United States Patent Application Publication	20250258423
Kind Code	A1
Publication Date	August 14, 2025
Inventor(s)	KAYA; Akimasa

PRINTER AND DIGITAL CAMERA WITH PRINTER

Abstract

A printer includes an encoder plate that rotates in conjunction with transport of a recording medium and on which slits are radially formed, a photo-interrupter that emits light to the encoder plate and receives the light to output a rotation detection signal, a fixed slit plate that narrows the light emitted from the photo-interrupter, and a positioning portion that positions the photo-interrupter with respect to the fixed slit plate and includes a reference holding portion and a deformable holding portion provided at a position facing the reference holding portion, in which the deformable holding portion is deformed to hold the photo-interrupter.

Inventors: **KAYA; Akimasa (Saitama-shi, JP)**

Applicant: **FUJIFILM Corporation** (Tokyo, JP)

Family ID: **94598377**

Assignee: **FUJIFILM Corporation (Tokyo, JP)**

Appl. No.: **19/048788**

Filed: **February 07, 2025**

Foreign Application Priority Data

JP	2024-017732	Feb. 08, 2024

Publication Classification

Int. Cl.: **G03B17/50** (20210101); **H04N1/21** (20060101); **H04N23/50** (20230101)

U.S. Cl.:

CPC **G03B17/50** (20130101); **H04N1/2154** (20130101); **H04N23/50** (20230101); H04N2201/0084 (20130101)

Background/Summary

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims priority under 35 U.S.C § 119 (a) to Japanese Patent Application No. 2024-017732 filed on 8 Feb. 2024. The above application is hereby expressly incorporated by reference, in its entirety, into the present application.

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0002] The present invention relates to a printer and a digital camera with a printer.

2. Description of the Related Art

[0003] A printer disclosed in JP2005-300838A records an image on an instant film. The printer comprises a pair of transport rollers, a pair of spreading rollers that are provided downstream of the pair of transport rollers in a transport direction and spread a developer with an instant film interposed therebetween, a motor that applies a rotational driving force to both the transport rollers and the spreading rollers, and a gear train that transmits the rotational driving force of the motor to the transport rollers and the spreading rollers, in which the gear train includes a first sub-gear train that transmits the rotational driving force from the motor to a middle stage, a second sub-gear train that directly receives the rotational driving force transmitted from the first sub-gear train and transmits the rotational driving force to the transport rollers, and a third sub-gear train that directly receives the rotational driving force transmitted from the first sub-gear train and transmits the rotational driving force to the spreading rollers.

[0004] A printer disclosed in JP2007-290157A comprises an exposure device, in which a body of the exposure device comprises a cleaning unit that is attached movably, a motor that drives the cleaning unit, a gear, a belt, and the like that transmit a driving force of the motor to the cleaning unit.

SUMMARY OF THE INVENTION

[0005] One embodiment according to the technology of the present disclosure provides a printer and a digital camera with a printer capable of accurately positioning a photo-interrupter that outputs a rotation detection signal of a member that rotates in conjunction with transport of a recording medium, via a simple operation and capable of suppressing an increase in cost.

[0006] An aspect of the technology of the present disclosure provides a printer comprising: an encoder plate; a photo-interrupter; a fixed slit plate; and a positioning portion. The encoder plate rotates in conjunction with transport of a recording medium and on which slits are radially formed. The photo-interrupter emits light to the encoder plate and receives the light to output a rotation detection signal. The fixed slit plate narrows the light emitted from the photo-interrupter. The positioning portion positions the photo-interrupter with respect to the fixed slit plate and includes a reference holding portion and a deformable holding portion provided at a position facing the reference holding portion, in which the deformable holding portion is deformed to hold the photo-interrupter.

[0007] It is preferable that the photo-interrupter is interposed and held between the reference holding portion and the deformable holding portion.

[0008] It is preferable that the deformable holding portion is a protrusion portion that protrudes in a circumferential direction of the encoder plate.

[0009] It is preferable that a protrusion amount of the deformable holding portion is within an outer shape tolerance range of the photo-interrupter.

[0010] It is preferable that the positioning portion has an opening portion in which at least a part of the photo-interrupter is accommodated, and the reference holding portion and the deformable holding portion are positioned inside the opening portion.

[0011] It is preferable that the deformable holding portion is deformed by being pressed by the photo-interrupter in a case in which the photo-interrupter is accommodated in the opening portion.
[0012] It is preferable that the printer further comprise a fixing member that fixes the photo-interrupter positioned by the positioning portion.
[0013] It is preferable that the printer further comprise a case member that holds the encoder plate and the positioning portion, in which the fixing member is a fastening member that is fastened to the case member.
[0014] It is preferable that the printer further comprise a transport roller that transports the recording medium, in which the encoder plate is provided on the same axis as the transport roller.
[0015] It is preferable that the recording medium is an instant film, and the printer further comprises an exposure head that exposes the instant film to record an image.
[0016] Another aspect of the technology of the present disclosure provides a digital camera with a printer, comprising: the printer according to the above-described aspect; and an imaging element that images a subject, in which the recording medium is an instant film, and the printer includes an exposure head that exposes an image captured by the imaging element onto the instant film.

