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(71) Applicant: **Fujifilm Business Innovation Corp.**
Tokyo 107-0052 (JP)

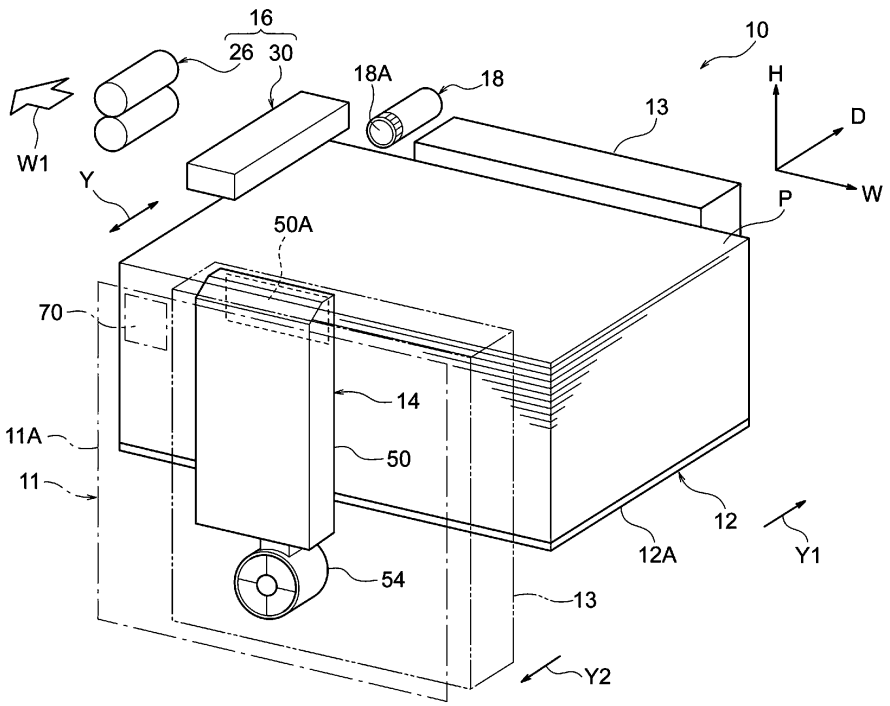
(72) Inventors:
- **ARAKI, Yuichi**
  Ebina, 243-0494 (JP)
- **HORIKAWA, Kazuhiko**
  Yokohama, 220-8668 (JP)
- **YONESAKA, Ryosuke**
  Yokohama, 220-8668 (JP)

(74) Representative: **Meissner Bolte Partnerschaft mbB**
Patentanwälte Rechtsanwälte
Postfach 86 06 24
81633 München (DE)

(54) **MEDIUM LOADING SYSTEM AND IMAGE FORMING SYSTEM**

(57) A medium loading system (10) includes: a supplier (14) that causes multiple loaded recording media to levitate and be separated from each other by supplying air to the recording media from an edge of the recording media; an image capturing unit (18) that captures an image of the recording media from the edge of the multiple recording media supplied with the air from the supplier; an image capturing target (70) other than the recording media, the image capturing target being a target to be image-captured by the image capturing unit; and a processor (41) configured to detect an abnormality in the image capturing unit in accordance with a change between multiple captured images of the image capturing target captured by the image capturing unit.

FIG. 2



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Description

Background

(i) Technical Field

[0001] The present disclosure relates to medium loading systems and image forming systems.

(ii) Related Art

[0002] A sheet feeding device according to Japanese Unexamined Patent Application Publication No. 2015-24868 includes: a placement section on which a sheet bundle including multiple vertically-stacked sheets is placeable; an air blower that causes at least an uppermost sheet of the sheet bundle to levitate by blowing air onto the sheet bundle placed on the placement section; a suction/transport unit that is provided above the placement section and that suctions the uppermost sheet levitated by the air blower and transports the uppermost sheet in a predetermined transport direction; a first light source that outputs strip-like first slit light having a vertically-extending component and intersecting at least a first edge of a first sheet of the multiple levitated sheets and a second edge of a second sheet located below the first sheet; an image capturing unit that captures an image of the first slit light radiated onto the first sheet and the second sheet and that has an image capturing direction different from the output direction of the first slit light from the first light source in a plane parallel to the first sheet and the second sheet; a calculator that calculates a vertical distance between the first sheet and the second sheet based on the first slit light image-captured by the image capturing unit; and an airflow adjuster that adjusts the airflow from the air blower based on the vertical distance between the first sheet and the second sheet calculated by the calculator.

Summary

[0003] A conceivable medium loading system includes a supplier that causes multiple loaded recording media to levitate and be separated from each other by supplying air to the recording media from an edge of the recording media, and also includes an image capturing unit that captures an image of the recording media from the edge of the multiple recording media supplied with the air from the supplier.

[0004] In this medium loading system, if an abnormality in the image capturing unit (e.g., damage or foreign matter on a component of the image capturing unit) is undetected and neglected, an image capturing failure occurs when the image capturing unit captures the image of the recording media from the edge of the multiple recording media.

[0005] Accordingly, it is an object of the present disclosure to suppress the image capturing failure occurring when the image capturing unit captures the image of the recording media from the edge of the multiple recording media, as compared with a case where the abnormality in the image capturing unit is neglected.

[0006] According to a first aspect of the present disclosure, there is provided a medium loading system comprising: a supplier that causes a plurality of loaded recording media to levitate and be separated from each other by supplying air to the recording media from an edge of the recording media; an image capturing unit that captures an image of the recording media from the edge of the plurality of recording media supplied with the air from the supplier; an image capturing target other than the recording media, the image capturing target being a target to be image-captured by the image capturing unit; and a processor configured to detect an abnormality in the image capturing unit in accordance with a change between a plurality of captured images of the image capturing target captured by the image capturing unit.

[0007] According to a second aspect of the present disclosure, in the first aspect, the processor may be configured to detect the abnormality in the image capturing unit in accordance with the change between the plurality of captured images captured in a state where the supplier has stopped supplying the air to the recording media.

[0008] According to a third aspect of the present disclosure, in the second aspect, when the processor does not detect the abnormality in the image capturing unit, the supplier may start supplying the air to the recording media, and the image capturing unit may capture the image of the recording media from the edge of the plurality of recording media supplied with the air from the supplier.

[0009] According to a fourth aspect of the present disclosure, in the second or third aspect, the image capturing target may be disposed opposite the image capturing unit relative to a position where the recording media supplied with the air from the supplier are disposed.

[0010] According to a fifth aspect of the present disclosure, in any one of the first to fourth aspects, the supplier may adjust a supply amount of the air in accordance with a distance between the plurality of recording media image-captured by the image capturing unit, and the supplier may be configured not to execute an adjustment of the supply amount of the air if the processor detects the abnormality in the image capturing unit.

[0011] According to a sixth aspect of the present disclosure, in any one of the first to fifth aspects, the image capturing target may be a component of the medium loading system.

[0012] According to a seventh aspect of the present disclosure, in the sixth aspect, the image capturing target may be the component having a hole.

[0013] According to an eighth aspect of the present disclosure, in any one of the first to seventh aspects, the image capturing target may be a target image provided

on a component of the medium loading system.

[0014] According to a ninth aspect of the present disclosure, in the eighth aspect, the target image may have a bright area and a dark area having a boundary with the bright area.

[0015] According to a tenth aspect of the present disclosure, the medium loading system according to any one of the first to ninth aspects may further comprise a moving mechanism that moves the image capturing target between an image capturing position and a retraction position, the image capturing position being where the image capturing unit captures an image of the image capturing target, the retraction position being where the image capturing target has retracted from the image capturing position.

[0016] According to an eleventh aspect of the present disclosure, in the tenth aspect, the moving mechanism may set the image capturing target at the image capturing position where the image capturing unit is in focus when the image capturing unit is to capture the image of the image capturing target, and the moving mechanism may set the image capturing target at the retraction position when the image capturing unit is to capture the image of the recording media.

[0017] According to a twelfth aspect of the present disclosure, the medium loading system according to any one of the first to eleventh aspects may further comprise a notifier that notifies a user of information indicating that the processor has detected the abnormality when the processor detects the abnormality.

[0018] According to a thirteenth aspect of the present disclosure, in the twelfth aspect, the information that the user is notified of by the notifier may be information prompting the user to replace or clean the image capturing unit or a component of the image capturing unit.

[0019] According to a fourteenth aspect of the present disclosure, in any one of the first to thirteenth aspects, the processor may have a dedicated mode for detecting the abnormality in the image capturing unit in accordance with a user command.

[0020] According to a fifteenth aspect of the present disclosure, there is provided an image forming system comprising the medium loading system according to any one of the first to fourteenth aspects and an image forming unit that forms an image onto a recording medium fed from the medium loading system.

[0021] In the configuration according to the first aspect, an image capturing failure occurring when the image capturing unit captures the image of the recording media from the edge of the plurality of recording media may be suppressed, as compared with a case where the abnormality in the image capturing unit is neglected.

[0022] In the configuration according to the second aspect, erroneous detection occurring when the processor detects the abnormality in the image capturing unit may be suppressed, as compared with a case where the processor detects an abnormality in the image capturing unit in accordance with a change between captured images captured in a state where the supplier is supplying the air to the recording media.

[0023] In the configuration according to the third aspect, an image capturing failure occurring when the image capturing unit captures the image of the recording media from the edge of the plurality of recording media may be suppressed, as compared with a case where the image capturing unit captures the image of the recording media from the edge of the plurality of recording media regardless of whether or not the processor has detected the abnormality in the image capturing unit.

[0024] In the configuration according to the fourth aspect, the image capturing direction in which the image capturing unit captures the image of the recording media from the edge of the plurality of recording media and the image capturing direction in which the image capturing unit captures the image of the image capturing target may be aligned with each other.

[0025] In the configuration according to the fifth aspect, an adjustment failure of the supply amount may be suppressed, as compared with a case where the supplier adjusts the supply amount of the air regardless of whether or not the processor has detected the abnormality in the image capturing unit.

[0026] In the configuration according to the sixth aspect, the number of components may be reduced, as compared with a case where the image capturing target is provided separately from the components of the medium loading system.

[0027] In the configuration according to the seventh aspect, erroneous detection occurring when the processor detects the abnormality in the image capturing unit may be suppressed, as compared with a case where the image capturing target is a component not having a hole.

[0028] In the configuration according to the eighth aspect, the disposition of the image capturing target is flexible, as compared with a case where the image capturing target is a component of the medium loading system.

[0029] In the configuration according to the ninth aspect, erroneous detection occurring when the processor detects the abnormality in the image capturing unit may be suppressed, as compared with a case where the target image does not have the boundary between the bright area and the dark area.

[0030] In the configuration according to the tenth aspect, when the image capturing unit does not capture an image of the image capturing target, the image capturing target may be less likely to become a hindrance, as compared with a case where the image capturing target is always set at the image capturing position.

[0031] In the configuration according to the eleventh aspect, an image capturing failure occurring when the image capturing unit captures the image of the image capturing target may be suppressed, as compared with a case where the image capturing target is set at an image capturing position where the image capturing unit is out of focus when the image capturing unit is to capture the

image of the image capturing target.

[0032] In the configuration according to the twelfth aspect, the user may recognize that there is an abnormality in the image capturing unit.

[0033] In the configuration according to the thirteenth aspect, the user may resolve the abnormality in the image capturing unit.

[0034] In the configuration according to the fourteenth aspect, an image capturing failure occurring when the image capturing unit captures the image of the recording media from the edge of the plurality of recording media may be suppressed, as compared with a case where the abnormality in the image capturing unit is detected exclusively at a predetermined timing.

[0035] In the configuration according to the fifteenth aspect, an image capturing failure occurring when the image capturing unit captures the image of the recording media from the edge of the plurality of recording media may be suppressed, as compared with a case where the abnormality in the image capturing unit is neglected.

Brief Description of the Drawings

[0036] An exemplary embodiment of the present disclosure will be described in detail based on the following figures, wherein:

Fig. 1 schematically illustrates an image forming apparatus according to an exemplary embodiment;
Fig. 2 is a perspective view illustrating a medium feeding device according to this exemplary embodiment;
Fig. 3 is a cross-sectional view illustrating a supplier in the medium feeding device according to this exemplary embodiment;
Fig. 4 is a cross-sectional view illustrating a state where multiple sheet members are being supplied with air in the configuration illustrated in Fig. 3;
Fig. 5 is a block diagram illustrating a hardware configuration of a controller of the medium feeding device according to this exemplary embodiment;
Fig. 6 is a block diagram illustrating an example of a functional configuration of the controller of the medium feeding device according to this exemplary embodiment;
Fig. 7 is a side view illustrating sheet members supplied with the air from the supplier and an image capturing target provided on a side plate of a device body in the medium feeding device according to this exemplary embodiment;
Fig. 8 is a side view illustrating the sheet members to which the supplier has stopped supplying the air and the image capturing target provided on the side plate of the device body in the medium feeding device according to this exemplary embodiment;
Fig. 9 is a flowchart illustrating the flow of an abnormality detection process executed in the medium feeding device according to this exemplary embodiment;
Fig. 10 is a flowchart according to a modification, illustrating the flow of the abnormality detection process executed in the medium feeding device according to this exemplary embodiment;
Figs. 11A to 11C schematically illustrate a moving mechanism included in a medium feeding device according to a modification;
Fig. 12 schematically illustrates a modification where the image capturing target is provided on a suction unit;
Fig. 13 schematically illustrates a modification where the suction unit is used as the image capturing target; and
Fig. 14 schematically illustrates a modification where the side plate having a hole is used as the image capturing target.

Detailed Description

[0037] An example of an exemplary embodiment of the present disclosure will be described below with reference to the drawings. An arrow H denoted in each drawing indicates an up-down direction (vertical direction) of an apparatus, an arrow W indicates a width direction (horizontal direction) of the apparatus, and an arrow D indicates a depth direction (horizontal direction) of the apparatus.

