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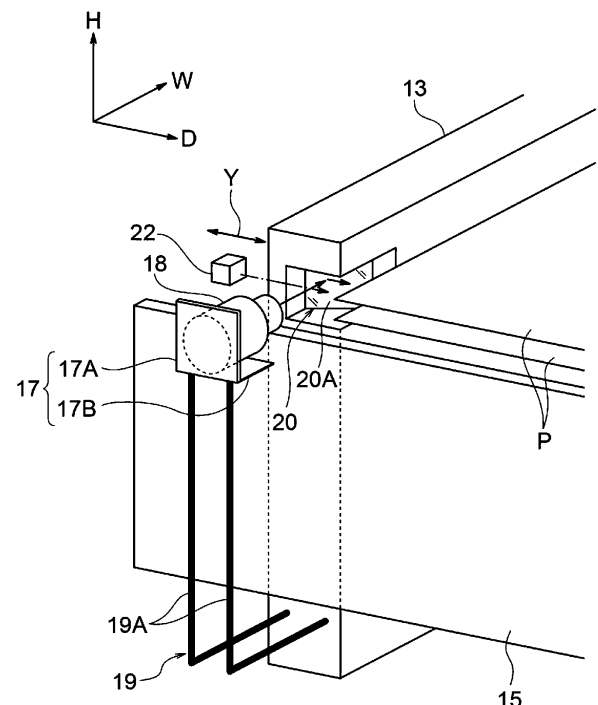
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(54) **MEDIUM FEEDING DEVICE AND IMAGE FORMING APPARATUS**

(57) A medium feeding device (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; a feeding unit (16) that feeds, in a feeding direction, an uppermost one of the recording media separated by the supplier; a contact section (13) that comes into contact with a lateral edge of the multiple recording media from a lateral side of the multiple recording media; a projection unit (20) that is provided at the contact section and onto which an image of the lateral edge of the multiple recording media is projected in the feeding direction; and an image capturing unit (18) that is disposed in the feeding direction relative to the multiple recording media and that captures the image projected on the projection unit in a state where the multiple recording media are supplied with the air from the supplier.

FIG. 5



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Description

Background

(i) Technical Field

[0001] The present disclosure relates to medium feeding devices and image forming apparatuses.

(ii) Related Art

[0002] Japanese Unexamined Patent Application Publication No. 2020-152535 discloses a sheet feeding device including an air blower that blows air to a sheet bundle loaded on a sheet loading section so as to cause upper sheets of the sheet bundle to levitate, a feeder that feeds an uppermost one of the levitated sheets, and an imager that captures an image of the sheet levitated by the air blower. In this sheet feeding device, the imaging range of the imager is set such that an image of a feed surface of the feeder and an image of at least the uppermost sheet of the sheet bundle loaded on the sheet loading section are captured.

Summary

[0003] A conceivable medium feeding device 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, a feeding unit that feeds an uppermost one of the recording media separated by the supplier in a feeding direction, and an image capturing unit that captures an image of a lateral edge of the multiple recording media.

[0004] In this medium feeding device, if the image capturing unit is to directly capture the image of the lateral edge of the multiple recording media, the image capturing unit is disposed at a position facing the lateral edge of the multiple recording media. Therefore, the degree of freedom with respect to the installation position of the image capturing unit is low.

[0005] Accordingly, it is an object of the present disclosure to enhance the degree of freedom with respect to the installation position of the image capturing unit, as compared with a case where the image capturing unit directly captures the image of the lateral edge of the multiple recording media.

[0006] According to a first aspect of the present disclosure, there is provided a medium feeding device 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; a feeding unit that feeds, in a feeding direction, an uppermost one of the recording media separated by the supplier; a contact section that comes into contact with a lateral edge of the plurality of recording media from a lateral side of the plurality of recording media; a projection unit that is provided at

the contact section and onto which an image of the lateral edge of the plurality of recording media is projected in the feeding direction; and an image capturing unit that is disposed in the feeding direction relative to the plurality of recording media and that captures the image projected on the projection unit in a state where the plurality of recording media are supplied with the air from the supplier.

[0007] According to a second aspect of the present disclosure, in the first aspect, the image capturing unit may be disposed at a position where the image capturing unit does not interfere with each recording medium fed by the feeding unit.

[0008] According to a third aspect of the present disclosure, in the second aspect, the image capturing unit may be disposed toward the lateral side relative to a position where each recording medium fed by the feeding unit passes.

[0009] According to a fourth aspect of the present disclosure, in any one of the first to third aspects, the contact section may be movable toward the lateral side of the recording media, and the image capturing unit may move toward the lateral side in conjunction with movement of the contact section.

[0010] According to a fifth aspect of the present disclosure, in the fourth aspect, the image capturing unit may be coupled to the contact section and move together with the contact section.

[0011] According to a sixth aspect of the present disclosure, in any one of the first to fifth aspects, the projection unit may be attachable to and detachable from the contact section.

[0012] According to a seventh aspect of the present disclosure, the medium feeding device according to any one of the first to sixth aspects may further comprise a light source that radiates light onto the lateral edge of the plurality of loaded recording media and does not radiate the light onto a projection surface of the projection unit onto which the image is projected.

[0013] According to an eighth aspect of the present disclosure, there is provided an image forming apparatus comprising the medium feeding device according to any one of the first to seventh aspects and an image forming unit that forms an image onto each recording medium fed from the medium feeding device.

[0014] In the configuration according to the first aspect, the degree of freedom with respect to the installation position of the image capturing unit may be enhanced, as compared with a case where the image capturing unit directly captures the image of the lateral edge of the plurality of recording media.

[0015] In the configuration according to the second aspect, a feeding failure of each recording medium may be suppressed, as compared with a case where the image capturing unit is disposed at a position where it interferes with each recording medium fed by the feeding unit.

[0016] In the configuration according to the third as-

pect, the degree of freedom with respect to the installation position of the image capturing unit in the up-down direction may be enhanced, as compared with a case where the image capturing unit is disposed above or below the position where each recording medium fed by the feeding unit passes.

[0017] In the configuration according to the fourth aspect, an out-of-focus state of the image capturing unit when the image capturing unit captures the image of the lateral edge of the plurality of recording media projected on the projection unit may be suppressed, as compared with a case where the image capturing unit is always set at a fixed position.

[0018] In the configuration according to the fifth aspect, an out-of-focus state of the image capturing unit when the image capturing unit captures the image of the lateral edge of the plurality of recording media projected on the projection unit may be suppressed, as compared with a case where the image capturing unit is separated from the contact section and moves independently therefrom.

[0019] In the configuration according to the sixth aspect, the projection unit may be cleaned readily, as compared with a case where the projection unit is fixed to the contact section in a non-detachable manner.

[0020] In the configuration according to the seventh aspect, an image capturing failure occurring when the image capturing unit captures the image of the lateral edge of the plurality of recording media projected on the projection unit may be suppressed, as compared with a case where the light source also radiates the light onto the projection surface of the projection unit.

Brief Description of the Drawings

[0021] 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 this 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 of the medium feeding device according to this exemplary embodiment;

Fig. 4 is a cross-sectional view illustrating a state where air is being supplied to multiple sheet members in the configuration illustrated in Fig. 3;

Fig. 5 is a perspective view illustrating a projection unit and a camera according to this exemplary embodiment;

Fig. 6 is a plan view illustrating the projection unit and the camera according to this exemplary embodiment;

Fig. 7 is a side view illustrating the projection unit and the camera according to this exemplary embodiment;

Fig. 8 is a block diagram illustrating a hardware configuration of a controller of the medium feeding device according to this exemplary embodiment;

Fig. 9 is a perspective view illustrating the projection unit and the camera according to a modification;

Fig. 10 is a side view illustrating the projection unit and the camera according to the modification;

Fig. 11 is a side view illustrating a state where a sheet member is fed in the configuration illustrated in Fig. 10;

Fig. 12 is a plan view illustrating the projection unit and the camera according to a modification;

Fig. 13 is a side view illustrating the projection unit and the camera according to another modification; and

Fig. 14 is a side view illustrating a state where a sheet member is fed in the configuration illustrated in Fig. 13.

Detailed Description

[0022] 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

[0023] 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.

Image Forming Unit 102

[0024] 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.

[0025] 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.

[0026] 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

[0027] 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 and a feeding unit 16. 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 Figs. 5, 6, and 7, the medium feeding device 10 includes a leading edge guide 15, a projection unit 20, a camera 18, and a light source 22. In addition, as illustrated in Fig. 8, the medium feeding device 10 includes a controller 40. The side guide 13 is an example of a contact section. The camera 18 is an example of an image capturing unit.

Loading Section 12, Side Guide 13, and Leading Edge Guide 15

[0028] 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.

[0029] 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.