Description

BRIEF DESCRIPTION OF THE DRAWINGS
[0017] FIG. **1** is a front perspective view of a digital camera with a printer.
[0018] FIG. **2** is a central longitudinal cross-sectional view of the digital camera with a printer.
[0019] FIG. **3** is a rear perspective view of the digital camera with a printer in a state in which a loading lid is positioned at a closed position.
[0020] FIG. **4** is a perspective view of an instant film pack.
[0021] FIG. **5** is a cross-sectional view of the instant film pack.
[0022] FIG. **6** is an exploded perspective view of the instant film pack.
[0023] FIG. **7** is a cross-sectional view of the instant film.
[0024] FIG. **8** is a cross-sectional view of a main part of a printer unit.
[0025] FIG. **9** is a perspective view of the printer unit in which a case member, an exposure head, a rotation detection sensor, and the like are omitted.
[0026] FIG. **10** is a perspective view of the printer unit.
[0027] FIG. **11** is a perspective view of the rotation detection sensor.
[0028] FIG. **12** is a cross-sectional view of the main part of the printer unit.
[0029] FIG. **13**A is a plan view of an encoder plate and FIG. **13**B is a plan view of a photo-interrupter.
[0030] FIG. **14** is an exploded perspective view of the rotation detection sensor and a perspective view of a cover member.
[0031] FIG. **15** is a plan view of the cover member.
[0032] FIG. **16** is a cross-sectional view of the cover member taken along XVI-XVI line of FIG. **15**.
[0033] FIG. **17** is an explanatory view showing attachment of the photo-interrupter to the cover member.
[0034] FIG. **18** is an explanatory view showing dimensions of a reference holding portion and a deformable holding portion in an accommodation portion.
[0035] FIGS. **19**A and **19**B are explanatory views showing a step of positioning the photo-interrupter via the reference holding portion and the deformable holding portion, in which FIG. **19**A shows a state before the photo-interrupter is held by the reference holding portion and the deformable holding portion, and FIG. **19**B shows a state after the photo-interrupter is held by the reference holding portion and the deformable holding portion.

[0036] FIG. **20** is an explanatory view showing a state in which the photo-interrupter is incorporated in a printer of the related art.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

First Embodiment

Overview of Digital Camera with Printer

[0037] In FIG. **1**, a digital camera **10** with a printer according to an embodiment of the present invention comprises a camera body **11**, an imaging unit **12**, and a printer unit **13**. A front surface of the camera body **11** is provided with an imaging window **15** and a release switch **16**. The imaging window **15** is disposed in the center on the front surface of the camera body **11**. The imaging window **15** exposes an imaging optical system **19** (see FIG. **2**) constituting the imaging unit **12**.

[0038] The camera body **11** has a vertically long rectangular shape as seen from the front. The digital camera **10** with a printer uses an instant film **28** (see FIG. **7**) as a sheet-like recording medium. The instant film **28** is, for example, a card-type instant film. It should be noted that the present invention is not limited to this, a square type or wide type instant film may be used. The instant film **28** corresponds to a recording medium in the claims.

[0039] As shown in FIG. **2**, the imaging optical system **19** and an imaging element **20** are provided in the imaging unit **12**. The imaging element **20** is, for example, a complementary metal-oxide-semiconductor (CMOS) type image sensor, and has a light receiving surface composed of a plurality of pixels (not shown) arranged in a two-dimensional matrix. Each pixel includes a photoelectric conversion element, photoelectrically converts a subject image formed on the light receiving surface by the imaging optical system **19**, and generates an imaging signal.

[0040] The imaging element **20** comprises signal processing circuits such as a noise removal circuit, an automatic gain controller, and an A/D conversion circuit (none of which is shown). The noise removal circuit executes noise removal processing on the imaging signal. The automatic gain controller amplifies a level of the imaging signal to an optimal value. The A/D conversion circuit converts the imaging signal into a digital signal, and outputs the digital signal to a built-in memory (not shown) from the imaging element **20**. The output signal from the imaging element **20** is image data (so-called RAW data) having one color signal for each pixel.

[0041] In a case in which the release switch **16** is pressed, the imaging element **20** is driven, and the subject image is captured. A film discharge port **21** is provided on an upper surface of the camera body **11**. The instant film **28** on which the image has been printed is discharged from the film discharge port **21**.

[0042] As shown in FIG. **3**, a loading lid **22** is attached to a rear surface side of the camera body **11** by using a hinge portion **22***a*. The hinge portion **22***a* supports the loading lid **22** in a rotatable manner between an open position (a position indicated by a solid line in FIG. **2**) and a closed position (a position indicated by a two-dot chain line in FIG. **2**). It should be noted that a locking mechanism and an unlocking mechanism (none of which is shown) are provided between the camera body **11** and the loading lid **22**, and in a case in which the locking mechanism holds the loading lid **22** at the closed position and operates the unlocking mechanism, the loading lid **22** moves rotationally from the closed position to the open position.

[0043] As shown in FIG. **4**, an instant film pack **24** in which the instant film **28** is accommodated is loaded into a loading chamber **23**. A plurality of film press portions **22***b* are provided on an inner surface of the loading lid **22**.

[0044] In a case in which the instant film pack **24** is loaded into the loading chamber **23** and the loading lid **22** is positioned at the closed position, the plurality of film press portions **22***b* enter the inside of the instant film pack **24** through an opening **32***a* (see FIG. **7**) and press a film press plate **27** (see FIG. **7**). Therefore, the instant film **28** in the instant film pack **24** is pressed in a stacking direction.

[0045] A rear display unit **17** and an operation unit **18** are provided on an outer surface of the loading lid **22**, that is, on the rear surface of the camera body **11**. The rear display unit **17** is, for

example, a liquid crystal display (LCD) panel or an organic electroluminescent (EL) display (OELD). Pieces of the image data for one frame output from the imaging element **20** are sequentially input into the rear display unit **17**, and are displayed as a live preview image.

[0046] In a case in which the release switch **16** is pressed by a person who captures an image, the imaging is started. In the imaging, the image data is acquired from the imaging element **20**. An image processing unit (not shown) performs known image processing on the image data, and then the image data is compressed. Examples of the image processing include matrix operation, demosaicing processing, y correction, brightness conversion, color difference conversion, and resize processing. The image data on which the image processing and the compression have been performed is recorded in the built-in memory (not shown) such as a flash memory provided within the camera body **11**.

[0047] In a case in which a menu switch of the operation unit **18** is pressed, the image is played and displayed on the rear display unit **17** based on the image data recorded in the built-in memory. In a case in which an image to be printed is displayed on the rear display unit **17**, the person who captures an image presses a print switch of the operation unit **18**, and thus printing processing via the printer unit **13** is started.

Configuration of Instant Film Pack

[0048] As shown in FIGS. **4** and **5**, the instant film pack **24** comprises a case **26**, a film press plate **27**, a plurality of instant films **28**, and a film cover **30**.