Image Forming Apparatus 100

[0038] An image forming apparatus 100 forms an image onto a sheet member P, and includes a medium feeding device 10 and an image forming unit 102, as illustrated in Fig. 1. The medium feeding device 10 may be provided in advance in an apparatus body 101 of the image forming apparatus 100, or may be optionally added and attached to the apparatus body 101 of the image forming apparatus 100. The sheet member P is an example of a recording medium. The medium feeding device 10 is an example of a medium loading system. The image forming apparatus 100 is an example of an image forming system.

Image Forming Unit 102

[0039] The image forming unit 102 illustrated in Fig. 1 is a component that forms an image onto the sheet member P fed from the medium feeding device 10. For example, the image forming unit 102 used is of an electrophotographic type that forms an image onto the sheet member P by using toner.

[0040] An electrophotographic image forming unit forms an image onto the sheet member P by performing, for example, charging, exposure, developing, transfer, and fixing steps. In detail, for example, an electrophotographic image forming unit forms an image onto a transfer body by performing charging, exposure, developing, and transfer steps, transfers the image from the transfer

body to the sheet member P, and subsequently fixes the image onto the sheet member P, thereby forming the image on the sheet member P.

[0041] The example of the image forming unit is not limited to the electrophotographic image forming unit mentioned above, and may be any of various image forming units, such as an inkjet image forming unit. For example, an inkjet image forming unit forms an image onto the sheet member P by ejecting ink droplets from an ejector onto the sheet member P.

Medium Feeding Device 10

[0042] The medium feeding device 10 illustrated in Fig. 1 feeds the sheet member P toward the image forming unit 102. As illustrated in Fig. 2, the medium feeding device 10 includes a loading section 12, a feeding unit 16, a camera 18, and an image capturing target 70. Furthermore, as illustrated in Figs. 2, 3, and 4, the medium feeding device 10 includes a side guide 13 and a supplier 14. Moreover, as illustrated in Fig. 5, the medium feeding device 10 includes a controller 40. The camera 18 is an example of an image capturing unit.

Loading Section 12 and Side Guide 13

[0043] The loading section 12 is a component on which the sheet member P is loaded. As illustrated in Fig. 2, the loading section 12 includes a bottom plate 12A on which multiple sheet members P are loaded in a stacked state in the up-down direction, and also includes an ascending-descending device (not illustrated) that causes the bottom plate 12A to ascend and descend in the up-down direction. The ascending-descending device causes the bottom plate 12A to ascend such that the position of an uppermost sheet member P of the sheet members P loaded on the bottom plate 12A is set at a predetermined height.

[0044] As illustrated in Fig. 2, the side guide 13 is a component that comes into contact with a lateral edge of the multiple sheet members P from a lateral side of the multiple sheet members P. In detail, the side guide 13 is disposed at each of opposite lateral edges of the sheet members P loaded on the bottom plate 12A. In other words, the side guide 13 is provided as a pair. The pair of side guides 13 come into contact with the opposite lateral edges (i.e., opposite edges of the sheet members P in the width direction (the direction of the arrow Y)) of the sheet members P loaded on the bottom plate 12A, so as to limit the position of the sheet members P in the width direction.

[0045] The loading section 12 is movable toward the lateral sides of the sheet members P relative to a device body 11. In detail, the loading section 12 is attached to the device body 11 (see Fig. 1) in a movable manner in the width direction (i.e., the direction of the arrow Y) of the sheet members P. The side guides 13 are provided at the loading section 12 and move together with the loading section 12.

[0046] In this exemplary embodiment, a user manually draws the loading section 12 including the side guides 13 out from the device body 11 (see Fig. 1) toward one side in the width direction (e.g., in the direction of an arrow Y1 in Fig. 2), refills the loading section 12 in the drawn state with sheet members P, and subsequently inserts the loading section 12 into the device body 11 toward the other side in the width direction (e.g., in the direction of an arrow Y2 in Fig. 2).

[0047] Furthermore, in this exemplary embodiment, when the loading section 12 is drawn out from the device body 11, the ascending-descending device causes the bottom plate 12A to descend to a lowermost position. When the loading section 12 is inserted into the device body 11, the ascending-descending device causes the bottom plate 12A to ascend.

Supplier 14

[0048] The supplier 14 is a component that supplies air toward an edge of the multiple sheet members P loaded on the loading section 12 to cause the sheet members P to levitate, thereby separating the sheet members P from one another. As illustrated in Fig. 2, for example, the supplier 14 is disposed inside one of the pair of side guides 13 (i.e., the one located toward the arrow Y2 in Fig. 2). As illustrated in Figs. 3 and 4, the supplier 14 includes a duct 50 having a supply port 50A and a blower 54 that supplies air into the duct 50.

[0049] As illustrated in Figs. 3 and 4, the duct 50 extends in the up-down direction. An area located at the upper end of the duct 50 and facing the loaded sheet members P is provided with the supply port 50A. As illustrated in Figs. 3 and 4, the blower 54 is disposed below the duct 50 and supplies air into the duct 50.

[0050] As illustrated in Fig. 4, in the supplier 14, the air supplied into the duct 50 by the blower 54 travels upward through the duct 50 and is supplied toward a lateral edge (i.e., an example of an edge) of the sheet members P via the supply port 50A. Then, the air is supplied between upper sheet members P of the multiple loaded sheet members P, so that multiple sheet members P levitate and become separated from one another.

[0051] In this exemplary embodiment, the supplier 14 supplies the air toward one lateral edge (i.e., the one located toward the arrow Y2 in Fig. 2) of the multiple sheet members P. However, the exemplary embodiment is not limited to this configuration. For example, as an alternative to or in addition to the one lateral edge (i.e., the one located toward the arrow Y2 in Fig. 2) of the multiple sheet members P, the supplier 14 may supply the air toward at least one of the other lateral edge (i.e., the one located toward the arrow Y1 in Fig. 2), the leading edge (i.e., the downstream edge in a feeding direction to be described later), and the trailing edge (i.e., the upstream edge in the feeding direction to be described later).

Feeding Unit 16

[0052] The feeding unit 16 is a component that feeds, in the feeding direction (see an arrow W1 in Fig. 2), an uppermost sheet member P separated by the supplier 14. In detail, as illustrated in Fig. 2, the feeding unit 16 is disposed above the uppermost sheet member P of the multiple sheet members P loaded on the bottom plate 12A of the loading section 12. The feeding unit 16 includes a suction unit 30 and a feed roller 26.

[0053] The suction unit 30 is disposed above a leading-edge area of the uppermost sheet member P in the loaded state. The suction unit 30 suctions the uppermost levitated sheet member P and moves the sheet member P in the suctioned state in the feeding direction (see the arrow W1 in Fig. 2), thereby transporting the sheet member P in the feeding direction.

[0054] The feed roller 26 is disposed in the feeding direction relative to the suction unit 30, receives the sheet member P transported by the suction unit 30, and feeds the received sheet member P toward the image forming unit 102 (see Fig. 1).

Camera 18

[0055] The camera 18 is a component that captures an image of the sheet members P from the edge of the multiple sheet members P supplied with the air from the supplier 14. As illustrated in Fig. 2, the camera 18 is disposed at a lateral side (i.e., the farther side in the depth direction D) relative to a lateral edge of the multiple sheet members P.

[0056] In this exemplary embodiment, the camera 18 captures, for example, a still image of the lateral edge of the sheet members P from one widthwise side (i.e., the farther side in the depth direction D) of the sheet members P. The camera 18 has a lens 18A that forms an image of the sheet members P. The lens 18A is disposed at an end of the camera 18 in the image capturing direction. The medium feeding device 10 includes a light source (not illustrated) that radiates light onto the lateral edge of the multiple sheet members P loaded on the loading section 12.

Image Capturing Target 70

[0057] The image capturing target 70 is to be image-captured by the camera 18 and is a target other than the sheet members P. The image capturing target 70 is disposed opposite the camera 18 relative to the position where the sheet members P supplied with the air from the supplier 14 are disposed. In detail, the image capturing target 70 is disposed at one widthwise side (i.e., the side located toward the arrow Y2 in Fig. 2) of the multiple sheet members P loaded on the loading section 12.

[0058] In this exemplary embodiment, the image capturing target 70 is disposed on a surface facing toward the arrow Y1 in Fig. 2 of a side plate 11A disposed toward the arrow Y2 in Fig. 2 relative to the side guide 13 located toward the arrow Y2 in Fig. 2. For example, the side plate 11A serves as a part of a frame in the device body 11 of the medium feeding device 10.

[0059] In this exemplary embodiment, the image capturing target 70 is fixed to the medium feeding device 10. Specifically, the image capturing target 70 is not movable and is positionally fixed.

[0060] As illustrated in Fig. 7, in this exemplary embodiment, in a state where the multiple sheet members P are levitating as a result of the air being supplied from the supplier 14 to the multiple sheet members P loaded on the loading section 12, the multiple sheet members P and the image capturing target 70 overlap each other, as viewed from the camera 18. On the other hand, as illustrated in Fig. 8, in a state where air is not supplied from the supplier 14 to the multiple sheet members P loaded on the loading section 12, the multiple sheet members P and the image capturing target 70 do not overlap each other, as viewed from the camera 18, and the multiple sheet members P are loaded below the image capturing target 70.

[0061] As illustrated in Fig. 8, in this exemplary embodiment, the image capturing target 70 is a target image provided on a component of the medium feeding device 10. The target image has bright areas 71 and dark areas 72 having boundaries 73 with the bright areas 71. In detail, examples of the target image that may be used include an image with a checkered pattern and a test chart given a geometric pattern. In the example illustrated in Fig. 8, the target image used as the image capturing target 70 is an image with a checkered pattern.

Display 35

[0062] A display 35 is an example of a notifier that notifies the user of presentation information to be presented to the user by displaying the presentation information. In detail, as will be described later, when a central processing unit (CPU) 41 detects an abnormality in the camera 18, the display 35 notifies the user of information (referred to as "abnormality information" hereinafter) indicating that the CPU 41 has detected the abnormality in the camera 18. The abnormality information provided to the user by the display 35 is information prompting the user to replace or clean the camera 18 or a component thereof (e.g., the lens 18A). Examples of the display 35 include a liquid crystal display and an organic electroluminescence (EL) display.

Controller 40

[0063] As illustrated in Fig. 5, the controller 40 has the CPU 41, a read only memory (ROM) 42, a random access memory (RAM) 43, a storage unit 44, and a communication interface (IF) 45. These components are connected to one another in a communicable manner by a bus 49. The CPU 41 is an example of a processor.

[0064] The CPU 41 is a central processing unit that executes various types of programs and controls each unit. The ROM 42 stores various types of programs, including a control program, and various types of data. The RAM 43 serves as a work area that temporarily stores a program or data. The storage unit 44 is a hard disk drive (HDD), a solid state drive (SSD), or a storage medium, such as a flash memory, and stores various types of programs, including an operating system, and various types of data. The control program may alternatively be stored in the storage unit 44.

[0065] The communication IF 45 is an interface for communicating with other components, such as the camera 18, the feeding unit 16, the blower 54, the image forming unit 102, and the display 35. The communication IF 45 communicates with the other components by utilizing a communication technique including wired communication, wireless communication, the Internet, and an intranet.

[0066] In the controller 40, the CPU 41 reads each type of program including the control program from the ROM 42 or the storage unit 44, and executes the program by using the RAM 43 as a work area. The CPU 41 executes the control program so as to control the operation of each unit of the medium feeding device 10. A functional configuration achieved in accordance with collaboration between the CPU 41 as a hardware resource and an information processing program as a software resource will be described below. Fig. 6 is a block diagram illustrating an example of the functional configuration of the controller 40 according to this exemplary embodiment.

[0067] In the controller 40, the CPU 41 executes the control program so as to function as a trigger acquisition unit 80, an image-capturing controller 81, an image acquisition unit 82, an abnormality detector 83, a supply controller 84, and a display controller 85, as illustrated in Fig. 6.

[0068] The trigger acquisition unit 80 acquires detection information indicating detection of a predetermined trigger. A trigger is an operation and a process in the medium feeding device 10 that cause an abnormality detection process to proceed. An example of a trigger is an insertion operation involving insertion of the loading section 12 into the device body 11. A predetermined trigger is detected by a detector (not illustrated), such as a detection sensor.

[0069] If the predetermined trigger is an insertion operation involving insertion of the loading section 12 into the device body 11, as mentioned above, when the detection sensor detecting that the loading section 12 has been inserted is provided in at least one of the loading section 12 and the device body 11 and detects the insertion, the detection sensor transmits detection information (i.e., a detection signal) to the trigger acquisition unit 80. Accordingly, the trigger acquisition unit 80 acquires the detection information indicating that the detector has detected the predetermined trigger.

[0070] The image-capturing controller 81 is a functional unit that controls the camera 18. When the trigger acquisition unit 80 acquires the detection information, the image-capturing controller 81 performs image-capturing control on the camera 18 for capturing an image of the image capturing target 70. The image-capturing control involves causing the camera 18 to capture an image of the image capturing target 70 in a state where the supplier 14 has stopped supplying air to the sheet members P.

[0071] The image acquisition unit 82 acquires information (referred to as "target image information" hereinafter) about an image of the image capturing target 70 captured by the camera 18.

[0072] The abnormality detector 83 performs an image analysis based on the target image information acquired by the image acquisition unit 82. The image analysis involves detecting an abnormality in the camera 18 in accordance with a change between multiple captured images of the image capturing target 70 captured by the camera 18. Therefore, in this exemplary embodiment, the abnormality detector 83 detects an abnormality in the camera 18 in accordance with a change between multiple captured images obtained in the state where the supplier 14 has stopped supplying air to the sheet members P.

[0073] Detailed examples of an abnormality in the camera 18 include damage and foreign matter on a component (e.g., the lens 18A) of the camera 18. An example of foreign matter on the component (e.g., the lens 18A) is extraneous matter (e.g., particles of the sheet members P (such as paper dust and paper powder)) adhered to the component.

