



US009961248B2

(12) **United States Patent**
Kojima et al.

(10) **Patent No.:** **US 9,961,248 B2**

(45) **Date of Patent:** **May 1, 2018**

(54) **IMAGING SYSTEM, ILLUMINATION DEVICE, AND CONTROL METHOD**

(58) **Field of Classification Search**

(71) Applicant: **CANON KABUSHIKI KAISHA**,
Tokyo (JP)

CPC H04N 5/2256; H04N 5/23209; H04N 5/2354; H04N 2101/00; G03B 13/36; G03B 7/17; G03B 15/05; G03B 2206/00

(72) Inventors: **Teruyuki Kojima**, Tokyo (JP); **Yoshiro Ichihara**, Yokohama (JP)

USPC 348/371
See application file for complete search history.

(73) Assignee: **CANON KABUSHIKI KAISHA**,
Tokyo (JP)

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days. days.

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(21) Appl. No.: **14/848,174**

(Continued)

(22) Filed: **Sep. 8, 2015**

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(65) **Prior Publication Data**
US 2016/0072995 A1 Mar. 10, 2016

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(Continued)

(30) **Foreign Application Priority Data**

Sep. 10, 2014 (JP) 2014-184404
Sep. 10, 2014 (JP) 2014-184405
Sep. 10, 2014 (JP) 2014-184406

Primary Examiner — Lin Ye

Assistant Examiner — Chan Nguyen

(74) *Attorney, Agent, or Firm* — Canon U.S.A., Inc. IP Division

(51) **Int. Cl.**
H04N 5/225 (2006.01)
H04N 5/235 (2006.01)
G03B 7/17 (2014.01)
G03B 15/05 (2006.01)
G03B 13/36 (2006.01)

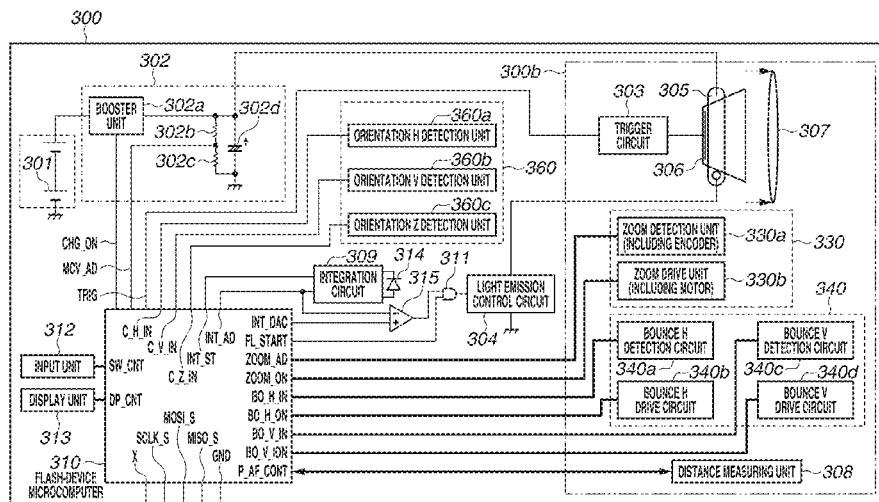
(Continued)

(57) **ABSTRACT**

To enable light emission shooting according to the condition of an imaging apparatus, an imaging system, which includes an illumination device capable of automatically driving a movable portion including a light emission unit to change a radiation direction of the light emission unit and an imaging apparatus, includes an acquisition unit configured to acquire information classifying a lens unit attached to the imaging apparatus, and a control unit configured to control the radiation direction of the light emission unit based on the information classifying the lens unit acquired by the acquisition unit.

(52) **U.S. Cl.**
CPC **H04N 5/2256** (2013.01); **G03B 7/17** (2015.01); **G03B 13/36** (2013.01); **G03B 15/05** (2013.01); **H04N 5/2354** (2013.01); **H04N 5/23209** (2013.01); **G03B 2206/00** (2013.01); **G03B 2215/0521** (2013.01); **H04N 2101/00** (2013.01)

26 Claims, 48 Drawing Sheets



- (51) **Int. Cl.**
H04N 5/232 (2006.01)
H04N 101/00 (2006.01)