[0030] The pair of side guides 13 are movable toward the lateral sides of the sheet members P. In detail, the pair of side guides 13 are attached to a device body 11 (see Fig. 1) of the medium feeding device 10 in a slidable manner in the depth direction serving as the width direc-

tion (see the direction of the arrow Y) of the sheet members P. In this exemplary embodiment, a user manually moves the side guides 13 in the width direction of the sheet members P in conformity with the widthwise size of the sheet members P, so that the side guides 13 come into contact with the opposite lateral edges of the sheet members P, thereby limiting the position of the sheet members P in the width direction.

[0031] As illustrated in Figs. 6 and 7, the leading edge guide 15 is a component that comes into contact with the leading edge of the multiple sheet members P from the downstream side (i.e., in the direction of an arrow W1 in Fig. 2) in a feeding direction, to be described later, relative to the multiple sheet members P. In detail, the leading edge guide 15 is disposed at the leading edge of the sheet members P loaded on the bottom plate 12A. The leading edge guide 15 comes into contact with the leading edge (i.e., downstream edge in the feeding direction to be described later) of the sheet members P loaded on the bottom plate 12A, so as to limit the position of the sheet members P in the feeding direction (i.e., transport direction).

Supplier 14

[0032] 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 front one in the depth direction D 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.

[0033] 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.

[0034] 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.

[0035] In this exemplary embodiment, the supplier 14 supplies the air toward one lateral edge (i.e., the front one in the depth direction D 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 front one in the depth direction D 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 rear

one in the depth direction D in Fig. 2), the leading edge (i.e., the downstream edge in the 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

[0036] The feeding unit 16 is a component that feeds, in the feeding direction (see the arrow W1 in Fig. 2), an uppermost one of the sheet members 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.

[0037] 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.

[0038] 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).

Projection Unit 20

[0039] As illustrated in Figs. 5, 6, and 7, the projection unit 20 is a component that is provided at the side guide 13 and onto which an image of the lateral edge of the multiple sheet members P is projected in the feeding direction. In detail, the projection unit 20 is constituted of a reflecting mirror serving as a reflector that reflects light from the lateral edge of the sheet members P in the feeding direction.

[0040] The projection unit 20 receives the light from the lateral edge of the sheet members P and reflects the light in the feeding direction. Accordingly, the image of the lateral edge of the multiple sheet members P is projected onto the projection unit 20 in the feeding direction.

[0041] For example, the projection unit 20 is attached to the side guide 13 such that a projection surface 20A onto which the image is projected is set at a 45-degree angle relative to the feeding direction and the width direction of the sheet members P. Furthermore, the projection unit 20 is attachable to and detachable from the side guide 13. The projection unit 20 is attached to the side guide 13 in a detachable manner from the side guide 13. Accordingly, maintenance and inspection processes, including a cleaning process of the projection surface 20A, may be executed on the projection unit 20 in a state where the side guide 13 is attached to the device body 11 of the medium feeding device 10.

[0042] Furthermore, in this exemplary embodiment, the side guide 13 is open in two directions relative to

the projection unit 20, namely, toward the downstream side in the feeding direction and toward the lateral edge of the sheet members P, and is closed in directions (i.e., other directions including the up-down direction) other than the two directions relative to the projection unit 20. Therefore, light is inputtable to and outputtable from the projection unit 20 in the two directions, namely, toward the downstream side in the feeding direction and toward the lateral edge of the sheet members P.

Light Source 22

[0043] The light source 22 is a component that radiates light onto the lateral edge of the multiple sheet members P loaded on the loading section 12. In this exemplary embodiment, for example, the light source 22 is disposed alongside the lateral edge of the sheet members P, as well as downstream of the side guide 13 in the feeding direction and above the leading edge guide 15 (see Figs. 6 and 7). The light source 22 radiates light onto the lateral edge of the sheet members P from the aforementioned position where the light source 22 is disposed.

[0044] Furthermore, the light source 22 does not radiate the light onto the projection surface 20A of the projection unit 20 onto which the image is projected. In detail, the light traveling from the light source 22 toward the projection surface 20A is blocked by the side guide 13, so that the light is not radiated onto the projection surface 20A from the light source 22. The light source 22 is, for example, a light emitting element, such as a light emitting diode (LED).

Camera 18

[0045] The camera 18 is a component that captures the image of the sheet members P projected on the projection unit 20 in a state where the sheet members P are supplied with the air from the supplier 14. As illustrated in Figs. 5, 6, and 7, the camera 18 is disposed in the feeding direction relative to the multiple sheet members P. Moreover, the camera 18 is disposed at a position where it does not interfere with each sheet member P fed by the feeding unit 16. In detail, the camera 18 is disposed alongside a position where a recording medium fed by the feeding unit 16 passes (see P1 in Fig. 6). In this exemplary embodiment, the camera 18 is disposed at the same height as the position where the recording medium passes (see P1 in Fig. 6).

[0046] Furthermore, the camera 18 is coupled to the side guide 13 and moves together with the side guide 13. In other words, the camera 18 moves laterally in conjunction with the movement of the side guide 13.

[0047] In detail, the camera 18 is coupled to the side guide 13 by an attachment section 17 and a coupling member 19. The attachment section 17 is a component to which the camera 18 is attached. For example, the attachment section 17 has a side plate 17A that supports the camera 18 from the feeding direction and a base plate

17B that supports the camera 18 from below.

[0048] The coupling member 19 has a pair of arms 19A that are L-shaped in side view. One end (i.e., upper end) of each arm 19A is fixed to the base plate 17B, whereas the other end (i.e., upstream end in the feeding direction) of each arm 19A is fixed to a lower area of the side guide 13.

[0049] Accordingly, the camera 18 disposed in the feeding direction relative to the sheet members P loaded on the loading section 12 captures the image, as, for example, a still image, of the lateral edge of the sheet members P projected on the projection unit 20 from the feeding direction relative to the sheet members P.

Controller 40

[0050] As illustrated in Fig. 8, the controller 40 has a central processing unit (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.

[0051] 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.

[0052] The communication IF 45 is an interface via which the controller 40 communicates with, for example, the camera 18, the feeding unit 16, the supplier 14 (i.e., the blower 54), and the image forming unit 102. The standard used by the communication IF 45 is, for example, Ethernet (registered trademark), fiber distributed data interface (FDDI), or Wi-Fi (registered trademark).

[0053] 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 the supplier 14. In detail, in this exemplary embodiment, for example, in accordance with the distance between the sheet members P image-captured by the camera 18, the supply amount of the supplier 14 (i.e., the blower 54) is adjusted, and the stoppage and activation of the supplier 14 are controlled.

Effects According to Exemplary Embodiment

[0054] In this exemplary embodiment, as illustrated in Figs. 5, 6, and 7, the image of the lateral edge of the multiple sheet members P is projected in the feeding

direction by the projection unit 20 provided at the side guide 13. The camera 18 captures the image of the sheet members P projected on the projection unit 20 in a state where the sheet members P are supplied with the air from the supplier 14.

[0055] Therefore, the degree of freedom with respect to the installation position of the camera 18 may be enhanced, as compared with a case where the camera 18 directly captures the image of the lateral edge of the multiple sheet members P. Furthermore, with this configuration, the camera 18 is capable of capturing an image of an edge of the sheet members P in the feeding direction together with the image of the lateral edge of the sheet members P.

[0056] In this exemplary embodiment, the camera 18 is disposed at the position where it does not interfere with each sheet member P fed by the feeding unit 16.

[0057] Therefore, a feeding failure of each sheet member P may be suppressed, as compared with a case where the camera 18 is disposed at a position where it interferes with each sheet member P fed by the feeding unit 16.

[0058] In this exemplary embodiment, the camera 18 is specifically disposed alongside the position where a recording medium fed by the feeding unit 16 passes (see P1 in Fig. 6).

[0059] Therefore, the degree of freedom with respect to the installation position of the camera 18 in the up-down direction may be enhanced, as compared with a case where the camera 18 is disposed above or below the position where each sheet member P fed by the feeding unit 16 passes. In this configuration, the camera 18 may be disposed at the same height as the position where each sheet member P fed by the feeding unit 16 passes.

[0060] In this exemplary embodiment, the camera 18 moves laterally in conjunction with the movement of the side guide 13.

[0061] Therefore, an out-of-focus state of the camera 18 when the camera 18 captures the image of the lateral edge of the multiple sheet members P projected on the projection unit 20 may be suppressed, as compared with a case where the camera 18 is always set at a fixed position.

[0062] In this exemplary embodiment, the camera 18 is coupled to the side guide 13 and moves together with the side guide 13.

[0063] Therefore, an out-of-focus state of the camera 18 when the camera 18 captures the image of the lateral edge of the multiple sheet members P projected on the projection unit 20 may be suppressed, as compared with a case where the camera 18 is separated from the side guide 13 and moves independently therefrom.

[0064] In this exemplary embodiment, the projection unit 20 is attachable to and detachable from the side guide 13.