[0074] In detail, the abnormality detector 83 detects an abnormality in the camera 18 in accordance with a difference (e.g., brightness, presence or absence of a distortion, presence or absence of a shadow, and presence or absence of a streak) between a preliminarily-captured reference image and a captured image subsequently captured at a predetermined timing (i.e., the detection timing of the aforementioned trigger). The reference image is captured at the time of, for example, shipment, installation, or first activation of the image forming apparatus 100 (i.e., the medium feeding device 10).

[0075] The supply controller 84 is a functional unit that controls the supplier 14. The supply controller 84 causes the supplier 14 to start supplying air to the sheet members P if the abnormality detector 83 does not detect an abnormality in the camera 18. In contrast, if the abnormality detector 83 detects an abnormality in the camera 18, the supply controller 84 does not execute an adjustment of the air supply amount. In detail, if the abnormality detector 83 detects an abnormality in the camera 18, the supply controller 84 does not activate the supplier 14 and maintains the supplier 14 in the stopped state.

[0076] The display controller 85 is a functional unit that controls the display 35. If the abnormality detector 83 detects an abnormality, the display controller 85 performs notification control on the display 35 for notifying the user of abnormality information indicating that the abnormality

detector 83 has detected the abnormality. The abnormality information may be information prompting the user to replace or clean the camera 18 or a component thereof (e.g., the lens 18A).

[0077] Furthermore, in this exemplary embodiment, in a state where the supplier 14 is supplying air to the sheet members P when the abnormality detector 83 does not detect an abnormality in the camera 18, the image-capturing controller 81 causes the camera 18 to capture an image of the multiple sheet members P. The supply controller 84 adjusts the supply amount from the supplier 14 and controls the stoppage and activation of the supplier 14 in accordance with the distance between the sheet members P image-captured by the camera 18.

[0078] Therefore, in this exemplary embodiment, when the abnormality detector 83 does not detect an abnormality in the camera 18, the supplier 14 starts supplying air to the sheet members P, and the camera 18 captures an image of the sheet members P from the edge of the multiple sheet members P supplied with the air from the supplier 14. Then, the supplier 14 adjusts the air supply amount in accordance with the distance between the multiple sheet members P image-captured by the camera 18. In contrast, if the abnormality detector 83 detects an abnormality in the camera 18, the supplier 14 does not execute the adjustment of the air supply amount. In other words, the supplier 14 is maintained in the stopped state without being activated.

[0079] As mentioned above, in the controller 40, the abnormality detector 83 detects an abnormality in the camera 18 in accordance with the difference between the reference image and the captured image. However, the configuration is not limited to this. For example, the abnormality detector 83 may detect an abnormality by performing a comparison between multiple captured images sequentially captured with a lapse of time. In this case, for example, a learned model obtained as a result of machine-learning image data of a captured image sequentially-captured in the past may receive an input of image data of a captured image captured after the past captured image, and a change from the past captured image may be detected, thereby detecting an abnormality in the camera 18.

Abnormality Detection Process in Medium Feeding Device 10

[0080] The abnormality detection process executed in the medium feeding device 10 will now be described. Fig. 9 is a flowchart illustrating an example of the flow of the abnormality detection process according to this exemplary embodiment.

[0081] This process is performed when the CPU 41 reads the control program from the ROM 42 or the storage unit 44 and executes the control program. For example, this process commences when the medium feeding device 10 is activated.

[0082] As illustrated in Fig. 9, in step S101, the CPU 41 determines whether or not a predetermined trigger (e.g., an insertion operation involving insertion of the loading section 12 into the device body 11) is detected. If the predetermined trigger is detected (YES in step S101), the CPU 41 proceeds to step S102. In contrast, if the predetermined trigger is not detected (NO in step S101), the CPU 41 repeats step S101 until the predetermined trigger is detected.

[0083] In step S102, the CPU 41 causes the camera 18 to capture an image of the image capturing target 70.

[0084] In step S103, the CPU 41 performs an image analysis on the captured image captured by the camera 18.

[0085] In step S104, the CPU 41 determines whether or not there is an abnormality in the camera 18 based on the image analysis. If the CPU 41 determines that there is an abnormality in the camera 18 (YES in step S104), the CPU 41 does not activate the supplier 14 and maintains the supplier 14 in the stopped state in step S105, causes the display 35 to display abnormality information (i.e., a message prompting the user to replace or clean the camera 18 or a component thereof) to the user in step S 106, and ends the process.

[0086] In contrast, if the CPU 41 determines that there is no abnormality in the camera 18 (NO in step S104), the CPU 41 causes the supplier 14 to start supplying air to the sheet members P in step S107, executes a feeding operation for feeding each sheet member P from the loading section 12 in step S108, and ends the process.

Effects According to Exemplary Embodiment

[0087] In this exemplary embodiment, the CPU 41 detects an abnormality in the camera 18 in accordance with a change between multiple captured images of the image capturing target 70 captured by the camera 18. Therefore, an image capturing failure occurring when the camera 18 captures an image of the sheet members P from the edge of the multiple sheet members P may be suppressed, as compared with a case where the abnormality in the camera 18 is neglected. As a result, the air supply amount from the supplier 14 may be appropriately adjusted based on the captured image, and a feeding failure of each sheet member P in the medium feeding device 10 may be suppressed.

[0088] In this exemplary embodiment, the CPU 41 specifically detects an abnormality in the camera 18 in accordance with a change between multiple captured images captured in a state where the supplier 14 has stopped supplying air to the sheet members P.

[0089] In a case (referred to as "mode A" hereinafter) where the CPU 41 detects an abnormality in the camera 18 in accordance with a change between captured images captured in a state where the supplier 14 is supplying air to the sheet members P, floating objects (e.g., particles (such as paper dust and paper powder) of the sheet members P and toner) floating due to the supply of air may possibly be image-captured together with the

image capturing target 70. In this case, it is conceivable that an abnormality in the camera 18 may be erroneously detected even though an abnormality has not occurred in the camera 18.

[0090] In contrast, in this exemplary embodiment, the CPU 41 detects an abnormality in the camera 18 in accordance with a change between multiple captured images captured in a state where the supplier 14 has stopped supplying air to the sheet members P, as mentioned above. Therefore, erroneous detection occurring when the CPU 41 detects an abnormality in the camera 18 may be suppressed, as compared with mode A.

[0091] Furthermore, in this exemplary embodiment, when the CPU 41 does not detect an abnormality in the camera 18, the supplier 14 starts supplying air to the sheet members P, and the camera 18 captures an image of the sheet members P from the edge of the multiple sheet members P supplied with the air from the supplier 14.

[0092] Therefore, an image capturing failure occurring when the camera 18 captures an image of the sheet members P from the edge of the multiple sheet members P may be suppressed, as compared with a case where the camera 18 captures an image of the sheet members P from the edge of the multiple sheet members P regardless of whether or not the CPU 41 has detected an abnormality in the camera 18.

[0093] In this exemplary embodiment, the image capturing target 70 is disposed opposite the camera 18 relative to the position where the sheet members P supplied with the air from the supplier 14 are disposed.

[0094] Therefore, the image capturing direction in which the camera 18 captures an image of the sheet members P from the edge of the multiple sheet members P and the image capturing direction in which the camera 18 captures an image of the image capturing target 70 are aligned with each other. Accordingly, the image capturing direction of the camera 18 does not have to be changed between when the camera 18 is to capture an image of the sheet members P from the edge of the multiple sheet members P and when the camera 18 is to capture an image of the image capturing target 70.

[0095] In this exemplary embodiment, the supplier 14 adjusts the air supply amount in accordance with the distance between the multiple sheet members P image-captured by the camera 18, and does not execute the adjustment of the air supply amount if the CPU 41 detects an abnormality in the camera 18.

[0096] Therefore, an adjustment failure of the supply amount may be suppressed, as compared with a case where the supplier 14 adjusts the air supply amount regardless of whether or not the CPU 41 has detected an abnormality in the camera 18.

[0097] The image capturing target 70 is a target image provided on the side plate 11A serving as a frame of the device body 11 of the medium feeding device 10. Therefore, the disposition of the image capturing target 70 is flexible, as compared with a case where the image capturing target 70 is a component of the medium feeding device 10.

[0098] Furthermore, the target image related to the image capturing target 70 has the bright areas 71 and the dark areas 72 having the boundaries 73 with the bright areas 71. Therefore, as compared with a case where the target image does not have boundaries between bright areas and dark areas, an abnormality may be readily identifiable, and erroneous detection occurring when the CPU 41 detects an abnormality in the camera 18 may be suppressed.

[0099] In this exemplary embodiment, the medium feeding device 10 has the display 35 that notifies the user of information indicating that the CPU 41 has detected an abnormality in the camera 18 when the CPU 41 detects the abnormality in the camera 18. Therefore, the user may recognize that there is an abnormality in the camera 18.

[0100] In detail, in this exemplary embodiment, the display 35 notifies the user of information prompting the user to replace or clean the camera 18 or a component thereof (e.g., the lens 18A) as the abnormality information. Accordingly, the user may resolve the abnormality in the camera 18.

Modification of Abnormality Detection Process

[0101] In the above abnormality detection process, if the predetermined trigger (e.g., an insertion operation involving insertion of the loading section 12 into the device body 11) is detected during the operation of the medium feeding device 10, the CPU 41 proceeds with the abnormality detection process, as illustrated in Fig. 9. Although an abnormality in the camera 18 is detected at a predetermined timing in this manner in this exemplary embodiment, the configuration is not limited to this.

[0102] For example, as illustrated in Fig. 10, the CPU 41 may have a dedicated mode for detecting an abnormality in the camera 18 in response to a user command, and may proceed with the abnormality detection process in accordance with the user command. In this configuration, step S110 is executed in place of step S101. In step S110, the CPU 41 determines whether or not a user command is acquired. If a user command is acquired (YES in step S1 10), the CPU 41 proceeds to step S102. In contrast, if a user command is not acquired (NO in step S1 10), the CPU 41 repeats step S 110 until a user command is acquired.

[0103] In this configuration, an image capturing failure occurring when the camera 18 captures an image of the sheet members P from the edge of the multiple sheet members P may be suppressed, as compared with a case where an abnormality in the camera 18 is detected exclusively at a predetermined timing.

Modification Where Image Capturing Target 70 is Movable

[0104] Although the image capturing target 70 is fixed in this exemplary embodiment, the configuration is not limited to this. For example, the image capturing target 70 may be movable. For example, as illustrated in Figs. 11A to 11C, the medium feeding device 10 may include a moving mechanism 90 that moves the image capturing target 70 between an image capturing position where the camera 18 captures an image of the image capturing target 70 and a retraction position where the image capturing target 70 is retracted from the image capturing position.

[0105] The moving mechanism 90 has, for example, a supporting body 91, a moving body 92, and a tension spring 93. The supporting body 91 is a component that supports the image capturing target 70. In detail, the supporting body 91 is formed of a rod extending in the up-down direction. The supporting body 91 is attached to the side guide 13 in a rotatable manner by a shaft 94. The image capturing target 70 is attached to the upper end of the supporting body 91. The image capturing target 70 is movable between the image capturing position (i.e., the position illustrated in Fig. 11B) and the retraction position (i.e., the position illustrated in each of Figs. 11A and 11C) in accordance with rotation of the supporting body 91.

[0106] The image capturing position (i.e., the position illustrated in Fig. 11B) is where the camera 18 captures an image of the image capturing target 70. In detail, the image capturing position is where the image capturing target 70 is disposed in an image capturing range of the camera 18 and is where image-capturing by the camera 18 is possible. Moreover, the image capturing position is also where the camera 18 is in focus. In this exemplary embodiment, at the image capturing position, the image capturing target 70 is disposed positionally in alignment with the camera 18, as viewed in the depth direction D.

[0107] The retraction position (i.e., the position illustrated in each of Figs. 11A and 11C) is where the image capturing target 70 has retracted from the image capturing position. In detail, the retraction position is where the image capturing target 70 is shielded from the camera 18 by the side guide 13, and is where image-capturing by the camera 18 is not possible.

[0108] The tension spring 93 pulls the image capturing target 70 toward the retraction position relative to the image capturing position by utilizing an elastic force. In this exemplary embodiment, the tension spring 93 has one end attached to the supporting body 91 and the other end attached to the side guide 13. The tension spring 93 utilizes its elastic force to pull the image capturing target 70 toward the retraction position relative to the image capturing position via the supporting body 91. Accordingly, the image capturing target 70 is set at the retraction position.

[0109] The moving body 92 is attached to the side guide 13 in a movable manner in a moving direction in which the moving body 92 presses the lower end of the supporting body 91 in the width direction W to set the image capturing target 70 at the image capturing position. The moving body 92 has a contact section 95 that moves the moving body 92 in the moving direction by coming into contact with the bottom plate 12A that ascends when the loading section 12 is inserted into the device body 11.

[0110] In the moving mechanism 90, the bottom plate 12A comes into contact with the contact section 95 when the ascending bottom plate 12A passes the contact section 95, and the moving body 92 is moved in the moving direction, whereby the image capturing target 70 moves from the retraction position to the image capturing position. In this configuration, the camera 18 captures an image of the image capturing target 70 at a timing at which the image capturing target 70 is set at the image capturing position. In other words, the moving mechanism 90 sets the image capturing target 70 at the image capturing position when the camera 18 is to capture an image of the image capturing target 70.

[0111] Furthermore, in the moving mechanism 90, when the bottom plate 12A completely passes the contact section 95, the tension spring 93 causes the image capturing target 70 to return to the retraction position. Therefore, in the state where the loading section 12 is inserted in the device body 11, the image capturing target 70 is set at the retraction position. In other words, the moving mechanism 90 sets the image capturing target 70 at the retraction position when the camera 18 is to capture an image of the sheet members P.