[0049] As shown in FIG. **6**, the case **26** accommodates the plurality of instant films **28** and one film cover **30** in a stacked manner. The case **26** is made of a material, such as a thermoplastic resin or a paper resin acquired by mixing the thermoplastic resin with cellulose. The case **26** includes a box-shaped case member **31** and a lid **32** that covers an opening formed in a rear surface side of the case member **31**.

[0050] An exposure aperture **31***a* for exposing the instant film **28** is formed in the case member **31**. In the following description, a surface of the instant film pack **24** in which the exposure aperture **31***a* is formed will be referred to as a “front surface”, a surface opposite to the “front surface” will be referred to as a “rear surface”, a surface facing the film discharge port **21** of the camera body **11** will be referred to as an “upper surface”, and a surface opposite to the “upper surface” will be referred to as a “bottom surface”. The film cover **30** is overlapped before the instant film **28** positioned in the foremost layer initially set in the exposure aperture **31***a* within the case member **31**. As a result, the exposure aperture **31***a* is light-tightly blocked by the film cover **30**. A notch **31***b* into which a known claw member **59** (see FIGS. **8** and **9**) formed at the camera is inserted is formed in a lower portion of the exposure aperture **31***a*. The notch **31***b* is a linear notch through which the claw member **59** passes in a case in which the instant film **28** or the film cover **30** is fed out. The notch **31***b* is connected from the lower portion of the exposure aperture **31***a* to the bottom surface of the case member **31**.

[0051] A feed port **31***c* is formed on an upper surface of the case member **31**. The feed port **31***c* is formed in a slit shape. The instant films **28** or the film cover **30** are fed out one by one outwards from the instant film pack **24** by the claw member **59** inserted into the notch **31***b* of the case member **31** through the feed port **31***c*.

[0052] A light shielding seal **31***d* is attached to the case member **31** so as to close the feed port **31***c* from an outside. The light shielding seal **31***d* is formed in a flexible sheet shape. The light shielding seal **31***d* is attached to only one edge of a long side of the feed port **31***c* so as not to hinder the instant film **28** or the film cover **30** in a case in which the instant film or the film cover passes through the feed port **31***c*.

[0053] The lid **32** has a pair of openings **32***a*, a pair of unit support projections **32***b*, a pair of caulking pins **32***c*, and a support piece **32***d*. The pair of openings **32***a* are formed so as to be spaced apart from each other in an up-down direction by a predetermined interval, and serve as an entrance into which the film press portions **22***b* provided in the digital camera **10** with a printer are inserted

in a case in which the digital camera **10** with a printer is loaded.

[0054] The pair of unit support projections **32***b* are provided at both side edge portions of the lid **32** so as to be vertically long, and each have an arc shape with the center portion protruding toward the exposure aperture **31***a*. The unit support projections **32***b* come into contact with both side edge portions on the rear surface of the instant film **28** positioned in the rearmost layer, and press up the instant film **28** in the arc shape with the center portion protruding toward the exposure aperture **31***a*. As a result, a gap between the film cover **30** and the exposure aperture **31***a* is prevented from being formed.

[0055] The pair of caulking pins **32***c* are used to attach the film press plate **27**. The support piece **32***d* supports the center portion of the instant film **28** positioned in the rearmost layer from behind, and prevents the instant film **28** from being bent in a direction in which the center portion is curved toward the lid **32**.

[0056] The film press plate **27** consists of two elastic sheets **27***a* and **27***b* made of a synthetic resin. The sheet **27***a* is pressed by the plurality of film press portions **22***b* in a case in which the loading lid **22** is closed, and is curved so as to protrude toward the lid **32**. An opening **27***c* and a pair of holes **27***d* are formed in the sheet **27***a*. The opening **27***c* is formed in the center portion of the sheet **27***a* so as to be vertically long, and the support piece **32***d* is inserted into the opening **27***c*. The pair of caulking pins **32***c* are inserted into the pair of holes **27***d*, and the pair of holes **27***d* are used to attach the film press plate **27** to the lid **32**.

[0057] An opening **27***e* and a pair of holes **27***f* are formed in the sheet **27***b*. The opening **27***e* is formed in the center portion of the sheet **27***a*, and the support piece **32***d* is inserted into the opening **27***e*. The pair of caulking pins **32***c* are inserted into the pair of holes **27***f*. The sheet **27***b* has a lower end portion **27***h* attached to a lower end portion **27***g* of the sheet **27***a*. Accordingly, the sheet **27***b* prevents the sheet **27***a* from being loosened, prevents light leakage from the pair of openings **32***a*, and presses up the instant film **28** in a substantially planar shape in a case in which the sheet **27***a* is elastically bent by the plurality of film press portions **22***b*. As a result, the film cover **30** or the instant film **28** positioned in the foremost layer is pressed to the back side of the front surface of the case member **31**.

Configuration of Instant Film

[0058] As shown in FIG. **7**, the instant film **28** includes a mask sheet **33**, a photosensitive sheet **34**, a cover sheet **35**, a developer pod **36**, and a trap portion **37**, and is a so-called mono-sheet type film. The mask sheet **33** is formed in a sheet shape made of a thin synthetic resin and comprises a screen opening **33***a*. A photosensitive layer, a diffuse-reflect layer, an image receiving layer, and the like are provided in the photosensitive sheet **34**. The cover sheet **35** includes an exposure surface **28***a* facing an exposure head **50** described later.

[0059] The developer pod **36** is formed in a substantially bag shape, and encompasses a developer **38**. The developer pod **36** is pasted onto the end portion of the photosensitive sheet **34** on the feed port **31***c* side, and is wrapped by the end portion of the mask sheet **33**. The trap portion **37** is pasted onto the end portion of the photosensitive sheet **34** opposite to the feed port **31***c* side, and is similarly wrapped by the end portion of the mask sheet **33**.