[0065] Therefore, the projection unit 20 may be cleaned readily, as compared with a case where the

projection unit 20 is fixed to the side guide 13 in a non-detachable manner.

[0066] In this exemplary embodiment, the light source 22 radiates light onto the lateral edge of the multiple sheet members P loaded on the loading section 12 and does not radiate the light onto the projection surface 20A of the projection unit 20.

[0067] Therefore, as compared with a case where the light source 22 also radiates the light onto the projection surface 20A of the projection unit 20, reflection of the light on the projection surface 20A may be less likely to occur, and an image capturing failure occurring when the camera 18 captures the image of the lateral edge of the multiple sheet members P projected on the projection unit 20 may be suppressed.

Modifications

[0068] 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 the image projected on the projection unit 20.

[0069] Although a reflecting mirror is used as an example of the projection unit 20 in this exemplary embodiment, the configuration is not limited to this. For example, the projection unit 20 may be a prism so long as the projection unit 20 is a component onto which the image of the lateral edge of the multiple sheet members P is projected in the feeding direction.

[0070] Although a light emitting element, such as an LED, is used as an example of the light source 22 in this exemplary embodiment, the configuration is not limited to this. For example, the light source 22 may be another light emitter that emits light so long as the light source 22 is capable of radiating light onto the lateral edge of the multiple sheet members P. Furthermore, the medium feeding device 10 may be configured not to include the light source 22.

[0071] In this exemplary embodiment, the camera 18 is disposed alongside the position where a recording medium fed by the feeding unit 16 passes (see P1 in Fig. 6) and at the same height as the position where the recording medium passes (see P1 in Fig. 6). However, the configuration is not limited to this.

[0072] For example, as illustrated in Figs. 9 and 10, the camera 18 may be disposed below the position where the recording medium passes (see P1 in Fig. 6). In this case, in side view as illustrated in Fig. 11, each sheet member P fed by the feeding unit 16 travels above the camera 18. Moreover, in this case, in plan view as illustrated in Fig. 12, the camera 18 may be disposed at a position aligned with the position where each sheet member P fed by the feeding unit 16 passes. In other words, the camera 18 may be disposed below the position where each sheet member P fed by the feeding unit 16 passes.

[0073] Furthermore, as illustrated in Fig. 13, the camera 18 may be disposed above the position where the recording medium passes (see P1 in Fig. 6). In this case, in side view as illustrated in Fig. 14, each sheet member P fed by the feeding unit 16 travels below the camera 18.

[0074] Although the camera 18 moves laterally in conjunction with the movement of the side guide 13 in this exemplary embodiment, the configuration is not limited to this. For example, the camera 18 may be constantly set at a fixed position. In this case, for example, the image capturing angle (orientation) of the camera 18 may be changed in accordance with the position of the projection unit 20 after the movement of the side guide 13.

[0075] Although the camera 18 is coupled to the side guide 13 and moves together with the side guide 13 in this exemplary embodiment, the configuration is not limited to this. For example, the camera 18 may be separated from the side guide 13 and move independently therefrom. In this case, the movement of the side guide 13 and the amount of movement thereof may be detected by a detector, such as a sensor, and the camera 18 may be moved by a driving force of a driver, such as a driving motor, based on the amount of movement detected by the detector, so that the camera 18 moves in conjunction with the movement of the side guide 13.

[0076] Although the projection unit 20 is attachable to and detachable from the side guide 13 in this exemplary embodiment, the configuration is not limited to this. For example, the projection unit 20 may be fixed to the side guide 13 in a non-detachable manner.

[0077] In this exemplary embodiment, the light source 22 radiates light onto the lateral edge of the multiple sheet members P loaded on the loading section 12 and does not radiate the light onto the projection surface 20A of the projection unit 20. However, the configuration is not limited to this. For example, the light source 22 may also radiate the light onto the projection surface 20A of the projection unit 20.

[0078] 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.

[0079] 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).

[0080] 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 embodiments above,

and may be changed.

[0081] The foregoing description of the exemplary 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 embodiments 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

[0082]

((1)) A medium feeding device 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;
a feeding unit that feeds, in a feeding direction, an uppermost one of the recording media separated by the supplier;
a contact section that comes into contact with a lateral edge of the plurality of recording media from a lateral side of the plurality of recording media;
a projection unit that is provided at the contact section and onto which an image of the lateral edge of the plurality of recording media is projected in the feeding direction; and
an image capturing unit that is disposed in the feeding direction relative to the plurality of recording media and that captures the image projected on the projection unit in a state where the plurality of recording media are supplied with the air from the supplier.

((2)) The medium feeding device according to ((1)),

wherein the image capturing unit is disposed at a position where the image capturing unit does not interfere with each recording medium fed by the feeding unit.

((3)) The medium feeding device according to ((2)),

wherein the image capturing unit is disposed toward the lateral side relative to a position where each recording medium fed by the feeding unit passes.

((4)) The medium feeding device according to any one of ((1)) to ((3)),

wherein the contact section is movable toward the lateral side of the recording media, and wherein the image capturing unit moves toward the lateral side in conjunction with movement of the contact section.

((5)) The medium feeding device according to ((4)),

wherein the image capturing unit is coupled to the contact section and moves together with the contact section.

((6)) The medium feeding device according to any one of ((1)) to ((5)),

wherein the projection unit is attachable to and detachable from the contact section.

((7)) The medium feeding device according to any one of ((1)) to ((6)), further comprising:

a light source that radiates light onto the lateral edge of the plurality of loaded recording media and does not radiate the light onto a projection surface of the projection unit onto which the image is projected.

((8)) An image forming apparatus comprising:

the medium feeding device according to any one of ((1)) to ((7)); and

an image forming unit that forms an image onto each recording medium fed from the medium feeding device.

[0083] In the configuration according to ((1)), the degree of freedom with respect to the installation position of the image capturing unit may be enhanced, as compared with a case where the image capturing unit directly captures the image of the lateral edge of the plurality of recording media.

[0084] In the configuration according to ((2)), a feeding failure of each recording medium may be suppressed, as compared with a case where the image capturing unit is disposed at a position where it interferes with each recording medium fed by the feeding unit.

[0085] In the configuration according to ((3)), the degree of freedom with respect to the installation position of the image capturing unit in the up-down direction may be enhanced, as compared with a case where the image capturing unit is disposed above or below the position where each recording medium fed by the feeding unit passes.

[0086] In the configuration according to ((4)), an out-of-focus state of the image capturing unit when the image capturing unit captures the image of the lateral edge of the plurality of recording media projected on the projection unit may be suppressed, as compared with a case where the image capturing unit is always set at a fixed position.

[0087] In the configuration according to ((5)), an out-of-focus state of the image capturing unit when the image capturing unit captures the image of the lateral edge of the plurality of recording media projected on the projec-

tion unit may be suppressed, as compared with a case where the image capturing unit is separated from the contact section and moves independently therefrom.

[0088] In the configuration according to (((6))), the projection unit may be cleaned readily, as compared with a case where the projection unit is fixed to the contact section in a non-detachable manner.

[0089] In the configuration according to (((7))), an image capturing failure occurring when the image capturing unit captures the image of the lateral edge of the plurality of recording media projected on the projection unit may be suppressed, as compared with a case where the light source also radiates the light onto the projection surface of the projection unit.

Claims

1. A medium feeding device 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;
a feeding unit that feeds, in a feeding direction, an uppermost one of the recording media separated by the supplier;
a contact section that comes into contact with a lateral edge of the plurality of recording media from a lateral side of the plurality of recording media;
a projection unit that is provided at the contact section and onto which an image of the lateral edge of the plurality of recording media is projected in the feeding direction; and
an image capturing unit that is disposed in the feeding direction relative to the plurality of recording media and that captures the image projected on the projection unit in a state where the plurality of recording media are supplied with the air from the supplier.

2. The medium feeding device according to claim 1, wherein the image capturing unit is disposed at a position where the image capturing unit does not interfere with each recording medium fed by the feeding unit.

3. The medium feeding device according to claim 2, wherein the image capturing unit is disposed toward the lateral side relative to a position where each recording medium fed by the feeding unit passes.

4. The medium feeding device according to any one of claims 1 to 3,

wherein the contact section is movable toward the lateral side of the recording media, and

wherein the image capturing unit moves toward the lateral side in conjunction with movement of the contact section.

5. The medium feeding device according to claim 4, wherein the image capturing unit is coupled to the contact section and moves together with the contact section.