[0112] Accordingly, in this modification, the medium feeding device 10 includes the moving mechanism 90 that moves the image capturing target 70 between the image capturing position where the camera 18 captures an image of the image capturing target 70 and the retraction position where the image capturing target 70 is retracted from the image capturing position.

[0113] Therefore, when the camera 18 does not capture an image of the image capturing target 70, the image capturing target 70 may be less likely to become a hindrance, as compared with a case where the image capturing target 70 is always set at the image capturing position.

[0114] Furthermore, in this modification, the moving mechanism 90 sets the image capturing target 70 at the image capturing position where the camera 18 is in focus when the camera 18 is to capture an image of the image capturing target 70, and sets the image capturing target 70 at the retraction position when the camera 18 is to capture an image of the sheet members P.

[0115] Therefore, an image capturing failure occurring when the camera 18 captures an image of the image capturing target 70 may be suppressed, as compared with a case where the image capturing target 70 is set at an image capturing position where the camera 18 is out of focus when the camera 18 is to capture an image of the image capturing target 70.

Modification of Image Capturing Target 70

[0116] In this exemplary embodiment, the image capturing target 70 is a target image provided on the side plate 11A serving as a frame of the device body 11 of the medium feeding device 10. However, the configuration is not limited to this. The image capturing target 70 may be provided on a component other than the side plate 11A serving as a frame of the device body 11. In detail, for example, as illustrated in Fig. 12, the image capturing target 70 may be provided on a side surface 30A of the suction unit 30.

[0117] Furthermore, as illustrated in Fig. 13, the image capturing target 70 may be a component of the medium feeding device 10. Specifically, a component of the medium feeding device 10 may be the image capturing target 70. In Fig. 13, the suction unit 30 and the side plate 11A as components of the medium feeding device 10 serve as the image capturing target 70. In this configuration, the number of components may be reduced, as compared with a case where the image capturing target 70 is provided separately from the components of the medium feeding device 10. In this configuration, for example, the image capturing target has a bright area 31 and a dark area 32 having a boundary 33 with the bright area 31, and the outline of the components serves as the boundary 33.

[0118] Furthermore, as illustrated in Fig. 14, the image capturing target 70 may be, for example, a component having a hole 39. The component is, for example, the side plate 11A serving as a frame of the device body 11 of the medium feeding device 10. In detail, in this configuration, the image capturing target 70 is constituted of the body of the side plate 11A and the hole 39. An area including the hole 39 in the component is image-captured as an image capturing range of the camera 18.

[0119] According to this configuration, as compared with a case where the image capturing target 70 is a component not having the hole 39, the bright and dark areas are clearly defined by the boundary of the hole 39, so that erroneous detection occurring when the CPU 41 detects an abnormality in the camera 18 may be suppressed. In this configuration, for example, the image capturing target has a bright area 61 defined by the side plate 11A and a dark area 62 (i.e., the hole 39) having a boundary 63 with the bright area 61, and an edge of the hole 39 serves as the boundary 63. The hole 39 includes multiple holes 39A extending in the up-down direction and multiple holes 39B extending in the width direction W.

[0120] Although the target image related to the image capturing target 70 has the bright areas 71 and the dark areas 72 having the boundaries 73 with the bright areas 71 in this exemplary embodiment, the configuration is not limited to this. The target image may be an image not having boundaries between bright and dark areas. In detail, the target image may entirely be a monochromatic (e.g., white and grey colored) image.

[0121] An image of the image capturing target 70 may be captured by overexposing the image capturing target 70 to light from a light source (not illustrated). In this case, a shadow appears in the captured image if extraneous matter is adhered to the lens 18A.

[0122] In this exemplary embodiment, the image capturing target 70 is disposed opposite the camera 18 relative to the position where the sheet members P supplied with the air from the supplier 14 are disposed. However, the configuration is not limited to this. For example, the image capturing target 70 may be disposed opposite the sheet members P relative to the camera 18. The image capturing target 70 may be disposed at one side in the width direction W relative to the camera 18. If the image capturing direction in which the camera 18 captures an image of the sheet members P from the edge of the multiple sheet members P and the image capturing direction in which the camera 18 captures an image of the image capturing target 70 are different from each other, the camera 18 is configured to change the image capturing direction and perform image-capturing.

Other Modifications

[0123] Although the camera 18 is used as an example of the image capturing unit in this exemplary embodiment, the configuration is not limited to this. For example, the image capturing unit may be a video camera that captures a video image so long as the image capturing unit is a component capable of capturing an image of the sheet members P.

[0124] In this exemplary embodiment, the camera 18 is disposed at one widthwise side of the multiple loaded sheet members P, as illustrated in Fig. 2. However, the configuration is not limited to this. For example, in place of or in addition to being disposed at one widthwise side of the multiple loaded sheet members P, the camera 18 may be disposed at the other widthwise side of the sheet members P.

[0125] Although the display 35 is used as a notifier in this exemplary embodiment, the configuration is not limited to this. For example, the notifier may be a loudspeaker that uses sound to notify the user of information indicating that an abnormality in the camera 18 has been detected, so long as the notifier is a component that notifies the user of the information.

[0126] In this exemplary embodiment, the CPU 41 detects an abnormality in the camera 18 in accordance with a change between multiple captured images captured in a state where the supplier 14 has stopped supplying air to the sheet members P. However, the configuration is not limited to this. For example, the CPU 41 may detect an abnormality in the camera 18 in accordance with a change between captured images captured in a state where the supplier 14 is supplying air to the sheet members P.

[0127] In this exemplary embodiment, when the CPU 41 does not detect an abnormality in the camera 18, the supplier 14 starts supplying air to the sheet members P and the camera 18 captures an image of the sheet

members P from the edge of the multiple sheet members P supplied with the air from the supplier 14. However, the configuration is not limited to this. For example, the camera 18 may be configured to capture an image of the sheet members P from the edge of the multiple sheet members P regardless of whether or not the CPU 41 has detected an abnormality in the camera 18.

[0128] In this exemplary embodiment, the supplier 14 adjusts the air supply amount in accordance with the distance between the multiple sheet members P image-captured by the camera 18, and does not execute the adjustment of the air supply amount if the CPU 41 detects an abnormality in the camera 18. However, the configuration is not limited to this. The supplier 14 may be configured to adjust the air supply amount regardless of whether or not the CPU 41 has detected an abnormality in the camera 18.

[0129] In this exemplary embodiment, when the CPU 41 detects an abnormality in the camera 18, the medium feeding device 10 causes the display 35 to notify the user of information indicating that the CPU 41 has detected the abnormality in the camera 18. However, the configuration is not limited to this. The medium feeding device 10 may be configured not to notify the user of the information.

[0130] The exemplary embodiment of the present disclosure is not limited to that described above, and various modifications, alterations, and improvements are possible so long as they do not depart from the scope of the exemplary embodiment of the present disclosure. For example, multiple modifications described above may be combined, where appropriate.

[0131] In the exemplary embodiment above, the term "processor" refers to hardware in a broad sense. Examples of the processor include general processors (e.g., CPU: Central Processing Unit) and dedicated processors (e.g., GPU: Graphics Processing Unit, ASIC: Application Specific Integrated Circuit, FPGA: Field Programmable Gate Array, and programmable logic device).

[0132] In the exemplary embodiment above, the term "processor" is broad enough to encompass one processor or plural processors in collaboration which are located physically apart from each other but may work cooperatively. The order of operations of the processor is not limited to one described in the exemplary embodiment above, and may be changed.

[0133] The foregoing description of the embodiments of the present disclosure has been provided for the purposes of illustration and description. It is not intended to be exhaustive or to limit the disclosure to the precise forms disclosed. Obviously, many modifications and variations will be apparent to practitioners skilled in the art. The embodiment were chosen and described in order to best explain the principles of the disclosure and its practical applications, thereby enabling others skilled in the art to understand the disclosure for various embodiments and with the various modifications as are suited to the particular use contemplated. It is intended that the scope of the disclosure be defined by the following claims and their equivalents.

Appendix

(((1)))

[0134] A medium loading system comprising:

a supplier that causes a plurality of loaded recording media to levitate and be separated from each other by supplying air to the recording media from an edge of the recording media;
an image capturing unit that captures an image of the recording media from the edge of the plurality of recording media supplied with the air from the supplier;
an image capturing target other than the recording media, the image capturing target being a target to be image-captured by the image capturing unit; and
a processor configured to:
detect an abnormality in the image capturing unit in accordance with a change between a plurality of captured images of the image capturing target captured by the image capturing unit.

(((2)))

[0135] The medium loading system according to (((1))),
wherein the processor is configured to detect the abnormality in the image capturing unit in accordance with the change between the plurality of captured images captured in a state where the supplier has stopped supplying the air to the recording media.

(((3)))

[0136] The medium loading system according to (((2))),
wherein when the processor does not detect the abnormality in the image capturing unit, the supplier starts supplying the air to the recording media, and the image capturing unit captures the image of the recording media from the edge of the plurality of recording media supplied with the air from the supplier.

(((4)))

[0137] The medium loading system according to (((2))) or (((3))),
wherein the image capturing target is disposed opposite the image capturing unit relative to a position where the recording media supplied with the air from the supplier are disposed.

(((5)))

[0138] The medium loading system according to any

one of (((1))) to (((4))),

wherein the supplier adjusts a supply amount of the air in accordance with a distance between the plurality of recording media image-captured by the image capturing unit, and
wherein the supplier does not execute an adjustment of the supply amount of the air if the processor detects the abnormality in the image capturing unit.

(((6)))

[0139] The medium loading system according to any one of (((1))) to (((5))),
wherein the image capturing target is a component of the medium loading system.

(((7)))

[0140] The medium loading system according to (((6))),
wherein the image capturing target is the component having a hole.

(((8)))

[0141] The medium loading system according to any one of (((1))) to (((7))),
wherein the image capturing target is a target image provided on a component of the medium loading system.

(((9)))

[0142] The medium loading system according to (((8))),
wherein the target image has a bright area and a dark area having a boundary with the bright area.

(((10)))

[0143] The medium loading system according to any one of (((1))) to (((9))), further comprising:
a moving mechanism that moves the image capturing target between an image capturing position and a retraction position, the image capturing position being where the image capturing unit captures an image of the image capturing target, the retraction position being where the image capturing target has retracted from the image capturing position.

(((11)))

[0144] The medium loading system according to (((10))),

wherein the moving mechanism sets the image capturing target at the image capturing position where the image capturing unit is in focus when the image capturing unit is to capture the image of the image capturing target, and
wherein the moving mechanism sets the image capturing target at the retraction position when the image capturing unit is to capture the image of the recording media.

(((12)))

[0145] The medium loading system according to any one of (((1))) to (((11))), further comprising:
a notifier that notifies a user of information indicating that the processor has detected the abnormality when the processor detects the abnormality.

(((13)))

[0146] The medium loading system according to (((12))),
wherein the information that the user is notified of by the notifier is information prompting the user to replace or clean the image capturing unit or a component of the image capturing unit.

(((14)))

[0147] The medium loading system according to any one of (((1))) to (((13))),
wherein the processor has a dedicated mode for detecting the abnormality in the image capturing unit in accordance with a user command.

(((15)))

[0148] An image forming system comprising:

the medium loading system according to any one of (((1))) to (((14))); and
an image forming unit that forms an image onto each recording medium fed from the medium loading system.

[0149] In the configuration according to (((1))), an image capturing failure occurring when the image capturing unit captures the image of the recording media from the edge of the plurality of recording media may be suppressed, as compared with a case where the abnormality in the image capturing unit is neglected.
[0150] In the configuration according to (((2))), erroneous detection occurring when the processor detects the abnormality in the image capturing unit may be suppressed, as compared with a case where the processor detects an abnormality in the image capturing unit in accordance with a change between captured images captured in a state where the supplier is supplying the air to the recording media.
[0151] In the configuration according to (((3))), an image capturing failure occurring when the image capturing

unit captures the image of the recording media from the edge of the plurality of recording media may be suppressed, as compared with a case where the image capturing unit captures the image of the recording media from the edge of the plurality of recording media regardless of whether or not the processor has detected the abnormality in the image capturing unit.

[0152] In the configuration according to (((4))), the image capturing direction in which the image capturing unit captures the image of the recording media from the edge of the plurality of recording media and the image capturing direction in which the image capturing unit captures the image of the image capturing target may be aligned with each other.

[0153] In the configuration according to (((5))), an adjustment failure of the supply amount may be suppressed, as compared with a case where the supplier adjusts the supply amount of the air regardless of whether or not the processor has detected the abnormality in the image capturing unit.

[0154] In the configuration according to (((6))), the number of components may be reduced, as compared with a case where the image capturing target is provided separately from the components of the medium loading system.

[0155] In the configuration according to (((7))), erroneous detection occurring when the processor detects the abnormality in the image capturing unit may be suppressed, as compared with a case where the image capturing target is a component not having a hole.

[0156] In the configuration according to (((8))), the disposition of the image capturing target is flexible, as compared with a case where the image capturing target is a component of the medium loading system.

[0157] In the configuration according to (((9))), erroneous detection occurring when the processor detects the abnormality in the image capturing unit may be suppressed, as compared with a case where the target image does not have the boundary between the bright area and the dark area.

[0158] In the configuration according to (((10))), when the image capturing unit does not capture an image of the image capturing target, the image capturing target may be less likely to become a hindrance, as compared with a case where the image capturing target is always set at the image capturing position.

[0159] In the configuration according to (((11))), an image capturing failure occurring when the image capturing unit captures the image of the image capturing target may be suppressed, as compared with a case where the image capturing target is set at an image capturing position where the image capturing unit is out of focus when the image capturing unit is to capture the image of the image capturing target.

[0160] In the configuration according to (((12))), the user may recognize that there is an abnormality in the image capturing unit.

[0161] In the configuration according to (((13))), the user may resolve the abnormality in the image capturing unit.