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FIG.1

FIG.1A
FIG.1B

FIG.1A

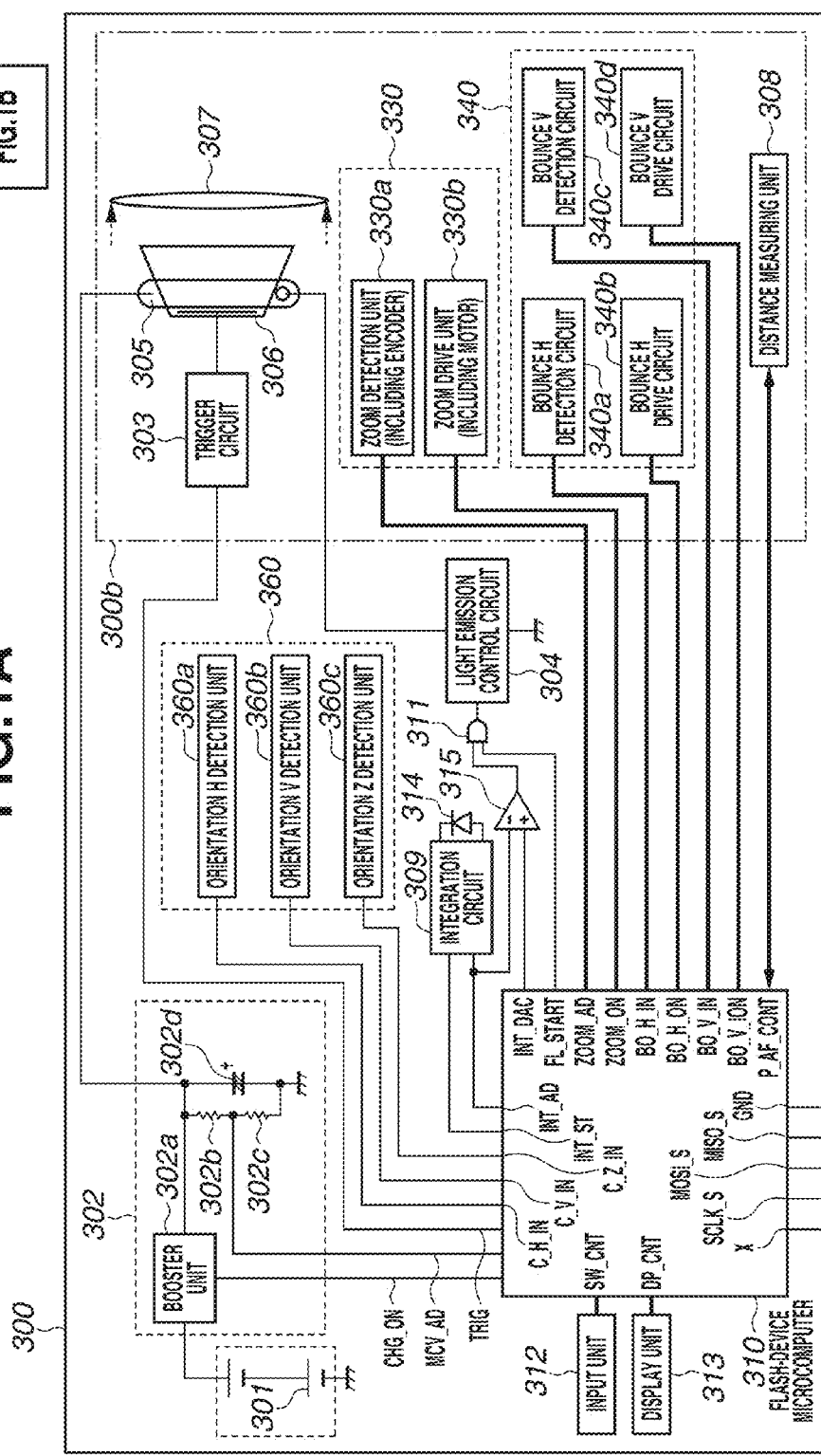


FIG.2

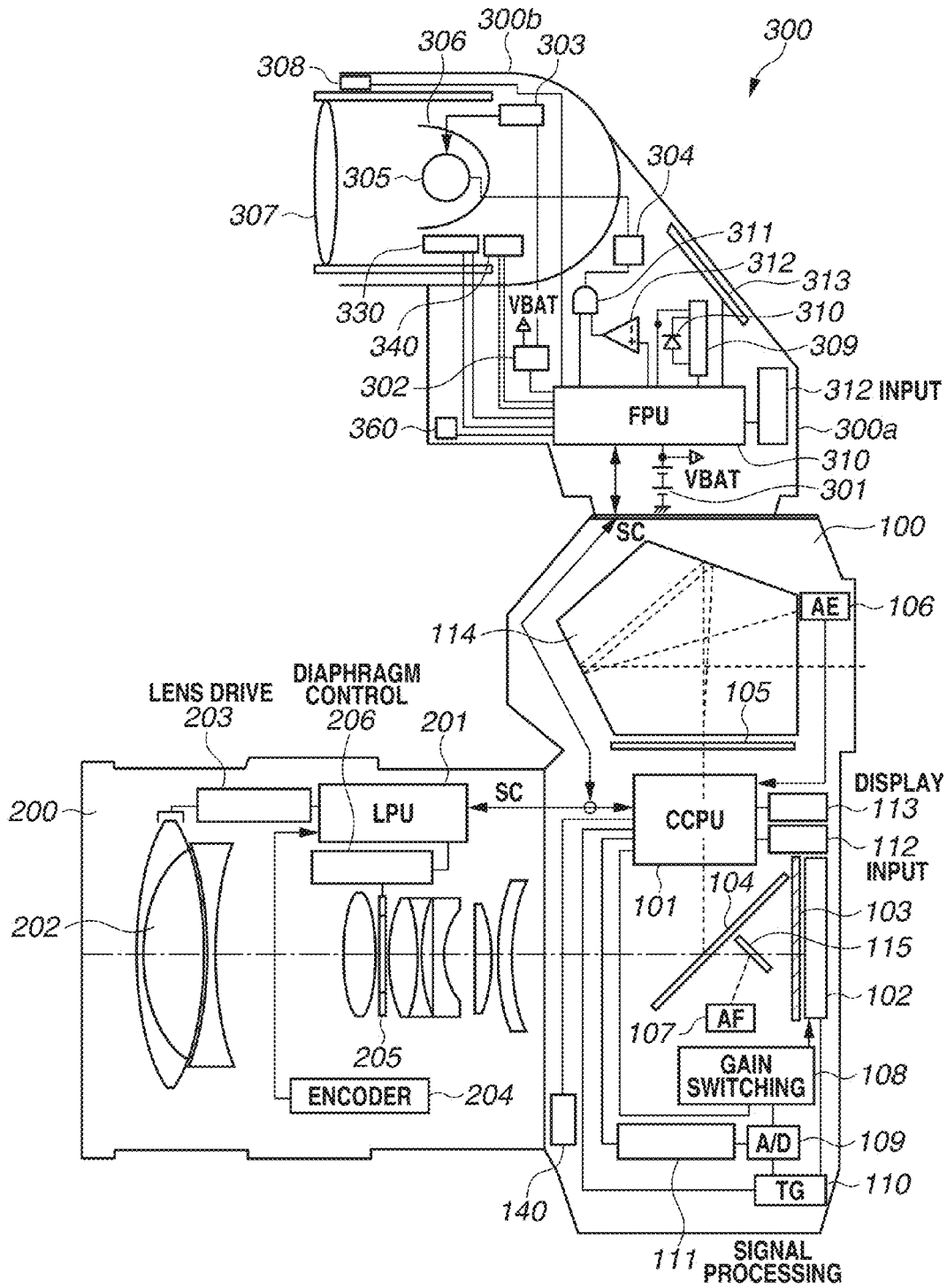


FIG.3

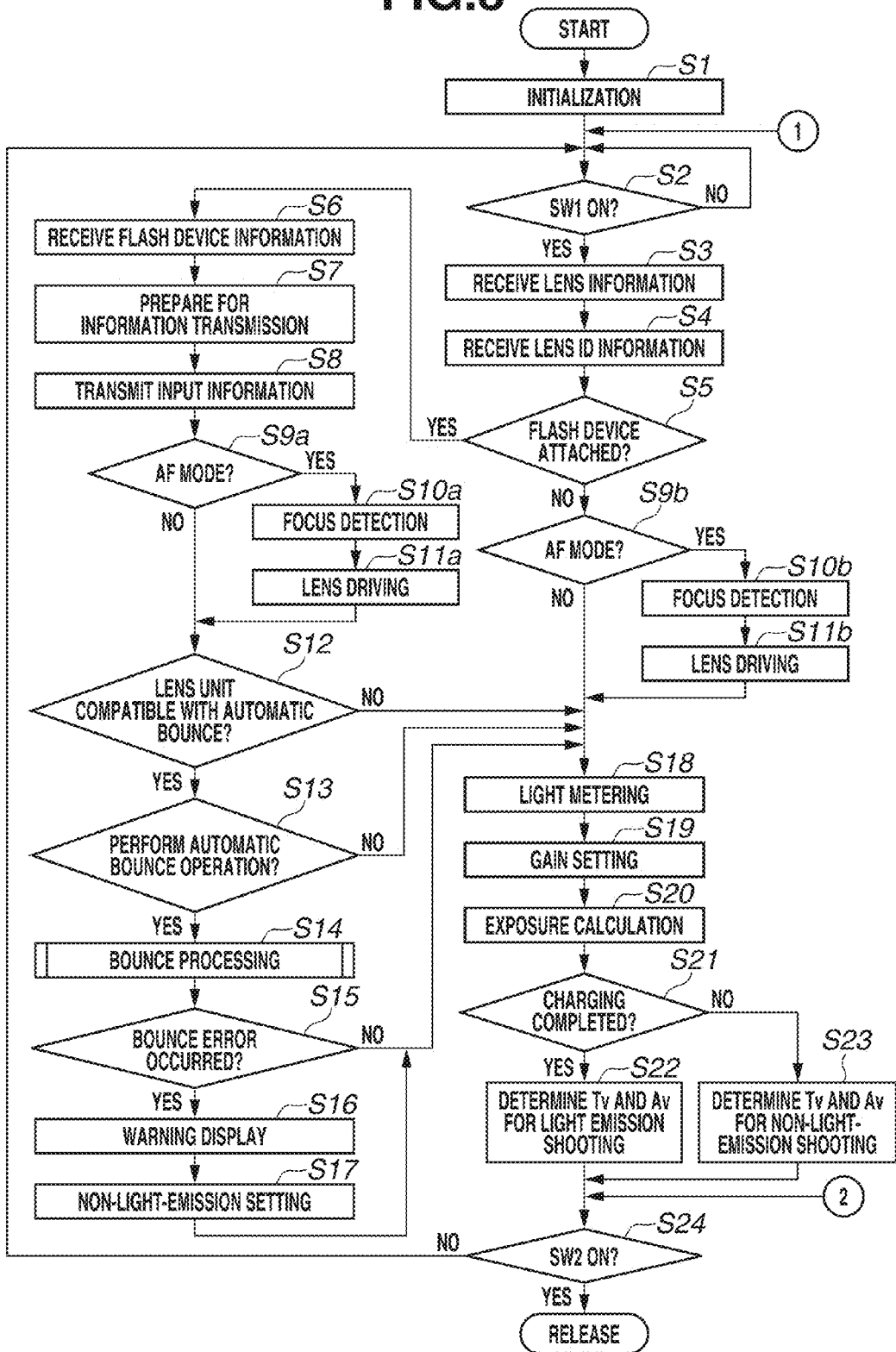