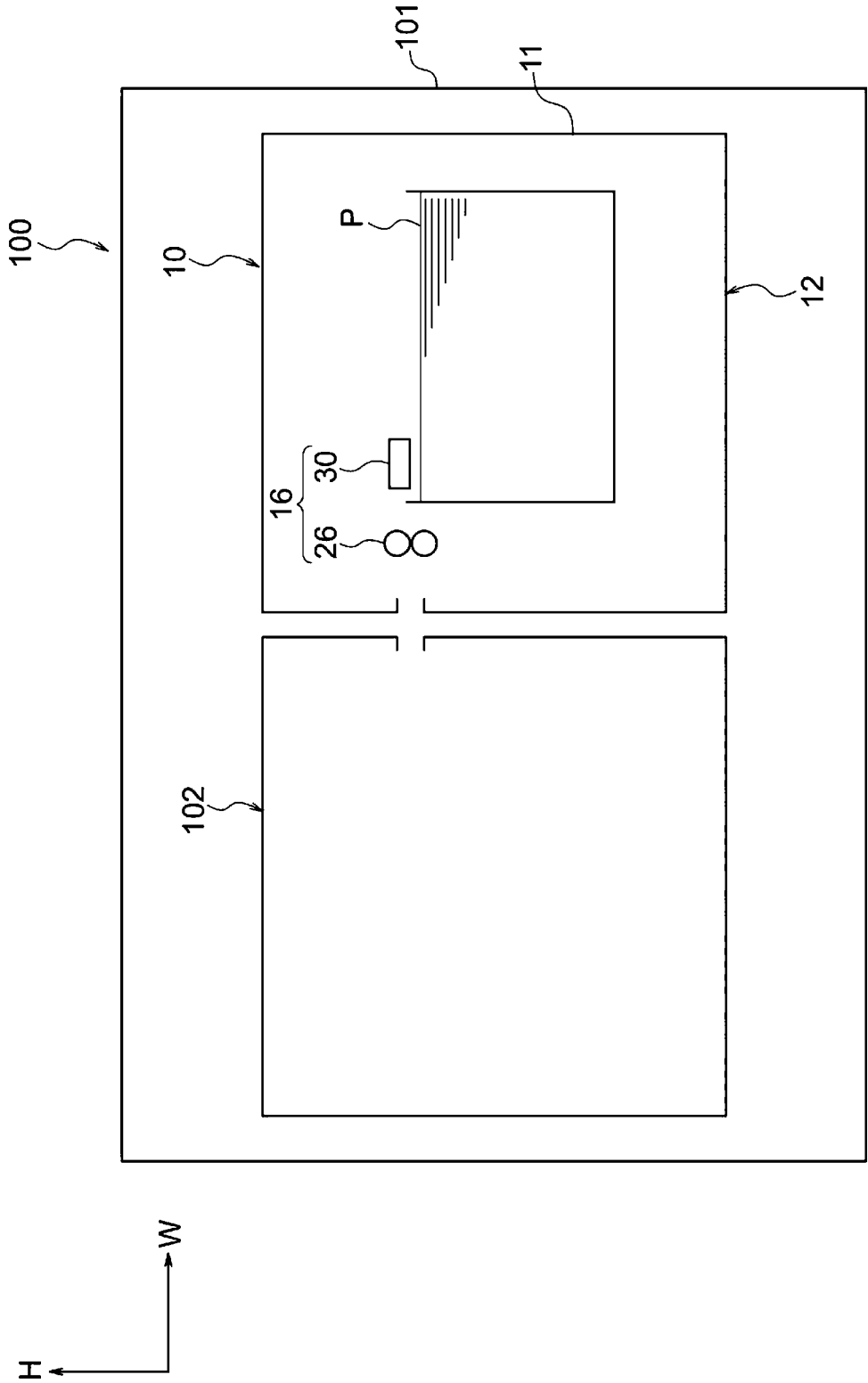
6. The medium feeding device according to any one of claims 1 to 5, wherein the projection unit is attachable to and detachable from the contact section.

7. The medium feeding device according to any one of claims 1 to 6, further comprising:
a light source that radiates light onto the lateral edge of the plurality of loaded recording media and does not radiate the light onto a projection surface of the projection unit onto which the image is projected.

8. An image forming apparatus comprising:

the medium feeding device according to any one of claims 1 to 7; and
an image forming unit that forms an image onto each recording medium fed from the medium feeding device.