[0162] In the configuration according to (((14))), an image capturing failure occurring when the image capturing unit captures the image of the recording media from the edge of the plurality of recording media may be suppressed, as compared with a case where the abnormality in the image capturing unit is detected exclusively at a predetermined timing.

[0163] In the configuration according to (((15))), an image capturing failure occurring when the image capturing unit captures the image of the recording media from the edge of the plurality of recording media may be suppressed, as compared with a case where the abnormality in the image capturing unit is neglected.

Claims

1. A medium loading system comprising:

a supplier that causes a plurality of loaded recording media to levitate and be separated from each other by supplying air to the recording media from an edge of the recording media;
an image capturing unit that captures an image of the recording media from the edge of the plurality of recording media supplied with the air from the supplier;
an image capturing target other than the recording media, the image capturing target being a target to be image-captured by the image capturing unit; and
a processor configured to:
detect an abnormality in the image capturing unit in accordance with a change between a plurality of captured images of the image capturing target captured by the image capturing unit.

2. The medium loading system according to claim 1,
wherein the processor is configured to detect the abnormality in the image capturing unit in accordance with the change between the plurality of captured images captured in a state where the supplier has stopped supplying the air to the recording media.

3. The medium loading system according to claim 2,
wherein when the processor does not detect the abnormality in the image capturing unit, the supplier starts supplying the air to the recording media, and the image capturing unit captures the image of the recording media from the edge of the plurality of recording media supplied with the air from the supplier.

4. The medium loading system according to claim 2 or 3,
wherein the image capturing target is disposed op-

posite the image capturing unit relative to a position where the recording media supplied with the air from the supplier are disposed.

5. The medium loading system according to any one of claims 1 to 4,

wherein the supplier adjusts a supply amount of the air in accordance with a distance between the plurality of recording media image-captured by the image capturing unit, and
wherein the supplier does not execute an adjustment of the supply amount of the air if the processor detects the abnormality in the image capturing unit.

6. The medium loading system according to any one of claims 1 to 5,
wherein the image capturing target is a component of the medium loading system.

7. The medium loading system according to claim 6,
wherein the image capturing target is the component having a hole.

8. The medium loading system according to any one of claims 1 to 7,
wherein the image capturing target is a target image provided on a component of the medium loading system.

9. The medium loading system according to claim 8,
wherein the target image has a bright area and a dark area having a boundary with the bright area.

10. The medium loading system according to any one of claims 1 to 9, further comprising:
a moving mechanism that moves the image capturing target between an image capturing position and a retraction position, the image capturing position being where the image capturing unit captures an image of the image capturing target, the retraction position being where the image capturing target has retracted from the image capturing position.

11. The medium loading system according to claim 10,

wherein the moving mechanism sets the image capturing target at the image capturing position where the image capturing unit is in focus when the image capturing unit is to capture the image of the image capturing target, and
wherein the moving mechanism sets the image capturing target at the retraction position when the image capturing unit is to capture the image of the recording media.

12. The medium loading system according to any one of claims 1 to 11, further comprising:
a notifier that notifies a user of information indicating that the processor has detected the abnormality when the processor detects the abnormality.

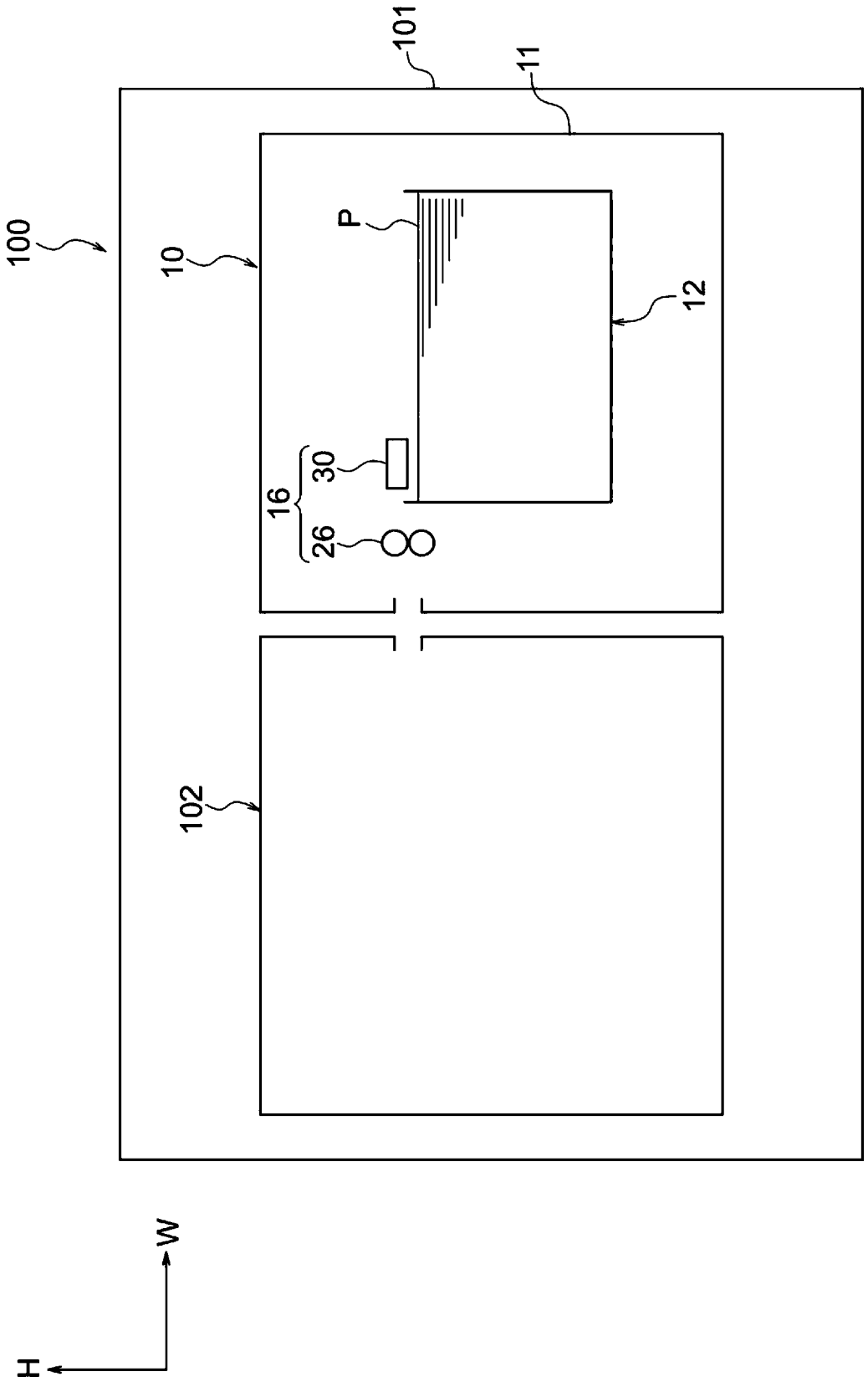
13. The medium loading system according to claim 12,
wherein the information that the user is notified of by the notifier is information prompting the user to replace or clean the image capturing unit or a component of the image capturing unit.

14. The medium loading system according to any one of claims 1 to 13,
wherein the processor has a dedicated mode for detecting the abnormality in the image capturing unit in accordance with a user command.

15. An image forming system comprising:

the medium loading system according to any one of claims 1 to 14; and
an image forming unit that forms an image onto each recording medium fed from the medium loading system.