FIG.4

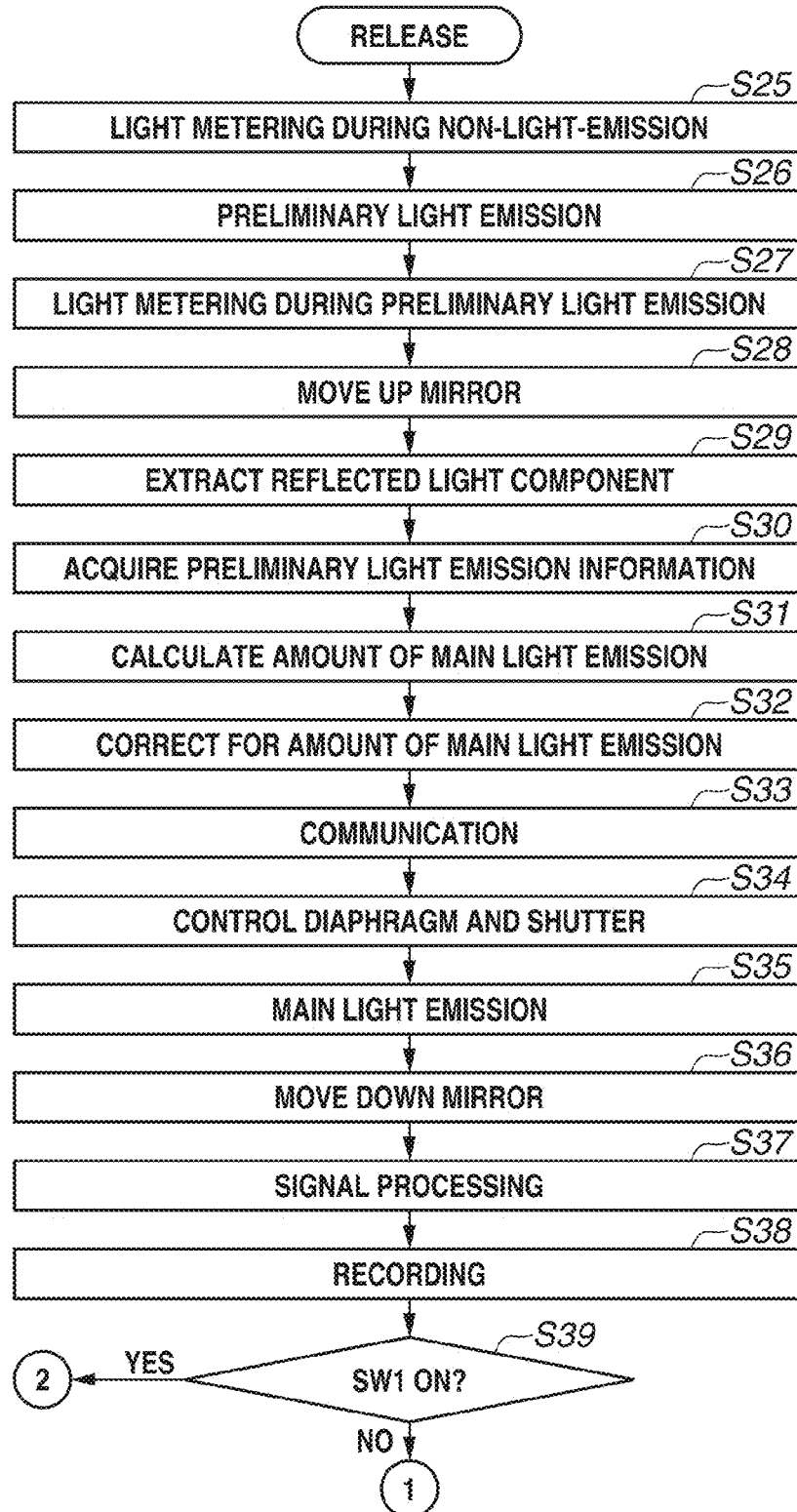


FIG.5

LENS NUMBER	ID	FOCAL LENGTH	FULL-APERTURE F-NUMBER	CLASSIFICATION	COMPATIBILITY WITH AUTOMATIC BOUNCE LIGHT EMISSION SHOOTING