FIG. 1



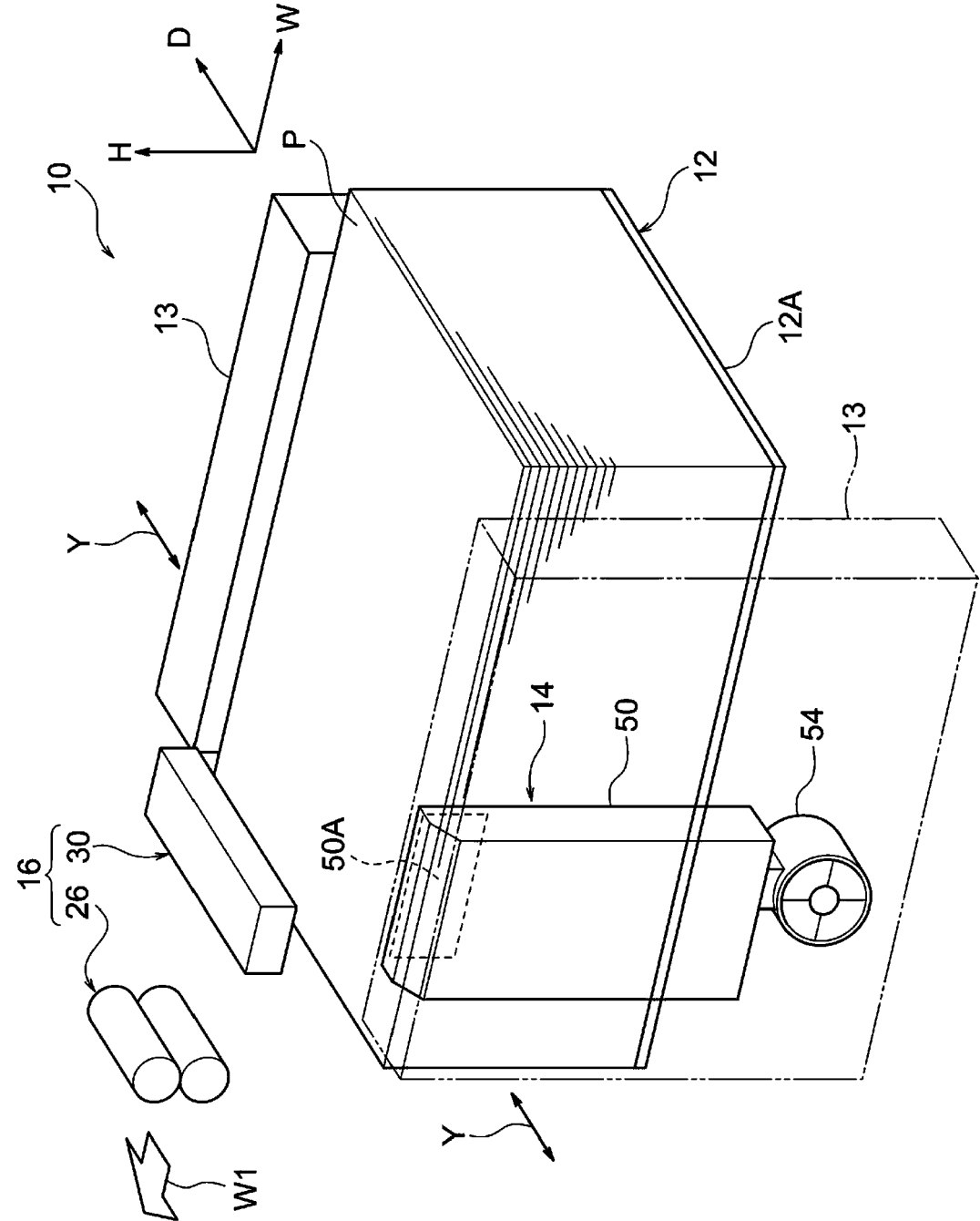


FIG. 3

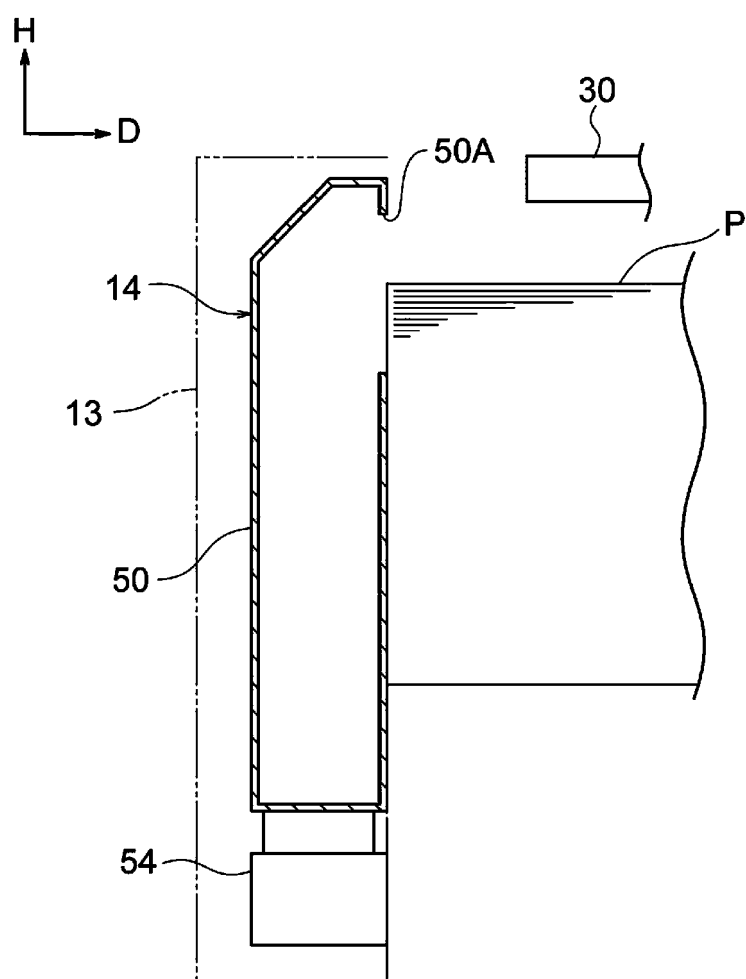


FIG. 4

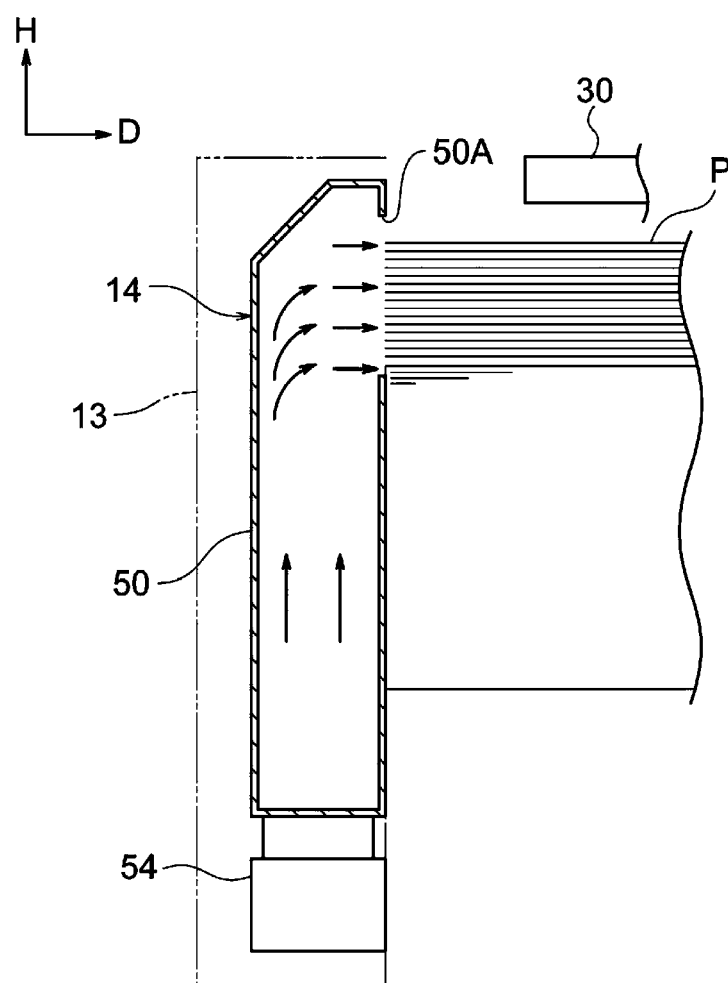


FIG. 5

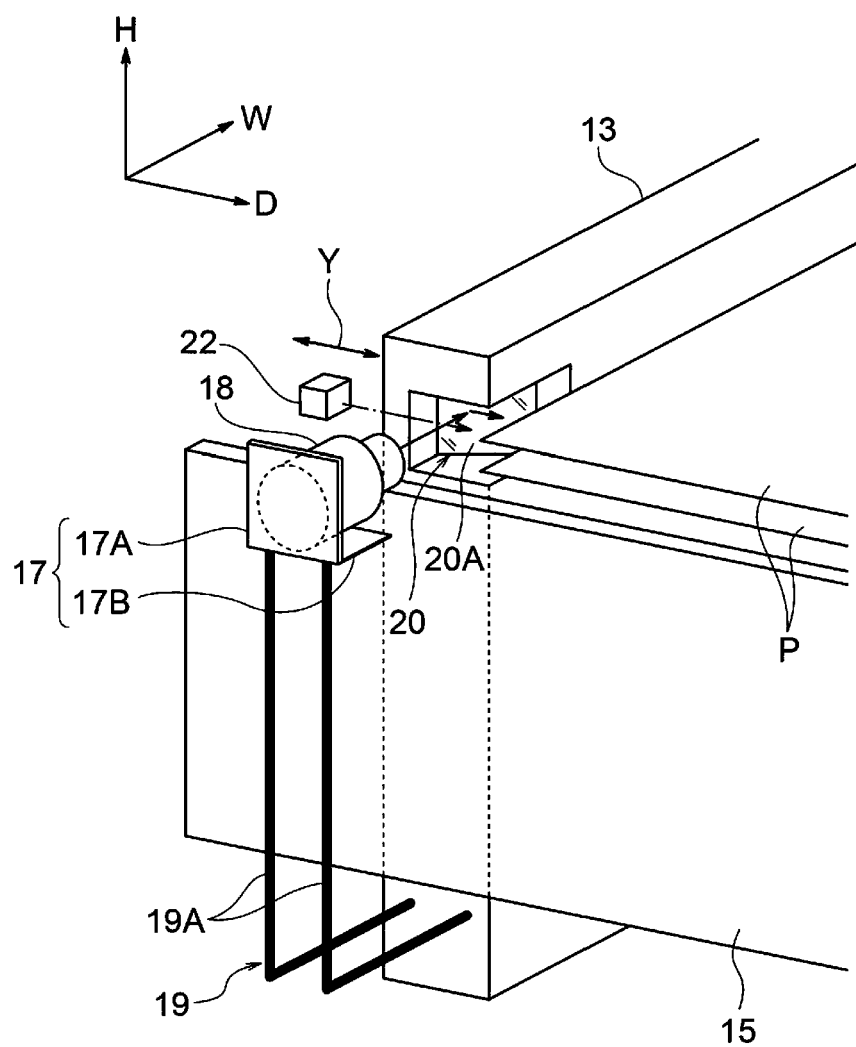


FIG. 6