FIG. 1



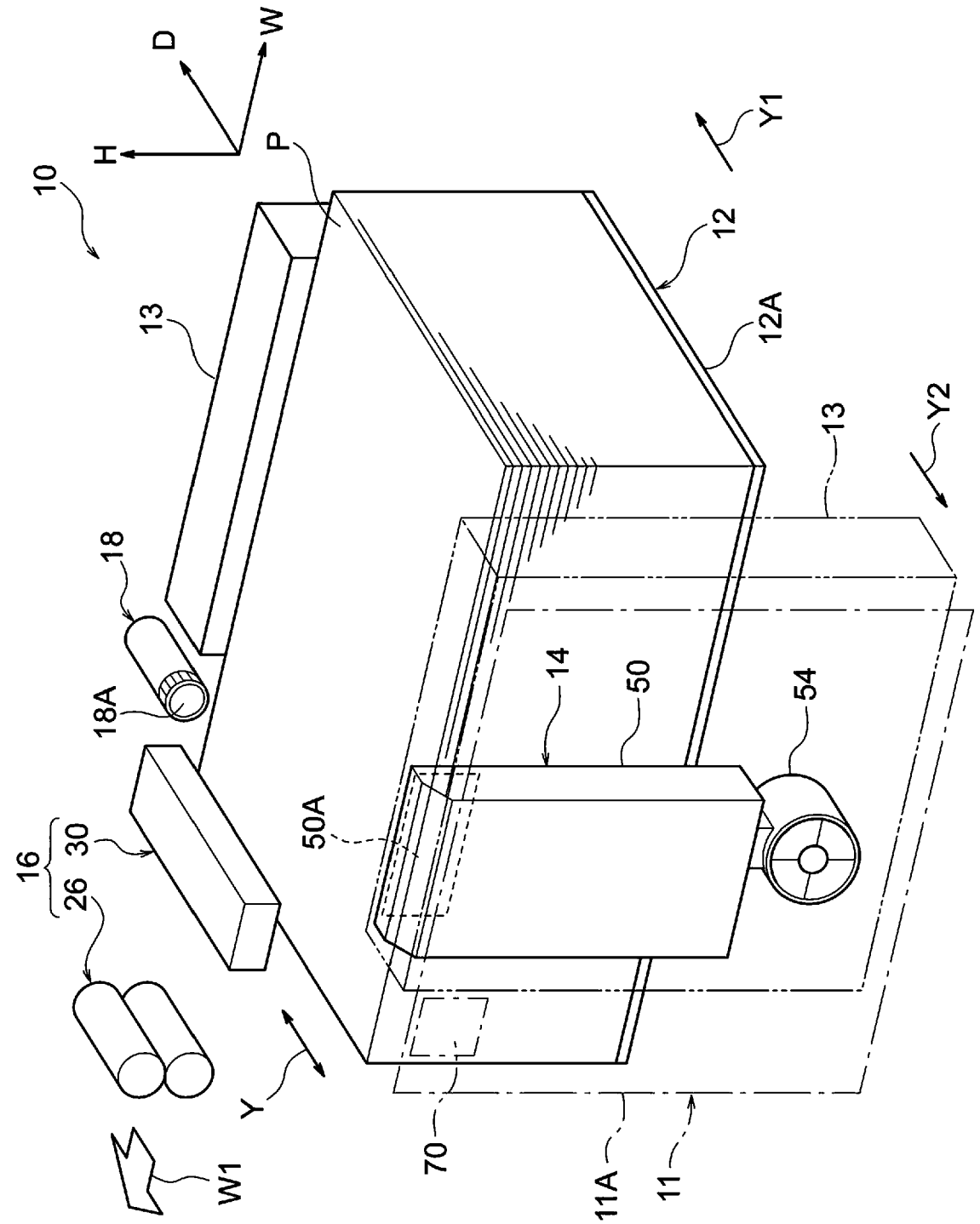


FIG. 2

FIG. 3

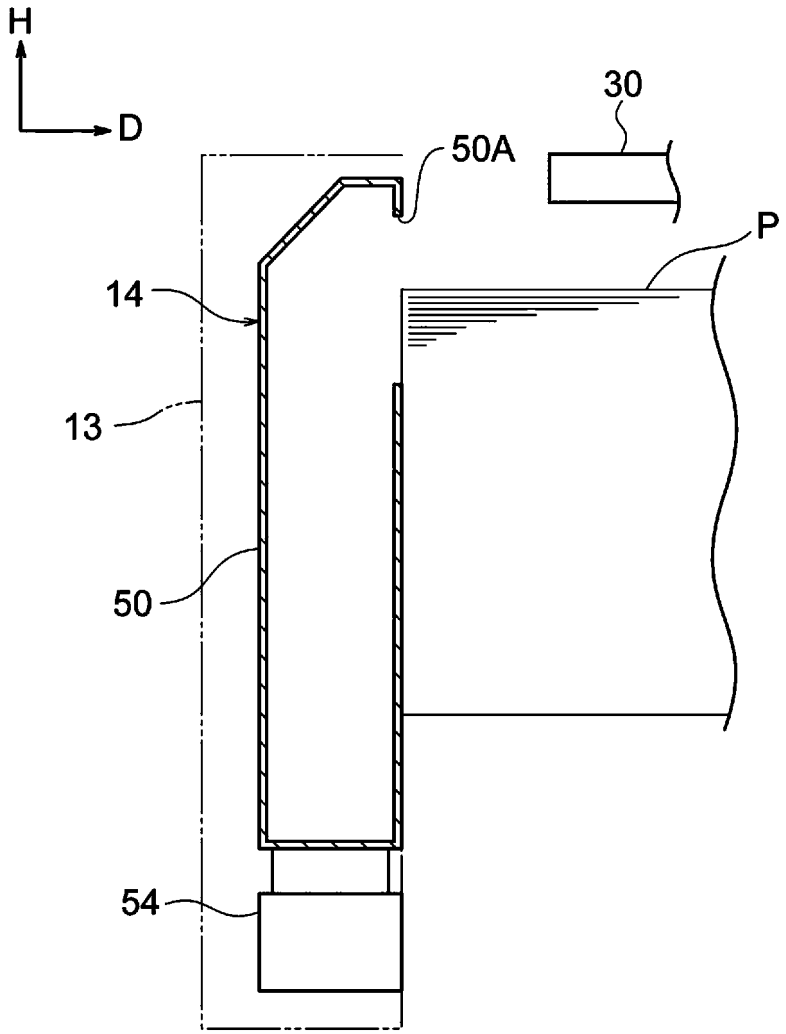


FIG. 4

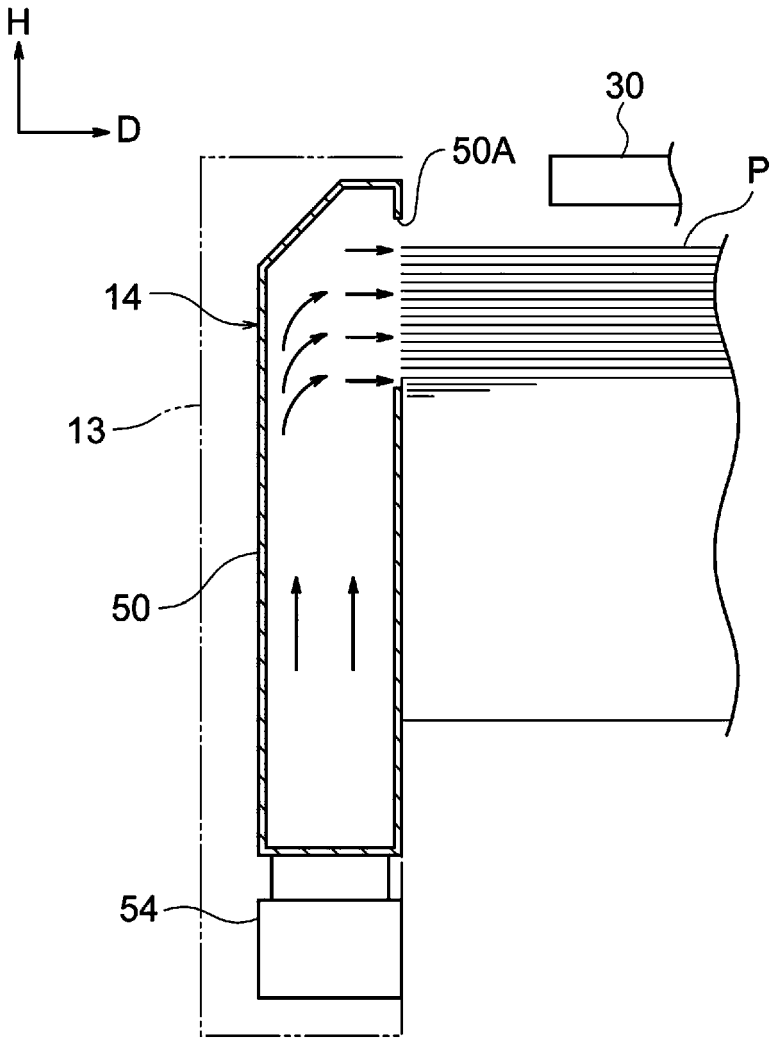


FIG. 5

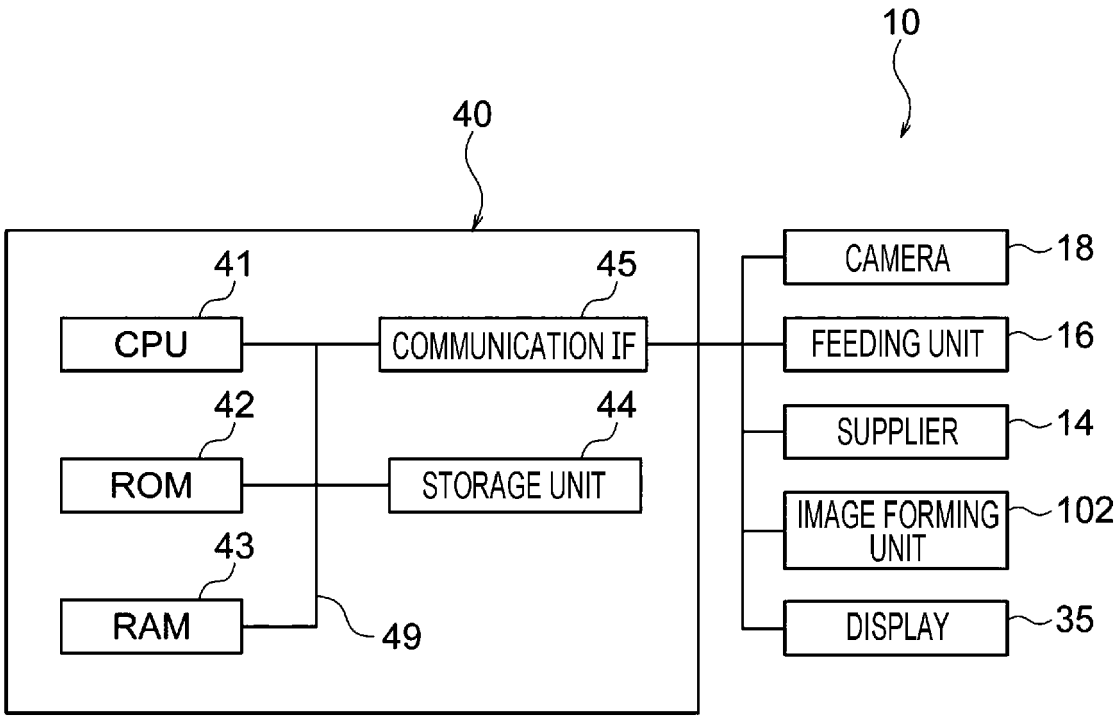

10
40
41
CPU
42
ROM
43
RAM
49
45
COMMUNICATION IF
44
STORAGE UNIT
CAMERA
18
FEEDING UNIT
16
SUPPLIER
14
IMAGE FORMING UNIT
102
DISPLAY
35

FIG. 6

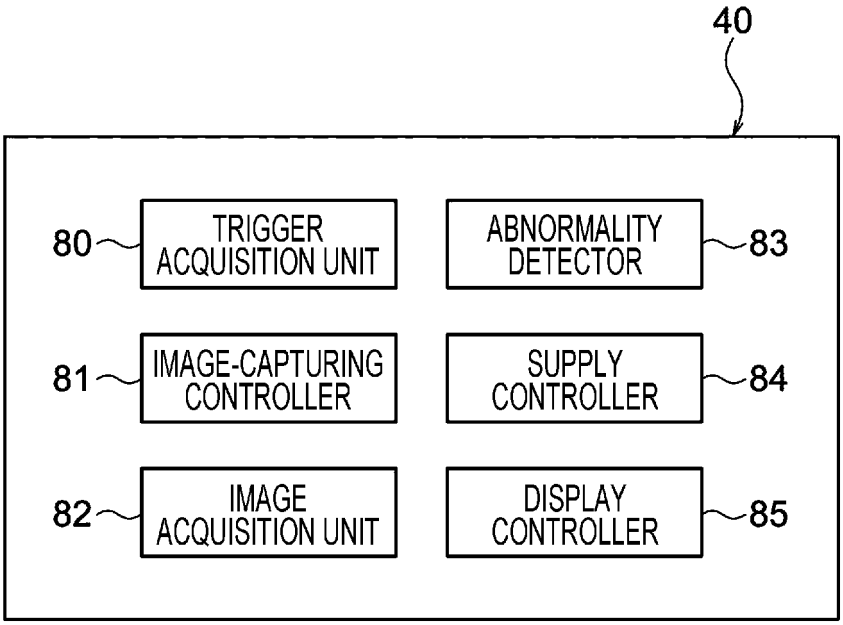

40
80
TRIGGER ACQUISITION UNIT
ABNORMALITY DETECTOR
83
81
IMAGE-CAPTURING CONTROLLER
SUPPLY CONTROLLER
84
82
IMAGE ACQUISITION UNIT
DISPLAY CONTROLLER
85