[0060] The photosensitive layer of the instant film **28** is irradiated with print light during the printing, and the photosensitive layer is exposed. The developer pod **36** is torn during the development, and the developer **38** flows and is spread into a gap **39** between the photosensitive sheet **34** and the cover sheet **35**. An image acquired by the exposure of the photosensitive layer is reversed by the diffuse-reflect layer, and is transferred to the image receiving layer. In this way, a positive image appears on an image observation surface **40** of the photosensitive sheet **34** exposed via the screen opening **33***a*.

[0061] The film cover **30** is formed in a thin sheet shape, and has light shielding properties and flexibility. In a case in which the instant film pack **24** is used by being loaded into the loading chamber **23**, the film cover **30** is discharged to the film discharge port **21** by spreading rollers **54**

(see FIGS. **8** and **9**) described later.

Configuration of Printer Unit

[0062] As shown in FIGS. **8** and **9**, the printer unit **13** includes the exposure head **50**, a case member **51** (see FIG. **10**), a roller driving mechanism **52**, a pair of transport rollers **53**, a pair of spreading rollers **54**, a spreading control member **55**, a distal end detection switch **56**, a rotation detection sensor **57**, a cover member **58** (see FIGS. **10** and **12**), the claw member **59**, a claw member driving mechanism **61**, and a controller **62**. The printer unit **13** corresponds to a printer in the claims.

[0063] It should be noted that, in FIGS. **8** and **9**, the case member **51** and the like are not shown in order to avoid complication, but, in practice, the printer unit **13** is configured by attaching the exposure head **50**, the roller driving mechanism **52**, the transport rollers **53**, the spreading rollers **54**, the spreading control member **55**, the distal end detection switch **56**, the rotation detection sensor **57**, the cover member **58**, the claw member **59**, the claw member driving mechanism **61**, and the like to the case member **51**.

[0064] It should be noted that, hereinafter, a transport direction in which the transport rollers **53** transport the instant film **28** will be referred to as a Y direction, a width direction of the instant film **28** orthogonal to the Y direction will be referred to as an X direction, and a direction orthogonal to the X direction and the Y direction will be referred to as a Z direction.

[0065] As shown in FIG. **10**, the case member **51** is formed in a box shape in which the rear surface side of the camera body **11** is opened, and the loading chamber **23** is integrally provided. It should be noted that FIG. **10** shows a state in which the instant film pack **24** is loaded into the loading chamber **23**. The case member **51** is made of, for example, a resin material.

[0066] As described so far, the instant film pack **24** is loaded into the loading chamber **23**. The image is recorded on the instant film **28** discharged from the instant film pack **24** by the printer unit **13**.

Configuration of Pair of Transport Rollers and Pair of Spreading Rollers

[0067] The transport rollers **53** and the spreading rollers **54** are pivotally supported by a bearing unit (not shown) provided in the case member **51**. The transport rollers **53** and the spreading rollers **54** are rotationally driven by the roller driving mechanism **52**, and transport the film cover **30** and the instant film **28**. The roller driving mechanism **52** comprises, for example, a motor as a driving source and a driving transmission gear train that transmits a rotational driving force.

[0068] The transport rollers **53** include a capstan roller **65** and a pinch roller **66**. The capstan roller **65** and the pinch roller **66** are disposed at positions at which these rollers interpose a transport passage of the instant film **28** (see FIG. **8**). The capstan roller **65** includes a pair of cylindrical grip roller members **65***a*, a driving gear **65***b*, and a rotation shaft **65***c* that holds each grip roller member **65***a* and the driving gear **65***b*.

[0069] The pinch roller **66** includes a roller member **66***a*, a driving gear **66***b*, and a rotation shaft **66***c*. The driving gears **65***b* and **66***b* are provided at both end portions of the rotation shafts **65***c* and **66***c* and mesh with each other. The motor is connected to one end of the rotation shaft **65***c* via the driving transmission gear train. Therefore, in a case in which the motor rotates, the capstan roller **65** and the pinch roller **66** rotate in synchronization with the motor. The instant film **28** discharged from the instant film pack **24** is transported toward the spreading rollers **54** by the transport rollers **53**.

[0070] The spreading rollers **54** include spreading rollers **67** and **68**, and are disposed downstream of the transport rollers **53** in the transport direction. The spreading roller **67** is disposed on a side of the instant film **28** facing the exposure surface **28***a*. The spreading roller **68** is disposed on a side of the instant film **28** facing the image observation surface **40**. The motor is connected to one end of the spreading roller **67** or **68** via the driving transmission gear train. Therefore, in a case in which the motor rotates, the spreading rollers **67** and **68** rotate in synchronization with the motor.

[0071] The spreading rollers **54** transport the instant film **28** transported by the transport rollers **53**

toward the film discharge port **21** while pinching the instant film over the entire width. The instant film is pinched by the spreading rollers **54**, and thus the developer pod **36** of the instant film **28** is crushed. As a result, the developer is spread (unfolded) into the gap **39** (see FIG. **7**).

[0072] The transport rollers **53** transport the instant film **28** fed out from the instant film pack **24** by the claw member **59** toward the film discharge port **21**. It should be noted that an exposure position EP (see FIG. **8**) at which the exposure head **50** exposes the instant film **28** to the print light is positioned between the feed port **31***c* of the instant film pack **24** and the transport rollers **53**. The exposure via the exposure head **50** is performed for a period during the transport via the transport rollers **53**.

[0073] The controller **62** controls the exposure of the exposure head **50** based on the image data. The exposure via the exposure head **50** is performed by sequentially exposing line images on the instant film **28** while moving the instant film **28** for each line. As a result, an image corresponding to a single screen is exposed on the photosensitive layer of the instant film **28**. The instant film **28** is continuously transported toward the spreading rollers **54** by the transport rollers **53**.

Configuration of Claw Member and Claw Member Driving Mechanism

[0074] In a case in which the instant film pack **24** is loaded into the loading chamber **23**, the claw member **59** enters the inside of the case **26** and the instant film **28** is fed out one by one to the outside of the instant film pack **24**.

[0075] The claw member **59** has a hook in which a distal end portion **59***a* is bent in a C shape (see FIG. **8**), and the distal end portion **59***a* engages with a base end portion of the instant film **28** and presses the instant film **28**. The claw member **59** is moved straight and driven rotationally by the claw member driving mechanism **61**. The claw member driving mechanism **61** has a known configuration including the motor and the driving transmission gear train.