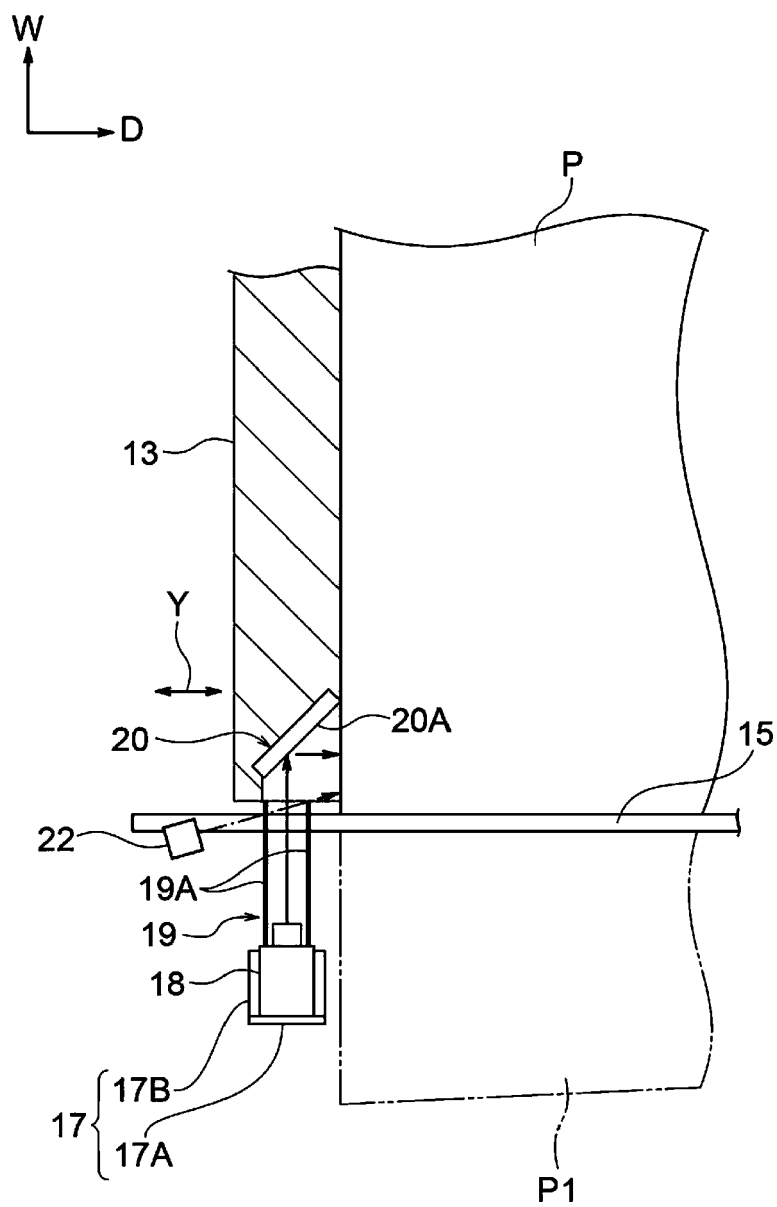


FIG. 7

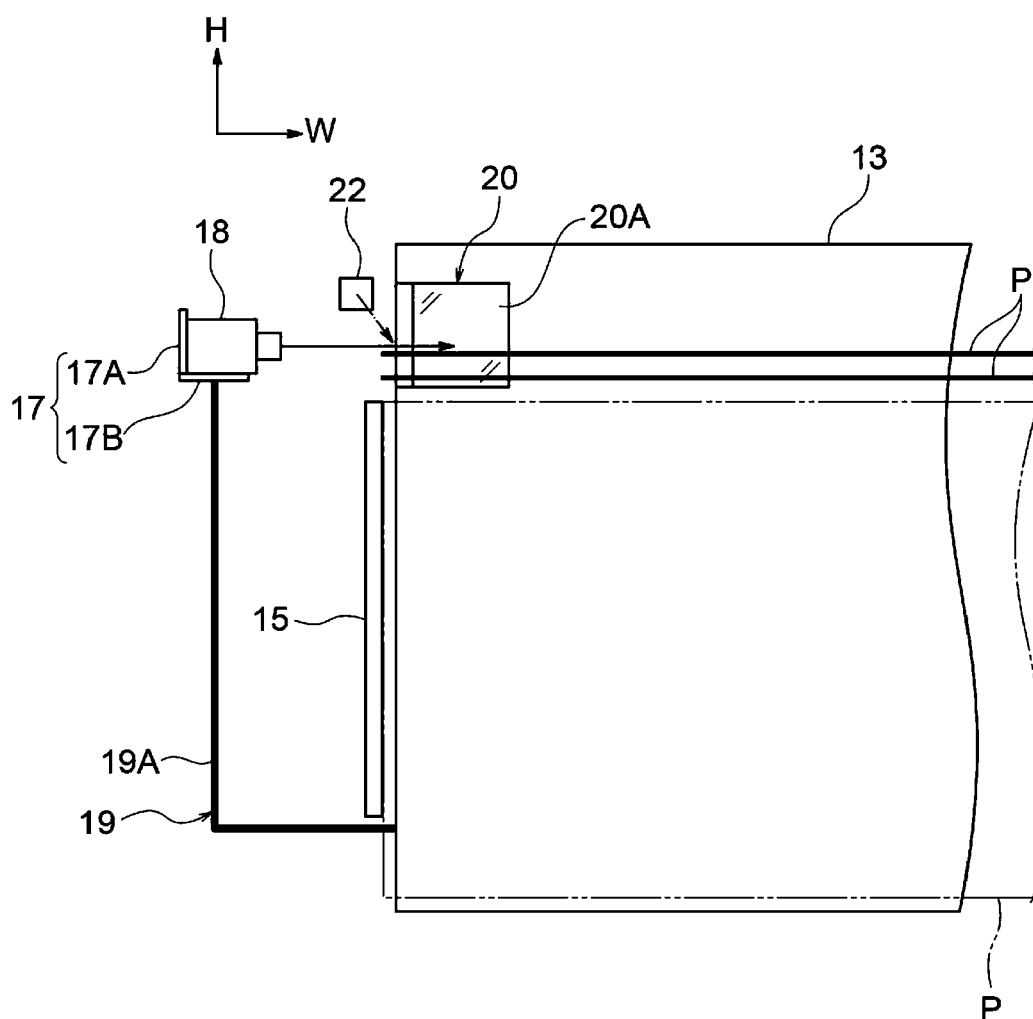


FIG. 8

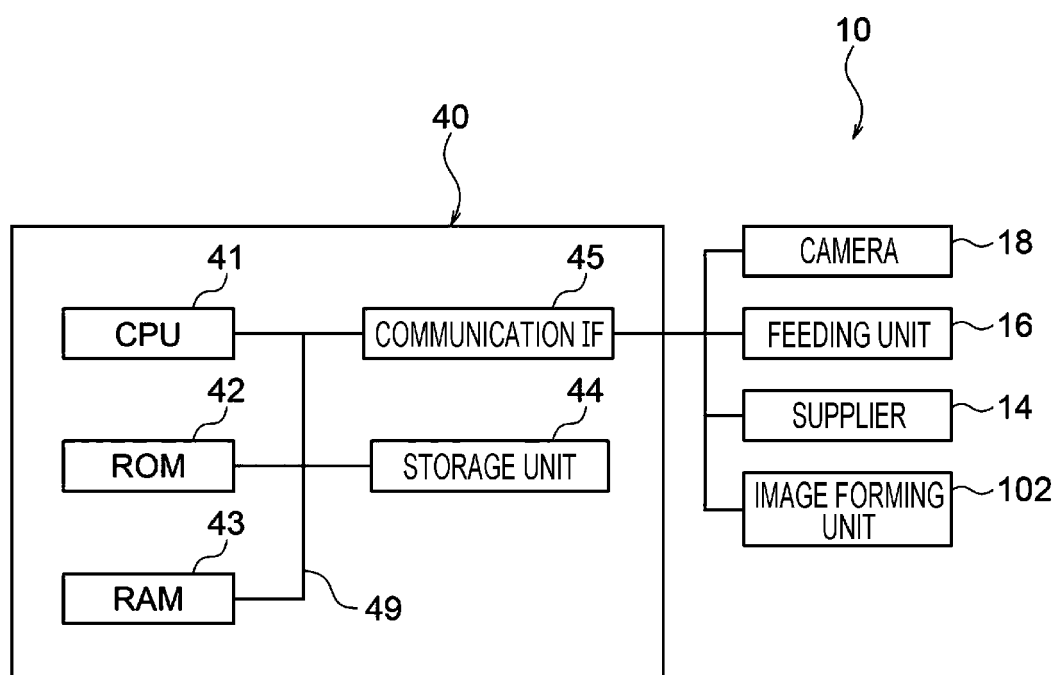


FIG. 9

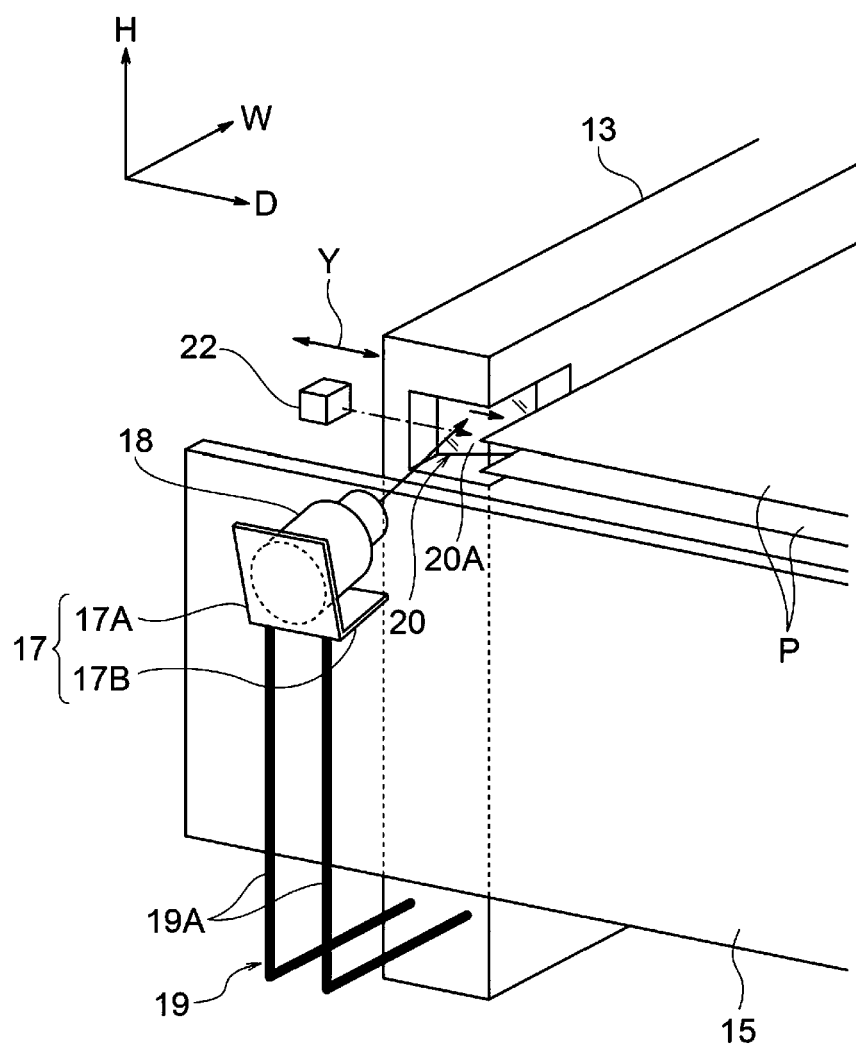


FIG. 10

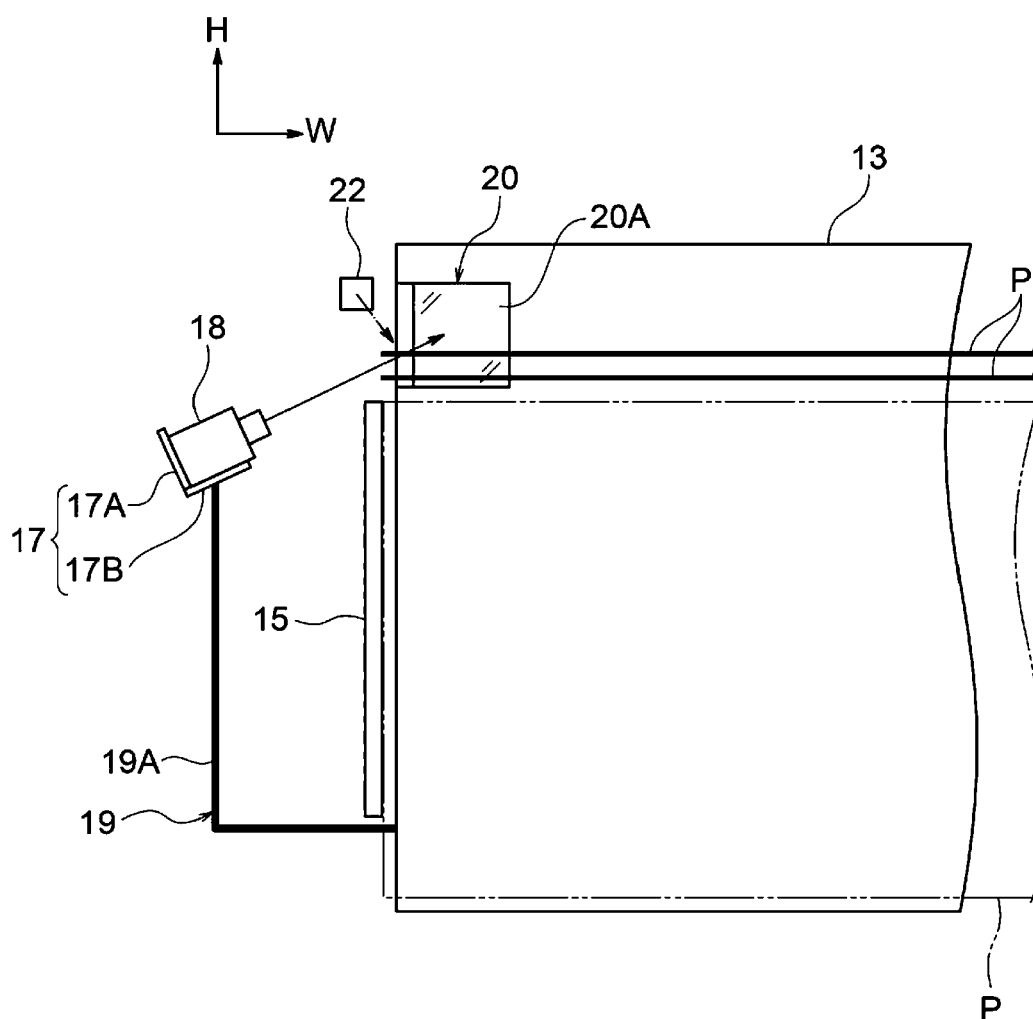