FIG. 7

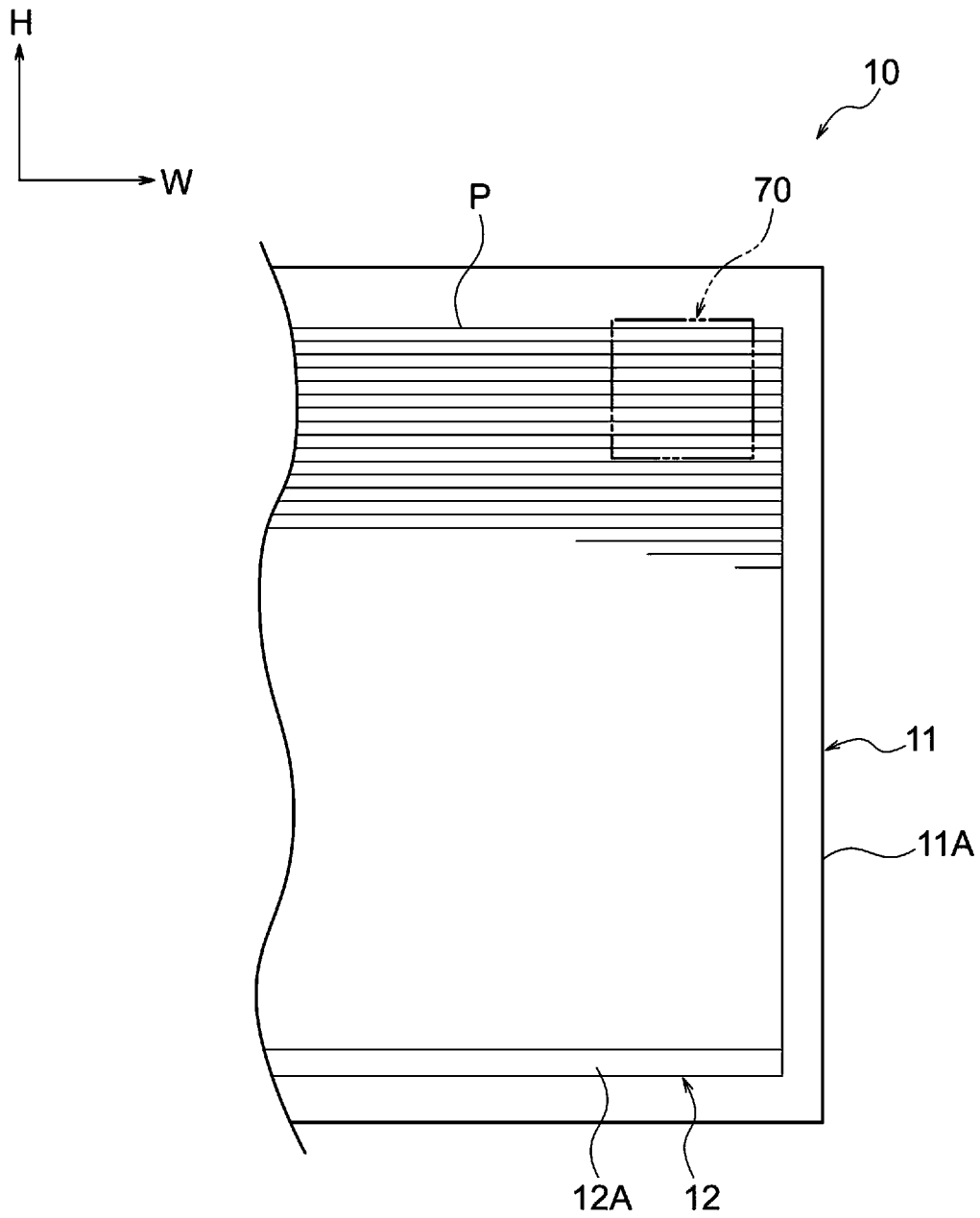


FIG. 8

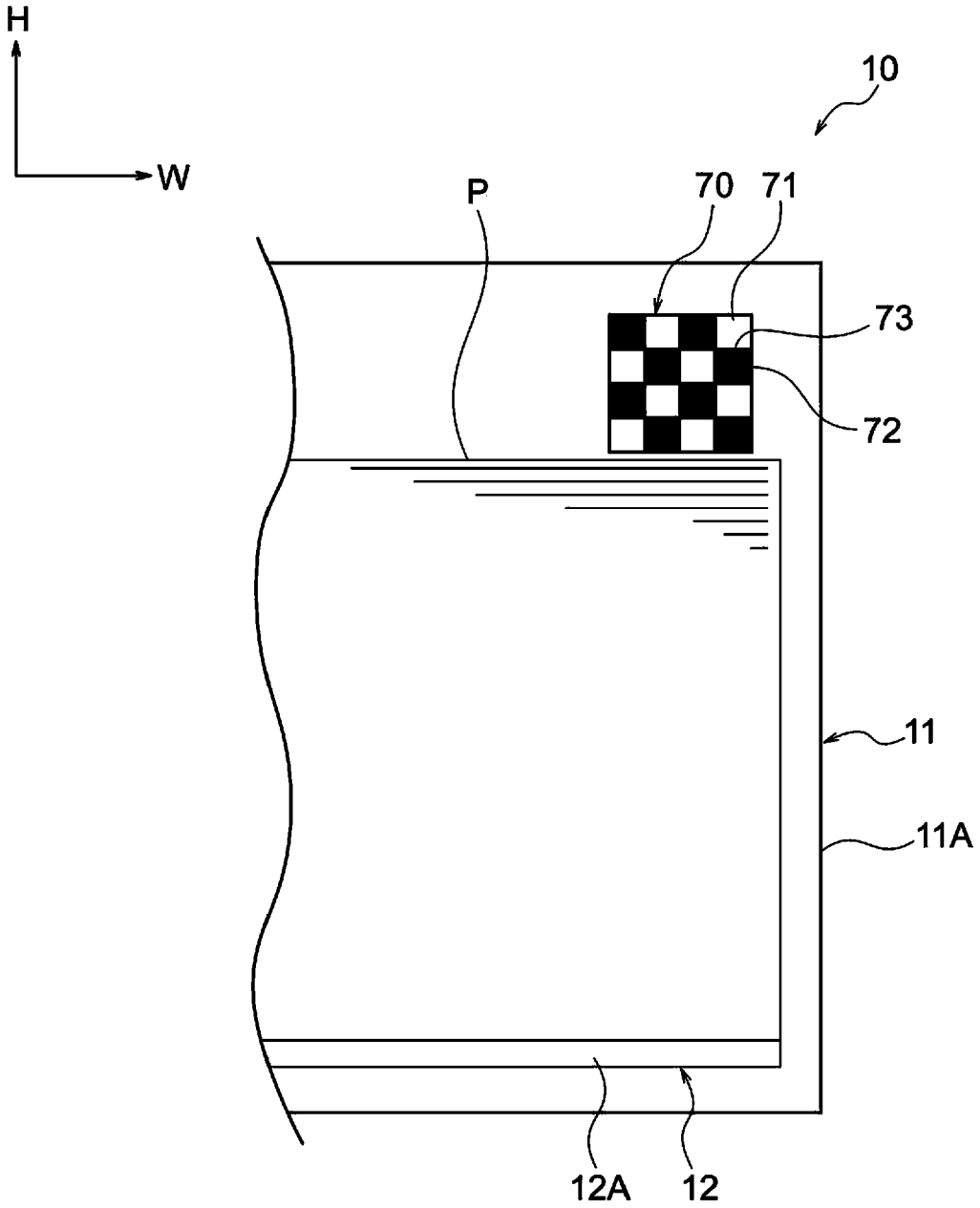


FIG. 9

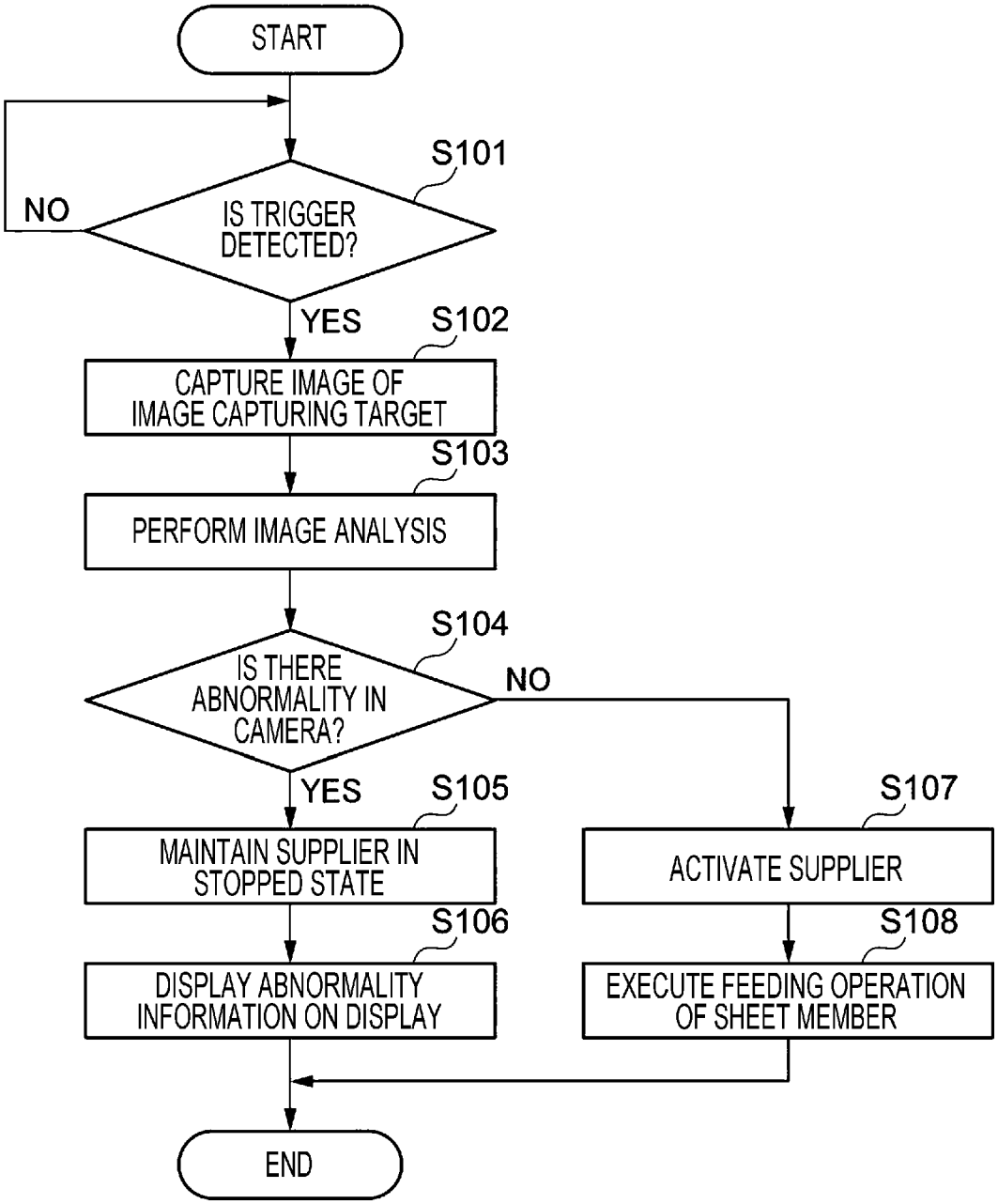

START
S101
IS TRIGGER DETECTED?
NO
YES
S102
CAPTURE IMAGE OF IMAGE CAPTURING TARGET
S103
PERFORM IMAGE ANALYSIS
S104
IS THERE ABNORMALITY IN CAMERA?
NO
YES
S105
MAINTAIN SUPPLIER IN STOPPED STATE
S106
DISPLAY ABNORMALITY INFORMATION ON DISPLAY
S107
ACTIVATE SUPPLIER
S108
EXECUTE FEEDING OPERATION OF SHEET MEMBER
END

FIG. 10

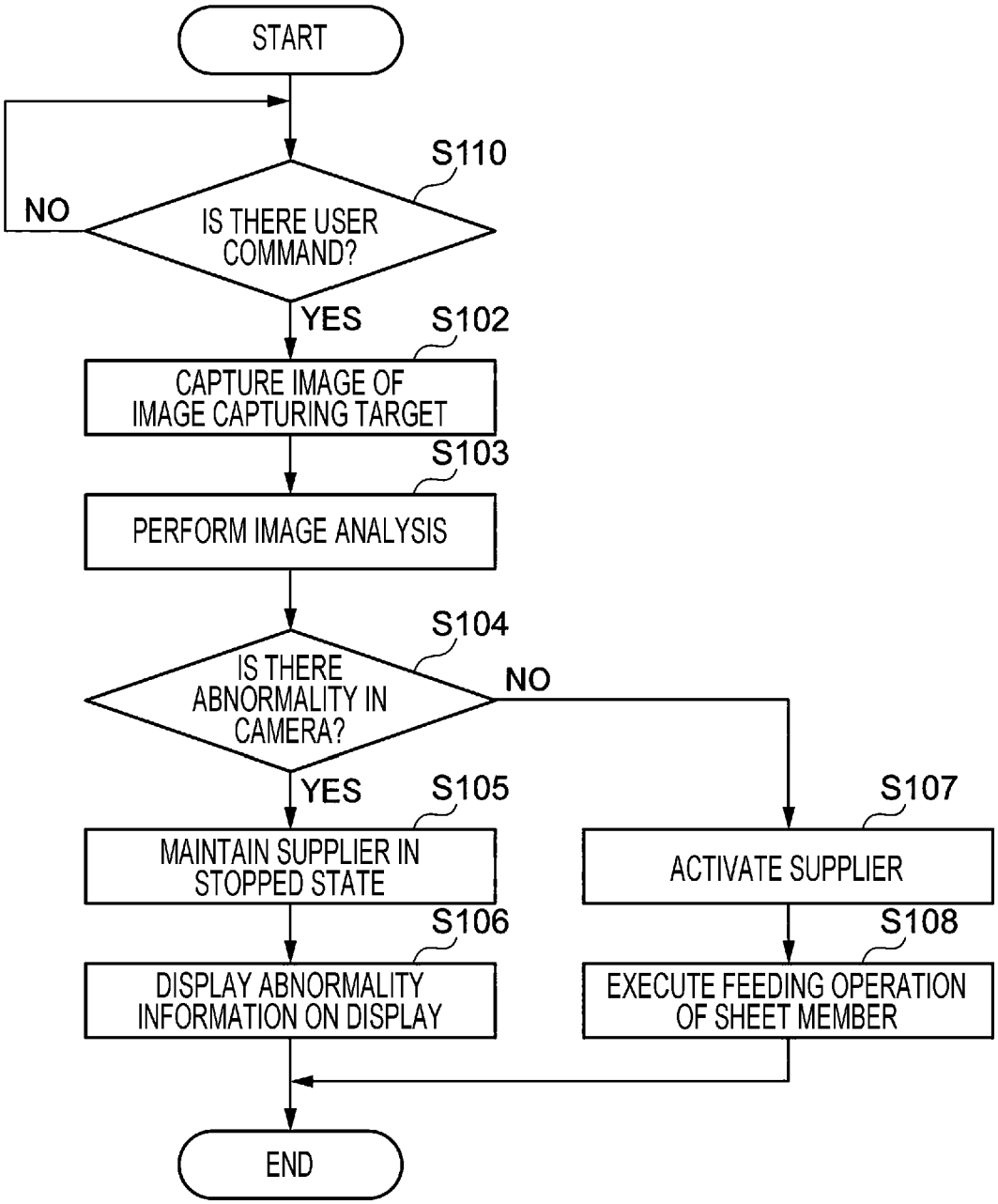

START
S110
IS THERE USER COMMAND?
NO
YES
S102
CAPTURE IMAGE OF IMAGE CAPTURING TARGET
S103
PERFORM IMAGE ANALYSIS
S104
IS THERE ABNORMALITY IN CAMERA?
NO
YES
S105
MAINTAIN SUPPLIER IN STOPPED STATE
S106
DISPLAY ABNORMALITY INFORMATION ON DISPLAY
S107
ACTIVATE SUPPLIER
S108
EXECUTE FEEDING OPERATION OF SHEET MEMBER
END