Configuration of Spreading Control Member

[0076] As shown in FIG. **8**, the spreading control member **55** is provided at a position between the transport rollers **53** and the spreading rollers **54** in the Y direction. The spreading control member **55** is formed in a plate shape extending in the X direction, and is fixed to the case member **51**. The spreading control member **55** comes into contact with the image observation surface **40** of the instant film **28** that has been transported, and controls the distribution of the developer spread into the gap **39** by rubbing the image observation surface **40** of the instant film **28**.

Configuration of Distal End Detection Switch

[0077] The distal end detection switch **56** is, for example, a mechanical switch and is positioned in the vicinity of the spreading control member **55**. The distal end detection switch **56** is in an ON state by receiving a pressing force from the distal end of the instant film **28**, and can detect the distal end of the instant film **28**.

[0078] The distal end detection switch **56** is in the ON state by receiving a pressing force from the distal end of the instant film **28**. The distal end detection switch **56** in the ON state outputs a signal to the controller **62**. The controller **62** that receives the signal from the distal end detection switch **56** counts the output signal from the rotation detection sensor **57**, and then drives the exposure head **50** to start the exposure of the image on the instant film **28**.

Configuration of Rotation Detection Sensor

[0079] As shown in FIG. **11**, the rotation detection sensor **57** includes an encoder plate **71**, a photo-interrupter **72**, and a fixed slit plate **73**. The encoder plate **71** has a disk shape, and is formed with a plurality of slits **71**A disposed radially.

[0080] The encoder plate **71** is provided on the same axis as the capstan roller **65** that is one of the transport rollers **53**. Specifically, the central portion of the encoder plate **71** is fixed to the rotation shaft **65***c* of the capstan roller **65**. As a result, the encoder plate **71** rotates in conjunction with the transport of the instant film **28** in a case in which the capstan roller **65** rotates.

[0081] In this way, since the capstan roller **65** is held by the case member **51**, the encoder plate **71** provided integrally with the capstan roller **65** is also supported by the case member **51**. The

encoder plate **71** is disposed outside the case member **51**. In addition, an end portion **65***d* (see FIG. **12**) of the rotation shaft **65***c* protrudes through the encoder plate **71** to the outside of the case member **51**.

[0082] As shown in FIG. **12**, the photo-interrupter **72** is an optical sensor having a light emitting unit **72**A and a light receiving unit **72**B. The photo-interrupter **72** has an outer shape formed in a U-shape, the light emitting unit **72**A is disposed at one end portion thereof, the light receiving unit **72**B is disposed at the other end portion thereof, and the light emitting unit **72**A and the light receiving unit **72**B are provided at positions facing each other. The light emitting unit **72**A is, for example, a light emitting diode. The light receiving unit **72**B is, for example, a light receiving element. In the photo-interrupter **72**, the light emitted from the light emitting unit **72**A is received by the light receiving unit **72**B. In the present embodiment, the encoder plate **71** and the fixed slit plate **73** are disposed between the light emitting unit **72**A and the light receiving unit **72**B. The fixed slit plate **73** is positioned on the light emitting unit **72**A side with respect to the encoder plate **71**. A light quantity stop slit **73**A is formed in the fixed slit plate **73**.

[0083] As shown in FIGS. **13**A and **13**B, a dimension L**21** of the light quantity stop slit **73**A of the fixed slit plate **73** in the width direction and a dimension L**22** of the light quantity stop slit **73**A of the fixed slit plate **73** in the length direction are smaller than a dimension L**11** of the slit **71**A of the encoder plate **71** in the width direction and a dimension L**12** of the slit **71**A of the encoder plate **71** in the length direction. As a result, the fixed slit plate **73** narrows the light emitted from the light emitting unit **72**A of the photo-interrupter **72**, and the light receiving unit **72**B receives the light of which the light quantity is narrowed by the fixed slit plate **73**. It should be noted that, here, the width direction is a circumferential direction R of the encoder plate **71**, and the length direction is a radial direction D of the encoder plate **71**.

[0084] In a case in which the slit **71**A passes between the light emitting unit **72**A and the light receiving unit **72**B, the light receiving unit **72**B receives the light emitted from the light emitting unit **72**A without being shielded, and the photo-interrupter **72** outputs an ON signal. On the other hand, in a case in which the slit **71**A does not pass between the light emitting unit **72**A and the light receiving unit **72**B, that is, in a case in which the encoder plate **71** shields the light emitted from the light emitting unit **72**A, the light receiving unit **72**B does not receive the light, and the photo-interrupter **72** outputs an OFF signal. In this way, the photo-interrupter **72** can output a rotation detection signal for detecting the rotation of the encoder plate **71**.

[0085] The controller **62** that receives the signal from the distal end detection switch **56** counts the rotation detection signal from the photo-interrupter **72**. In a case in which the controller **62** counts a predetermined number of rotation detection signals, the distal end of the exposure surface **28***a* of the instant film **28** reaches the exposure position EP. The controller **62** drives the exposure head **50** to start the exposure of the image on the exposure surface **28***a*. Therefore, the exposure head **50** can accurately expose the image in accordance with the position of the exposure surface **28***a*.

Configuration of Cover Member

[0086] As shown in FIG. **14**, the cover member **58** is attached to the case member **51**, and covers the encoder plate **71** disposed outside the case member **51**. The cover member **58** includes a cover body **74**, fixing portions **75**A and **75**B, an accommodation portion **76**, and a contact portion **77**.

[0087] As shown in FIG. **15**, the cover body **74** has a semi-circular portion **74**A, a rectangular portion **74**B, and a fitting hole **74**C, and is formed to have a larger outer shape than the encoder plate **71**. The semi-circular portion **74**A and the rectangular portion **74**B are connected to each other. The fitting hole **74**C is positioned at the center of a circle formed in a case in which an outer peripheral surface of the semi-circular portion **74**A is extended. The fitting hole **74**C is rotatably fitted to the end portion **65***d* of the rotation shaft **65***c* that protrudes from the encoder plate **71** (see FIG. **12**). As a result, the cover member **58** is positioned with respect to the encoder plate **71** and the case member **51**.