FIG. 11

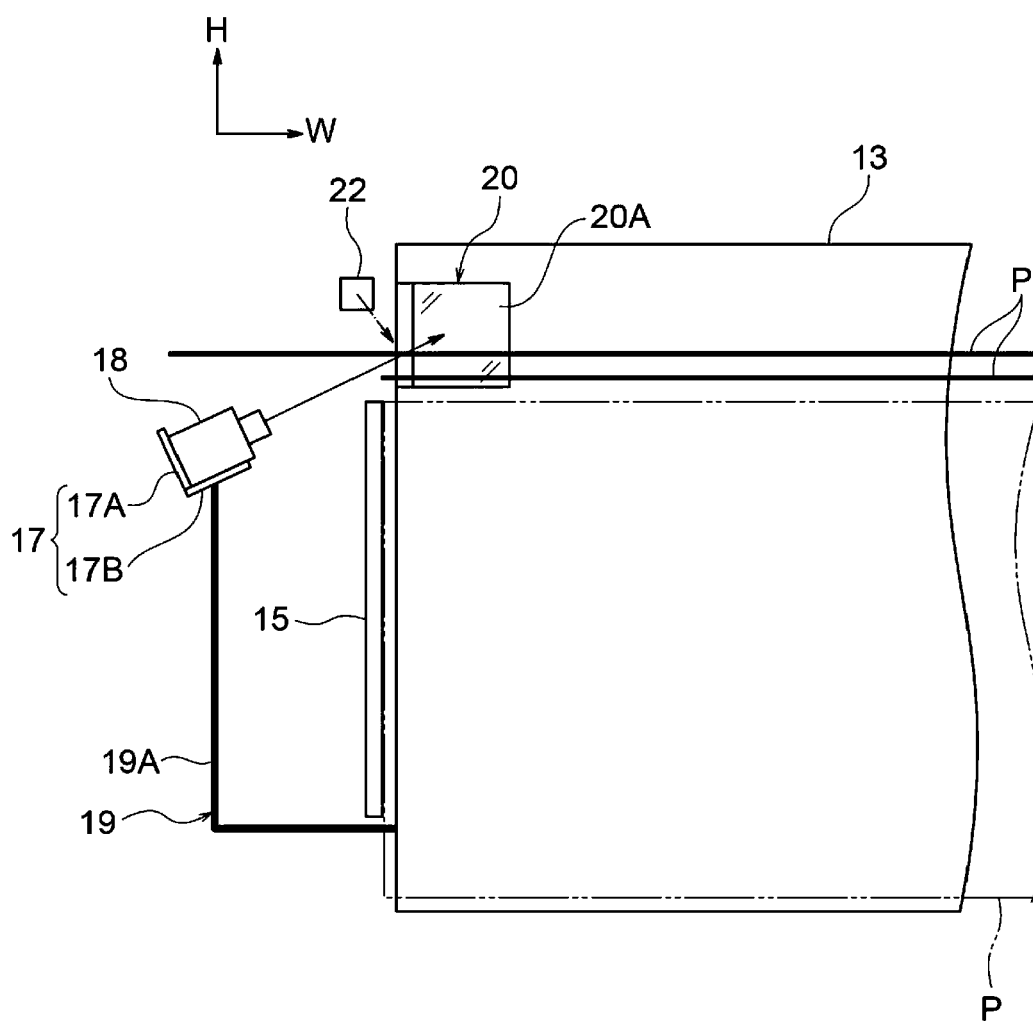


FIG. 12

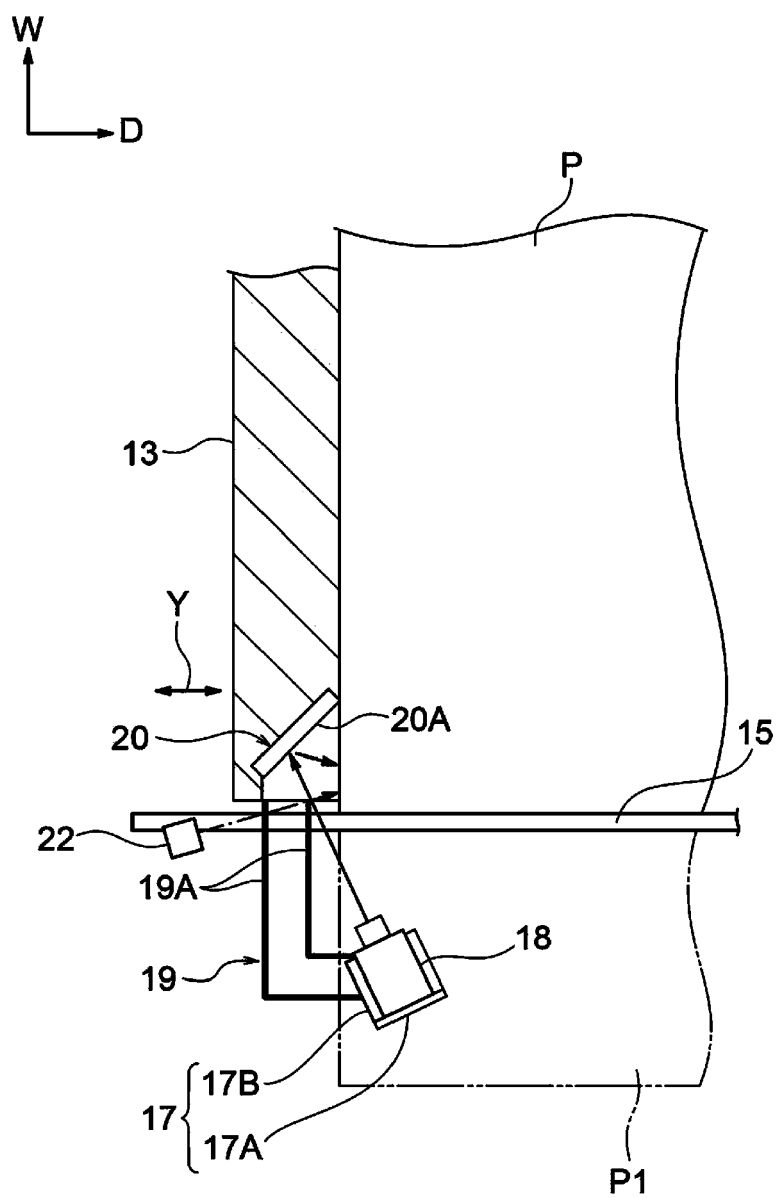


FIG. 13

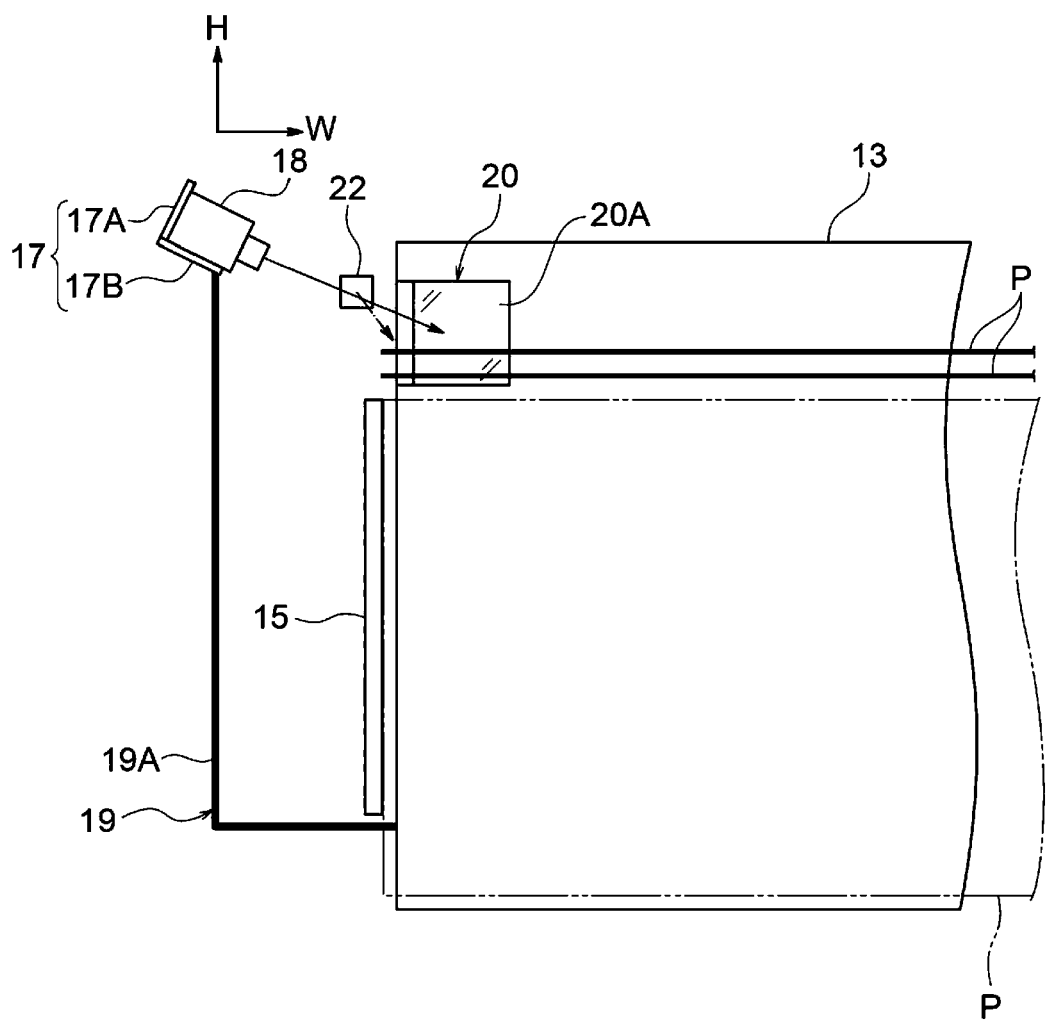
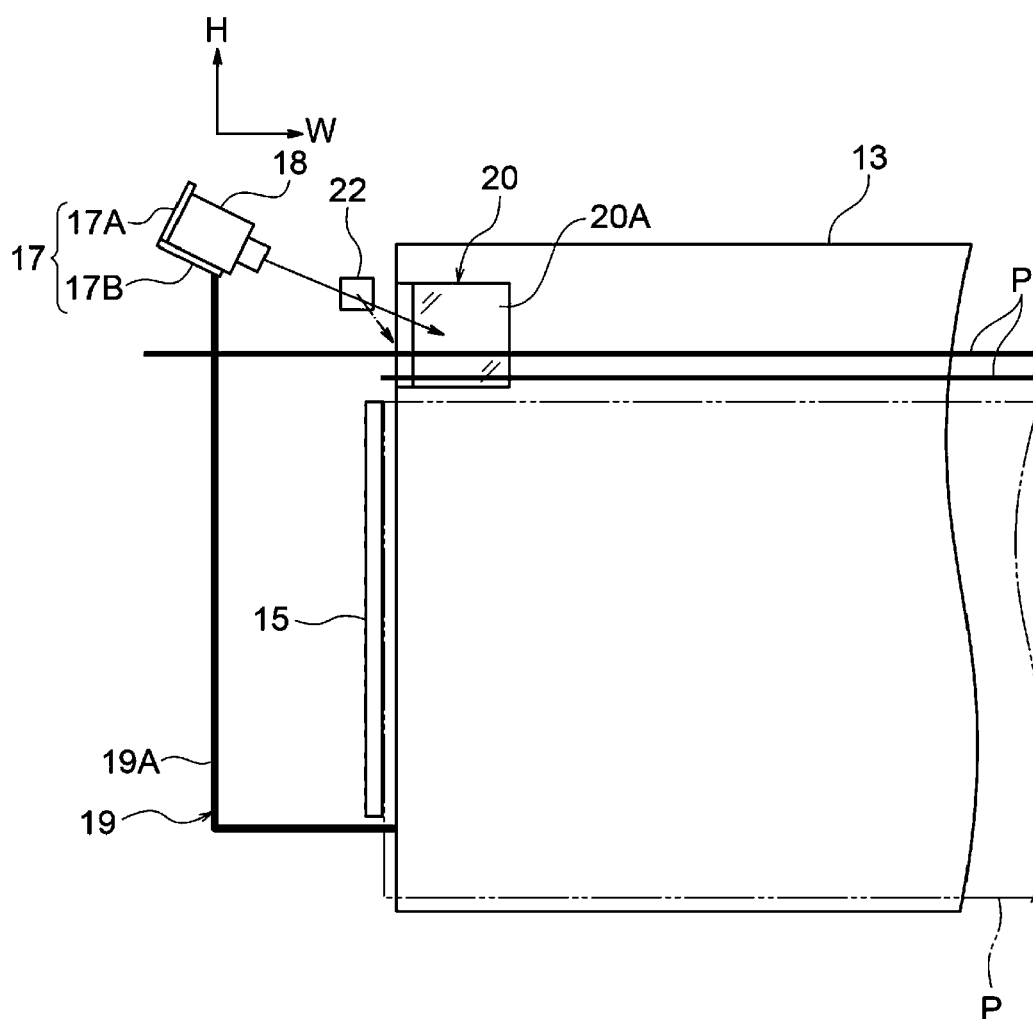


FIG. 14





EUROPEAN SEARCH REPORT

Application Number

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			B65H
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The Hague		10 July 2024	Athanasiadis, A
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