FIG. 11C

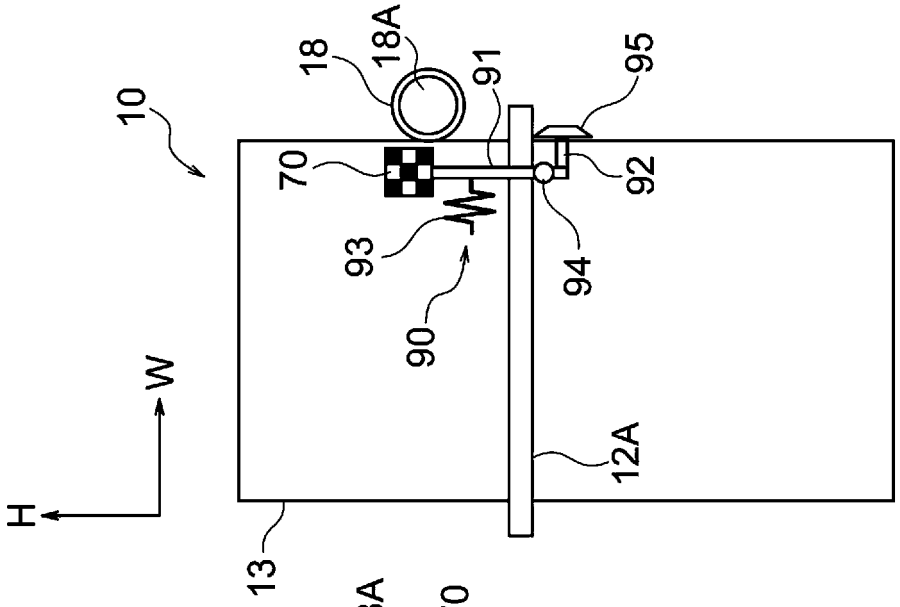


FIG. 11B

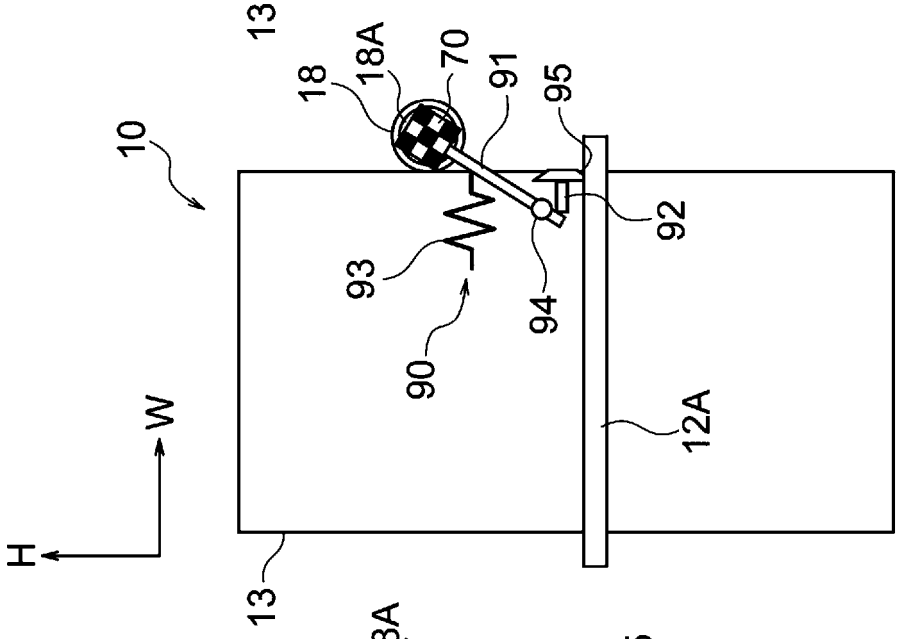


FIG. 11A

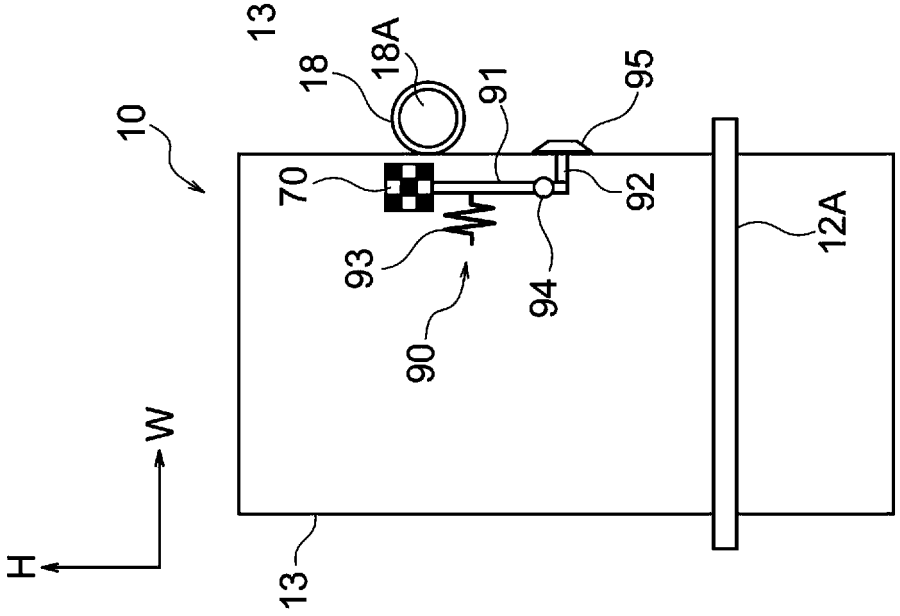


FIG. 12

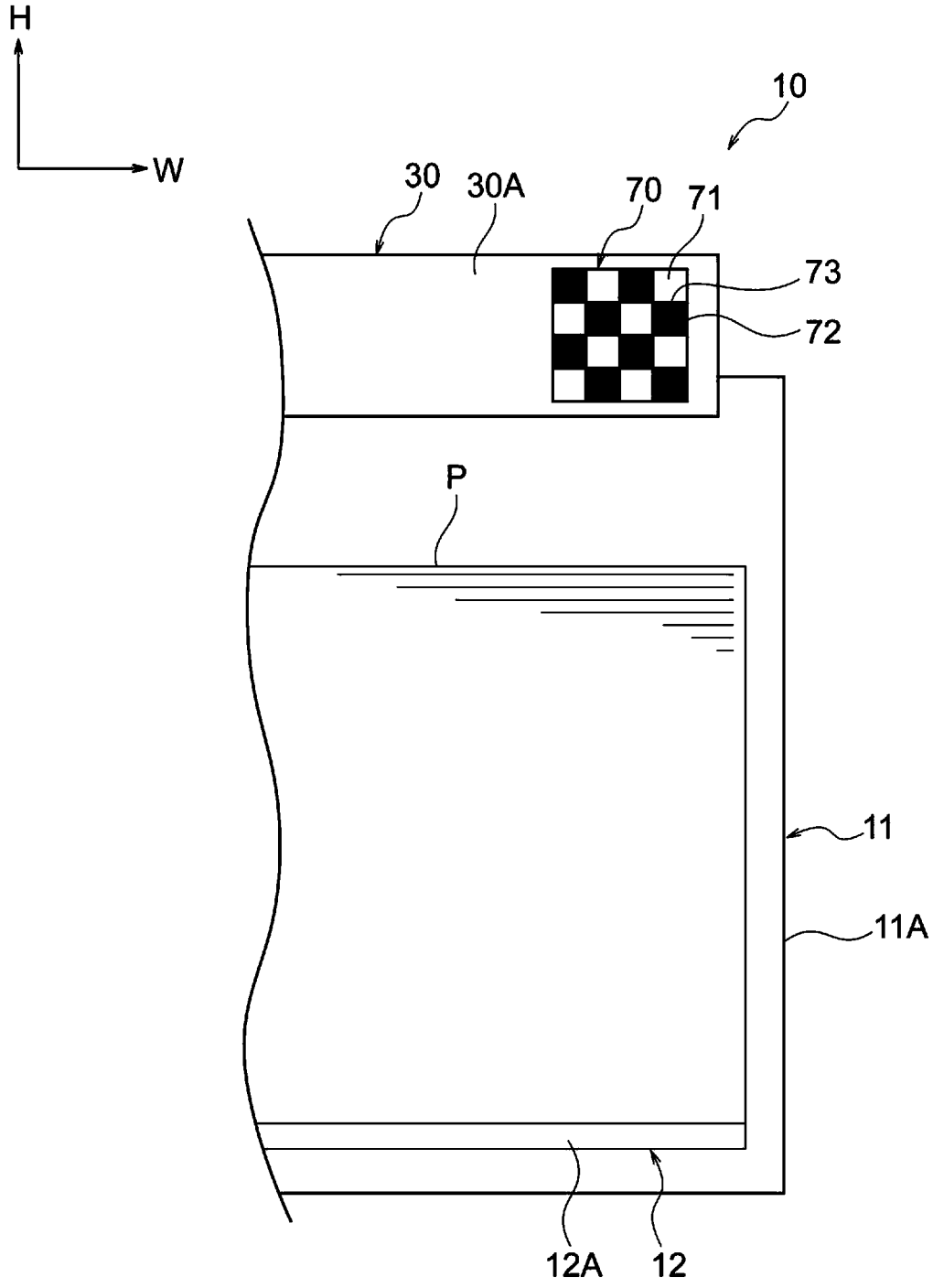


FIG. 13

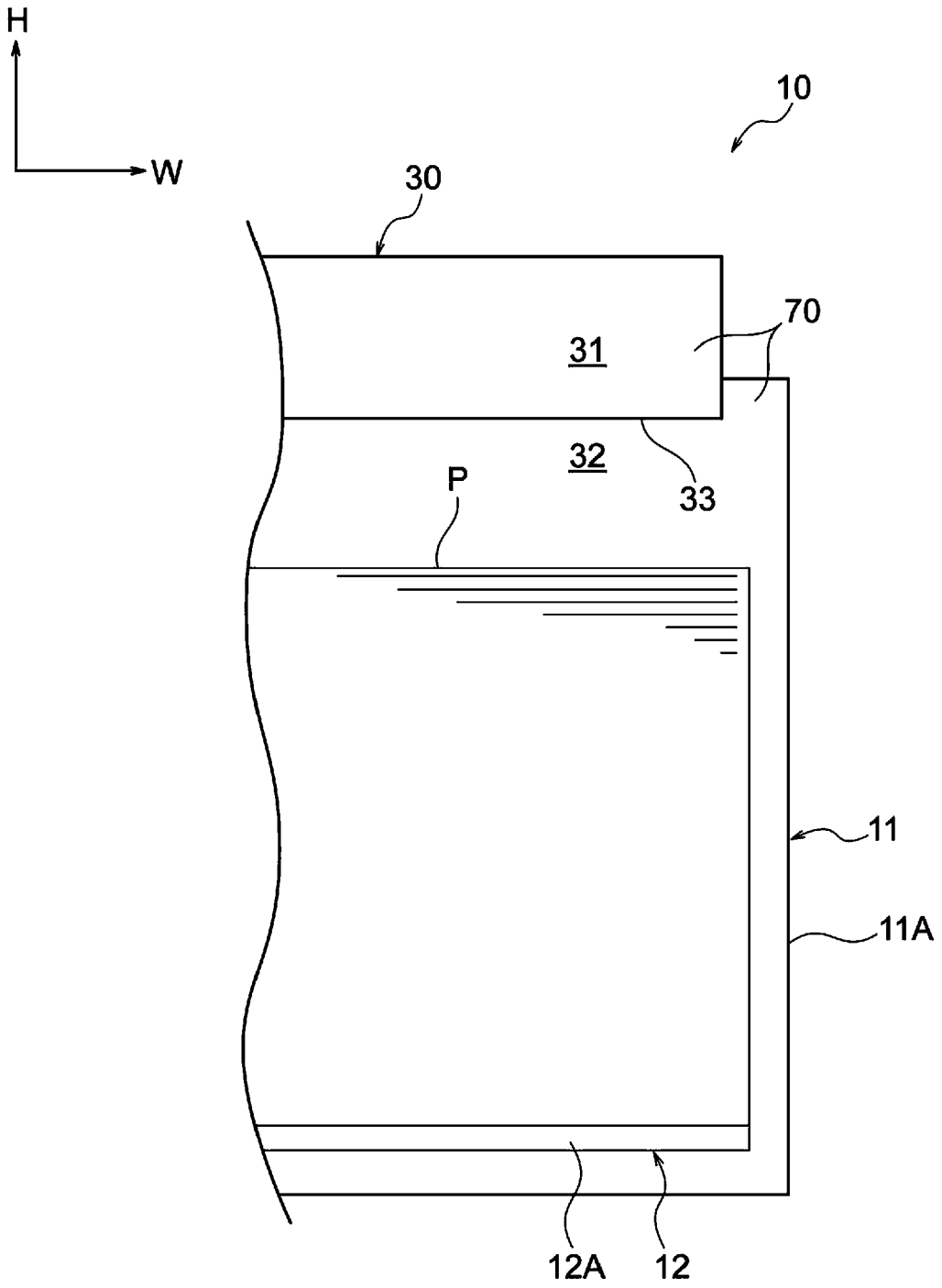
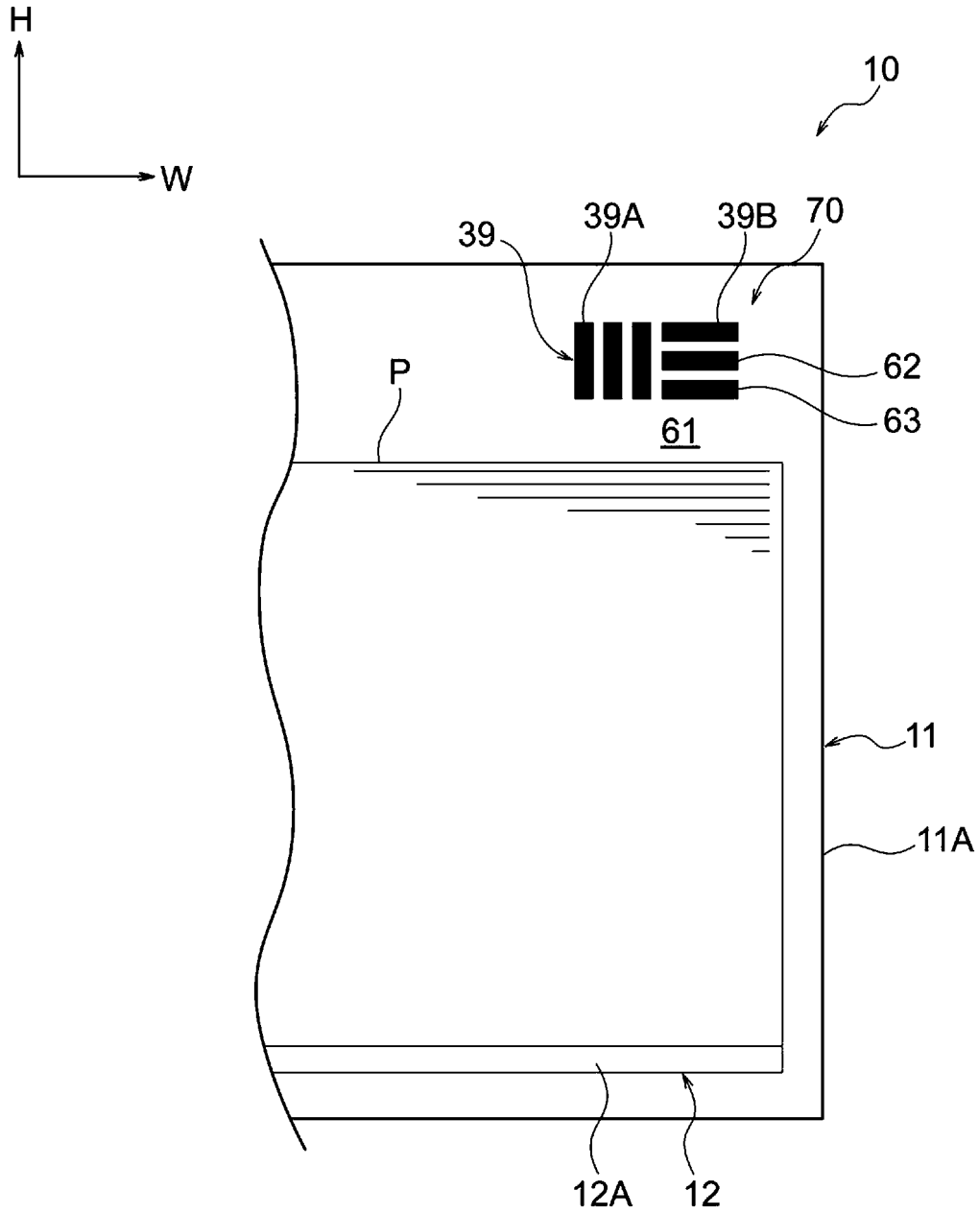


FIG. 14



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EUROPEAN SEARCH REPORT

Application Number
EP 24 15 8387

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	US 2021/163246 A1 (NAKANO TAKASHI [JP] ET AL) 3 June 2021 (2021-06-03) * the whole document *	1-15	INV. B65H3/48 B65H7/14
A	US 2022/321723 A1 (AKAISHI RYOHSUKE [JP]) 6 October 2022 (2022-10-06) * the whole document *	1-15	
A	US 2022/411224 A1 (ASABA YOHICHI [JP]) 29 December 2022 (2022-12-29) * the whole document *	1-15	
A,D	JP 2015 024868 A (KONICA MINOLTA INC) 5 February 2015 (2015-02-05) * the whole document *	1-15	

TECHNICAL FIELDS SEARCHED (IPC)

B65H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	3 July 2024	Athanasiadis, A

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03-07-2024

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- JP 2015024868 A **[0002]**