[0088] The fixing portions **75**A and **75**B are positioned on both side portions of the cover body **74**.

The accommodation portion **76** is formed at one end of the rectangular portion **74**B. The contact portion **77** is disposed at a position continuous to the accommodation portion **76**. The fixing portions **75**A and **75**B are fastened to the case member **51** by screwing with screw members **78** (see FIG. **14**). Therefore, the cover member **58** is attached to the case member **51**. That is, the cover member **58** is held by the case member **51**.

[0089] In addition, the fixing portions **75**A and **75**B are screwed with the screw member **78** and a press member **79** is fastened thereto (see FIG. **14**). The press member **79** is fixed outside the cover member **58**. The press member **79** comes into contact with the end portion **65***d* of the rotation shaft **65***c* (see FIG. **12**). As a result, the movement of the rotation shaft **65***c* in an axial direction is restricted.

[0090] As shown in FIG. **16**, the accommodation portion **76** includes an opening portion **81** in which at least a part of the photo-interrupter **72** is accommodated, a groove portion **82** in which at least a part of the fixed slit plate **73** is accommodated, reference holding portions **83**A and **83**B (see FIG. **15**), and deformable holding portions **84**A and **84**B (see FIG. **15**).

[0091] The groove portion **82** is formed in accordance with a thickness of the fixed slit plate **73** and is disposed at a position passing through the opening portion **81**. In a case in which the cover member **58** is attached to the case member **51** and the fixed slit plate **73** is accommodated in the groove portion **82**, the fixed slit plate **73** is positioned parallel to the encoder plate **71** (see FIG. **12**).

[0092] The contact portion **77** is disposed at a position continuous to the groove portion **82**. The contact portion **77** comes into contact with the fixed slit plate **73** accommodated in the groove portion **82**. As a result, the fixed slit plate **73** is restricted from moving in the axial direction A. That is, an axial direction A is an axial direction of the rotation shaft **65***c* and is also an axial direction of the encoder plate **71**. The fixed slit plate **73** is fastened to the cover member **58** by screwing with a screw member **85** (see FIG. **14**). Therefore, the fixed slit plate **73** is attached to the cover member **58**. In addition, in a case in which the fixed slit plate **73** is attached to the cover member **58**, the positioning in the radial direction D and the circumferential direction R is also performed.

[0093] As shown in FIG. **17**, the opening portion **81** is formed in accordance with the outer shape of the photo-interrupter **72**. In a case in which the photo-interrupter **72** is accommodated in the opening portion **81**, the light emitting unit **72**A and the light receiving unit **72**B are disposed at positions interposing the encoder plate **71** and the fixed slit plate **73** (see FIG. **12**). It should be noted that, in FIGS. **17** to **20**, the fixed slit plate **73** is not shown in order to prevent the drawings from becoming complicated.

[0094] The opening portion **81**, the reference holding portions **83**A and **83**B, and the deformable holding portions **84**A and **84**B correspond to a "positioning portion" in the claims. The "positioning portion" positions the photo-interrupter **72** with respect to the fixed slit plate **73**. The reference holding portions **83**A and **83**B and the deformable holding portions **84**A and **84**B are positioned inside the opening portion **81**.

[0095] The opening portion **81** has an inner distal end surface **81**A and inner side surfaces **81**B and **81**C. The inner distal end surface **81**A is disposed at a position facing a distal end surface **72**C of the photo-interrupter **72**. The inner side surfaces **82**B and **82**C are disposed at positions facing the side surfaces **72**D and **72**E of the photo-interrupter **72**.

[0096] It should be noted that the distal end surface **72**C of the photo-interrupter **72** is a side on which the encoder plate **71** and the fixed slit plate **73** are positioned, that is, a distal end surface in the radial direction D in a case in which the photo-interrupter **72** is accommodated in the opening portion **81**. The side surfaces **72**D and **72**E of the photo-interrupter **72** are surfaces that are continuous to the distal end surface **72**C and on which the light emitting unit **72**A and the light receiving unit **72**B are disposed therebetween. That is, the side surfaces **72**D and **72**E are surfaces that are disposed at different positions in the circumferential direction R with respect to the light emitting unit **72**A and the light receiving unit **72**B.

[0097] As shown in FIG. **18**, the inner side surfaces **81**B and **81**C of the opening portion **81** are

surfaces parallel to the radial direction D. The inner side surface **81**B is provided with the reference holding portions **83**A and **83**B. The inner side surface **81**C is provided with deformable holding portions **84**A and **84**B. That is, the reference holding portion **83**A and the deformable holding portion **84**A are provided at positions facing each other, and the reference holding portion **83**B and the deformable holding portion **84**B are provided at positions facing each other. Further, an interval between the reference holding portion **83**A and the deformable holding portion **84**A and an interval between the reference holding portion **83**B and the deformable holding portion **84**B are formed in accordance with a dimension L**31** (see FIG. **17**) in the width direction on the side surfaces **72**D and **72**E of the photo-interrupter **72**. As a result, the photo-interrupter **72** is interposed and held between the reference holding portions **83**A and **83**B and the deformable holding portions **84**A and **84**B.

[0098] The deformable holding portions **84**A and **84**B are protrusion portions that protrude from the inner side surface **81**C in the circumferential direction R. A protrusion amount P (dimension in the circumferential direction R) of the deformable holding portions **84**A and **84**B is within an outer shape tolerance range of the photo-interrupter **72**. In addition, a dimension L**41** of the deformable holding portions **84**A and **84**B in the radial direction D is the same as the protrusion amount P. In a case in which the outer shape tolerance range of the photo-interrupter **72** is, for example, 0 mm to 0.1 mm, it is preferable that the protrusion amount P of the deformable holding portions **84**A and **84**B is 0.1 mm or less.

