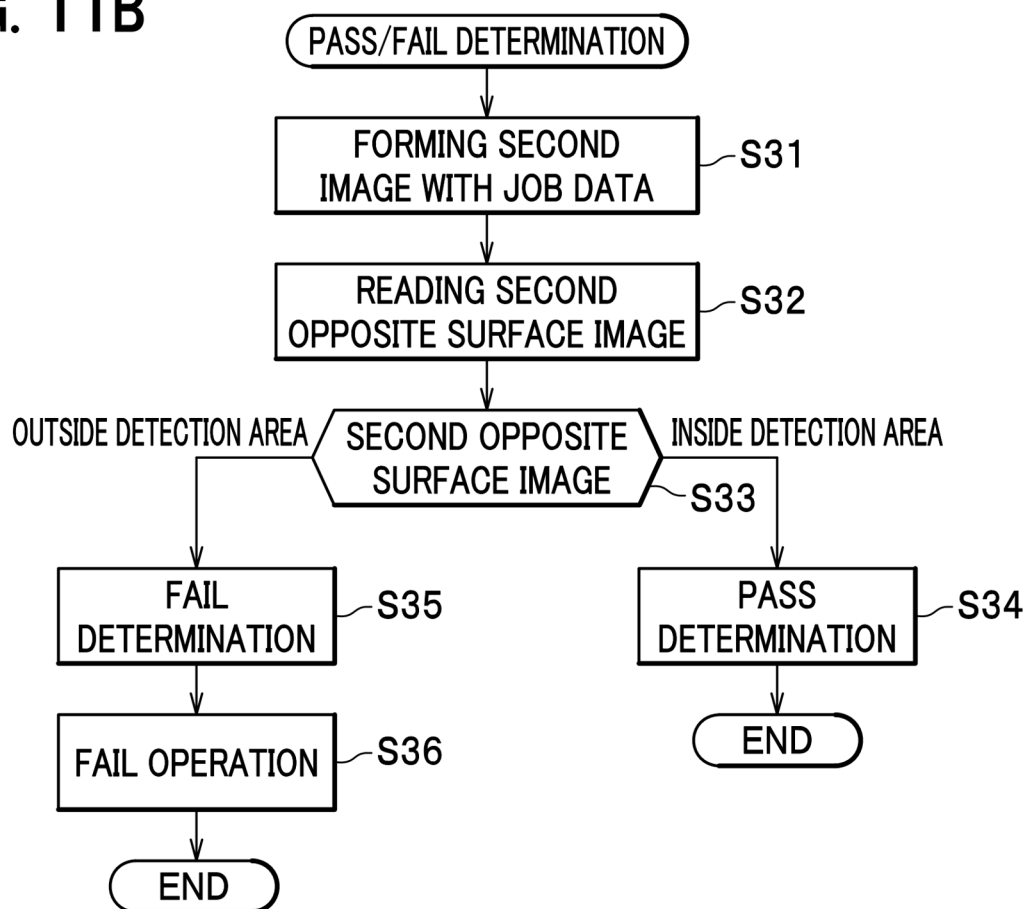
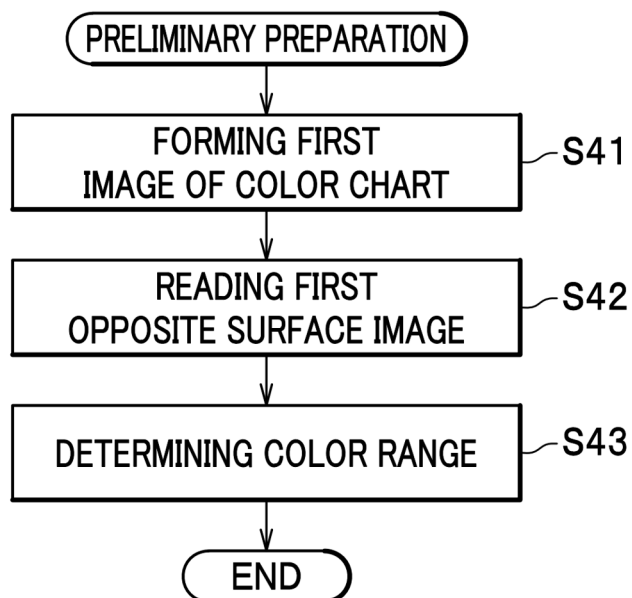
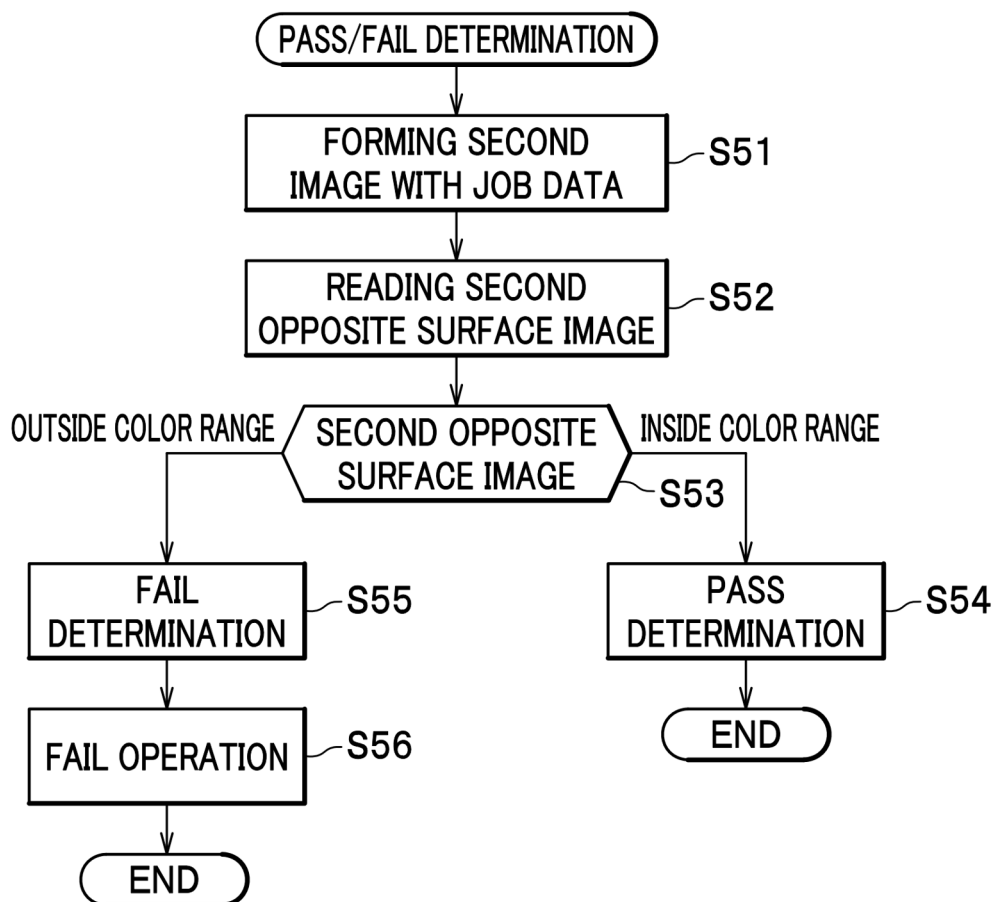


FIG. 12A**FIG. 12B**



EUROPEAN SEARCH REPORT

Application Number

EP 26 17 2100

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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The Hague		17 August 2026	Dewaele, Karl
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