[0099] The reference holding portions **83**A and **83**B have a dimension L**42** in the radial direction D that is longer than the dimension L**41** in the radial direction of the deformable holding portions **84**A and **84**B, and have a shape sufficient to hold the photo-interrupter **72**. In a case in which the photo-interrupter **72** is accommodated in the opening portion **81**, the deformable holding portions **84**A and **84**B are pressed and deformed by the photo-interrupter **72**. Therefore, the photo-interrupter **72** is held between the reference holding portions **83**A and **83**B and the deformable holding portions **84**A and **84**B, and is positioned in the circumferential direction R.

[0100] The photo-interrupter **72** that is held and positioned by the reference holding portions **83**A and **83**B and the deformable holding portions **84**A and **84**B is fixed to the case member **51** by the fixing member. In the present embodiment, the fixing member that fixes the photo-interrupter **72** is a screw member **86** (fastening member) that is fastened to the case member **51**.

Operation of Positioning Portion

[0101] As described above, the photo-interrupter **72** is interposed and held between the reference holding portions **83**A and **83**B and the deformable holding portions **84**A and **84**B. In a case in which the photo-interrupter **72** is accommodated in the opening portion **81** and held by the reference holding portions **83**A and **83**B and the deformable holding portions **84**A and **84**B, the photo-interrupter **72** is inserted into the opening portion **81** from the distal end surface **72**C side.

[0102] As shown in FIG. **19**A, the deformable holding portions **84**A and **84**B come into contact with the photo-interrupter **72** that is inserted into the opening portion **81**. Since the protrusion amounts P of the deformable holding portions **84**A and **84**B are extremely small dimensions within the outer shape tolerance range of the photo-interrupter **72**, the deformable holding portions **84**A and **84**B are deformed by receiving a pressing force from the photo-interrupter **72**.

[0103] As shown in FIG. **19**B, in a case in which the photo-interrupter **72** is accommodated in the opening portion **81**, the deformable holding portions **84**A and **84**B pressed by the photo-interrupter **72** are deformed to hold the photo-interrupter **72**. The photo-interrupter **72** is pushed to a position at which the distal end surface **72**C comes into contact with the inner distal end surface **81**A of the opening portion **81**, and is accommodated in the opening portion **81**. As a result, the photo-interrupter **72** is positioned in the radial direction D.

[0104] As described so far, the photo-interrupter **72** is held between the reference holding portions **83**A and **83**B and the deformable holding portions **84**A and **84**B, and is positioned in the circumferential direction R. The fixed slit plate **73** is positioned with respect to the encoder plate **71**, and thus the photo-interrupter **72** is positioned with respect to the fixed slit plate **73**.

[0105] As shown in FIG. **20**, in a case of a configuration in which a reference holding portion and a deformable holding portion are not provided as in a printer in the related art, the photo-interrupter **72** inserted into the opening portion **81** may be inserted with an inclination with respect to the radial direction D. In a case in which the photo-interrupter **72** is inserted with an inclination, the position of the photo-interrupter **72** is shifted with respect to the fixed slit plate **73**, and sufficient light may not reach the light quantity stop slit **73**A of the fixed slit plate **73** from the light emitting unit **72**A. In this case, the light received by the light receiving unit **72**B cannot be received because the light quantity is narrowed by the light quantity stop slit **73**A, and the photo-interrupter **72** cannot output the rotation detection signal of the transport rollers **53**. Therefore, it is necessary to perform an operation of reassembling the photo-interrupter **72**, and thus the yield is poor, and the production cost is increased. In addition, in a case in which the gap between the photo-interrupter **72** and the opening portion **81** is reduced, it is difficult to insert the photo-interrupter **72** into the opening portion **81**, and it takes time and effort.

[0106] On the other hand, since the printer unit **13** according to the present embodiment comprises the positioning portion including the reference holding portions **83**A and **83**B and the deformable holding portions **84**A and **84**B, the photo-interrupter **72** is positioned with respect to the fixed slit plate **73**, without being inclined. Accordingly, sufficient light is emitted from the light emitting unit **72**A to the light quantity stop slit **73**A of the fixed slit plate **73**, and the light of which the light quantity is narrowed by the light quantity stop slit **73**A is received by the light receiving unit **72**B. Therefore, the photo-interrupter **72** can output the rotation detection signal of the transport rollers **53**.

[0107] As described so far, the photo-interrupter **72** can be accurately positioned with respect to the fixed slit plate **73** by a simple operation of inserting the photo-interrupter **72** into the opening portion **81**. Further, the yield is improved, and an increase in cost can be suppressed.

[0108] In the above-described embodiment, although a mono-sheet type instant film has been described as the sheet-like recording medium, the present invention is not limited to this, and any recording medium may be used, for example, thermal paper, ink jet paper, or the like may be used. In a case in which the recording medium is the thermal paper, the printer is a thermal printer, and in a case in which the recording medium is the ink jet paper, the printer is an ink jet printer. In addition, in the above-described embodiment, an example has been described in which the present invention is applied to the digital camera with a printer, but the present invention is not limited to this, and the present invention may be applied to a single printer. In addition, in the above-described embodiment, an example has been described in which the present invention is applied to the digital camera with a printer, but the present invention is not limited to this, and the present invention may be applied to an analog camera with a printer.

[0109] In the above-described embodiment, the hardware structure of the processing units that execute various types of processing, such as the controller **62**, is the following various processors. The various processors include a central processing unit (CPU) that is a general-purpose processor that executes software (programs) to function as various processing units, a graphical processing unit (GPU), a programmable logic device (PLD) that is a processor having a circuit configuration changeable after manufacture, such as a field programmable gate array (FPGA), and an exclusive electric circuit that is a processor having a circuit configuration exclusively designed to execute various types of processing.

[0110] One processing unit may be configured by one of these various processors, or may be configured by a combination of two or more processors of the same type or different types (for example, a combination of a plurality of FPGAs, a combination of a CPU and an FPGA, or a combination of a CPU and a GPU). Further, a plurality of the processing units may be configured by one processor. As an example in which the plurality of processing units are configured by one processor, first, there is a form in which one processor is configured by a combination of one or more CPUs and software, and this processor functions as the plurality of processing units, as

represented by a computer, such as a client or a server. Second, there is a form in which a processor, which implements the functions of the entire system including the plurality of processing units with one integrated circuit (IC) chip, is used, as represented by a system-on-a-chip (SoC) or the like. As described above, various processing units are configured by one or more of the various processors described above, as the hardware structure.

[0111] Further, the hardware structure of these various processors is, more specifically, an electric circuit (circuitry) having a form in which circuit elements, such as semiconductor elements, are combined.

EXPLANATION OF REFERENCES

[0112] **10**: digital camera with printer [0113] **11**: camera body [0114] **12**: imaging unit [0115] **13**: printer unit [0116] **15**: imaging window [0117] **16**: release switch [0118] **17**: rear display unit [0119] **18**: operation unit [0120] **19**: imaging optical system [0121] **20**: imaging element [0122] **21**: film discharge port [0123] **22**: loading lid [0124] **22***a*: hinge portion [0125] **22***b*: film press portion [0126] **23**: loading chamber [0127] **24**: instant film pack [0128] **26**: case [0129] **27**: film press plate [0130] **27***a*, **27***b*: sheet [0131] **27***c*: opening [0132] **27***d*: hole [0133] **27***e*: opening [0134] **27***f*: hole [0135] **27***g*: lower end portion [0136] **27***h*: lower end portion [0137] **28**: instant film [0138] **28***a*: exposure surface [0139] **30**: film cover [0140] **31**: case member [0141] **31***a*: exposure aperture [0142] **31***b*: notch [0143] **31***c*: feed port [0144] **31***d*: light shielding seal [0145] **32**: lid [0146] **32***a*: opening [0147] **32***b*: unit support projection [0148] **32***c*: caulking pin [0149] **32***d*: support piece [0150] **33**: mask sheet [0151] **33***a*: screen opening [0152] **34**: photosensitive sheet [0153] **35**: cover sheet [0154] **36**: developer pod [0155] **37**: trap portion [0156] **38**: developer [0157] **39**: gap [0158] **40**: image observation surface [0159] **50**: exposure head [0160] **51**: case member [0161] **52**: roller driving mechanism [0162] **53**: transport roller [0163] **54**: spreading roller [0164] **55**: spreading control member [0165] **56**: distal end detection switch [0166] **57**: rotation detection sensor [0167] **58**: cover member [0168] **59**: claw member [0169] **59***a*: distal end portion [0170] **61**: claw member driving mechanism [0171] **62**: controller [0172] **65**: capstan roller [0173] **65***a*: grip roller member [0174] **65***b*, **66***b*: driving gear [0175] **65***c*, **66***c*: rotation shaft [0176] **65***d*: end portion [0177] **66**: pinch roller [0178] **66***a*: roller member [0179] **67**, **68**: spreading roller [0180] **71**: encoder plate [0181] **71**A: slit [0182] **72**: photo-interrupter [0183] **72**A: light emitting unit [0184] **72**B: light receiving unit [0185] **72**C: distal end surface [0186] **72**D, **72**E: side surface [0187] **73**: fixed slit plate [0188] **73**A: light quantity stop slit [0189] **74**: cover body [0190] **74**A: semi-circular portion [0191] **74**B: rectangular portion [0192] **74**C: fitting hole [0193] **75**A, **75**B: fixing portion [0194] **76**: accommodation portion [0195] **77**: contact portion [0196] **78**: screw member [0197] **79**: press member [0198] **81**: opening portion [0199] **81**A: inner distal end surface [0200] **81**B, **81**C: inner side surface [0201] **82**: groove portion [0202] **83**A, **83**B: reference holding portion [0203] **84**A, **84**B: deformable holding portion [0204] **85**: screw member [0205] **86**: screw member [0206] A: axial direction [0207] D: radial direction [0208] EP: exposure position [0209] L**11**, L**12**, L**21**, L**22**, L**31**, L**41**, L**42**: dimension [0210] P: protrusion amount [0211] R: circumferential direction [0212] X, Y, Z: direction

Claims

1. A printer comprising: an encoder plate that rotates in conjunction with transport of a recording medium and on which slits are radially formed; a photo-interrupter that emits light to the encoder plate and receives the light to output a rotation detection signal; a fixed slit plate that narrows the light emitted from the photo-interrupter; and a positioning portion that positions the photo-interrupter with respect to the fixed slit plate and includes a reference holding portion and a deformable holding portion provided at a position facing the reference holding portion, in which the deformable holding portion is deformed to hold the photo-interrupter.

2. The printer according to claim 1, wherein the photo-interrupter is interposed and held between

the reference holding portion and the deformable holding portion.
3. The printer according to claim 1, wherein the deformable holding portion is a protrusion portion that protrudes in a circumferential direction of the encoder plate.
4. The printer according to claim 3, wherein a protrusion amount of the deformable holding portion is within an outer shape tolerance range of the photo-interrupter.
5. The printer according to claim 4, wherein the positioning portion has an opening portion in which at least a part of the photo-interrupter is accommodated, and the reference holding portion and the deformable holding portion are positioned inside the opening portion.
6. The printer according to claim 5, wherein the deformable holding portion is deformed by being pressed by the photo-interrupter in a case in which the photo-interrupter is accommodated in the opening portion.
7. The printer according to claim 1, further comprising: a fixing member that fixes the photo-interrupter positioned by the positioning portion.
8. The printer according to claim 7, further comprising: a case member that holds the encoder plate and the positioning portion, wherein the fixing member is a fastening member that is fastened to the case member.
9. The printer according to claim 1, further comprising: a transport roller that transports the recording medium, wherein the encoder plate is provided on the same axis as the transport roller.
10. The printer according to claim 1, wherein the recording medium is an instant film, and the printer further comprises an exposure head that exposes the instant film to record an image.
11. A digital camera with a printer, comprising: the printer according to claim 1; and an imaging element that images a subject, wherein the recording medium is an instant film, and the printer includes an exposure head that exposes an image captured by the imaging element onto the instant film.