#01	L01	50 mm	1.8	STANDARD	COMPATIBLE
#02	L02	28 mm - 105 mm	4	STANDARD ZOOM	COMPATIBLE
#03	L03	24 mm	1.4	WIDE-ANGLE	COMPATIBLE
#04	L04	14 mm	2.8	SUPER-WIDE-ANGLE (FISH-EYE)	INCOMPATIBLE
#05	L05	105 mm	2.8	TELEPHOTO	COMPATIBLE
#06	L06	400 mm	2.8	SUPER-TELEPHOTO	INCOMPATIBLE
#07	L07	24 mm	3.5	SHIFT-TILT	COMPATIBLE (INCOMPATIBLE)
#N/A	N/A	50 mm	1.8	NO ID	INCOMPATIBLE

FIG.6A

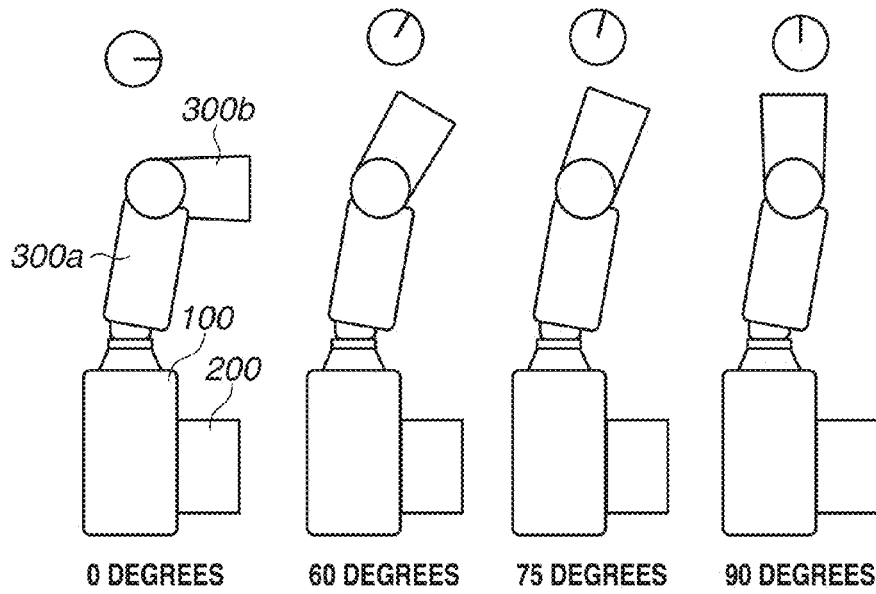


FIG.6B

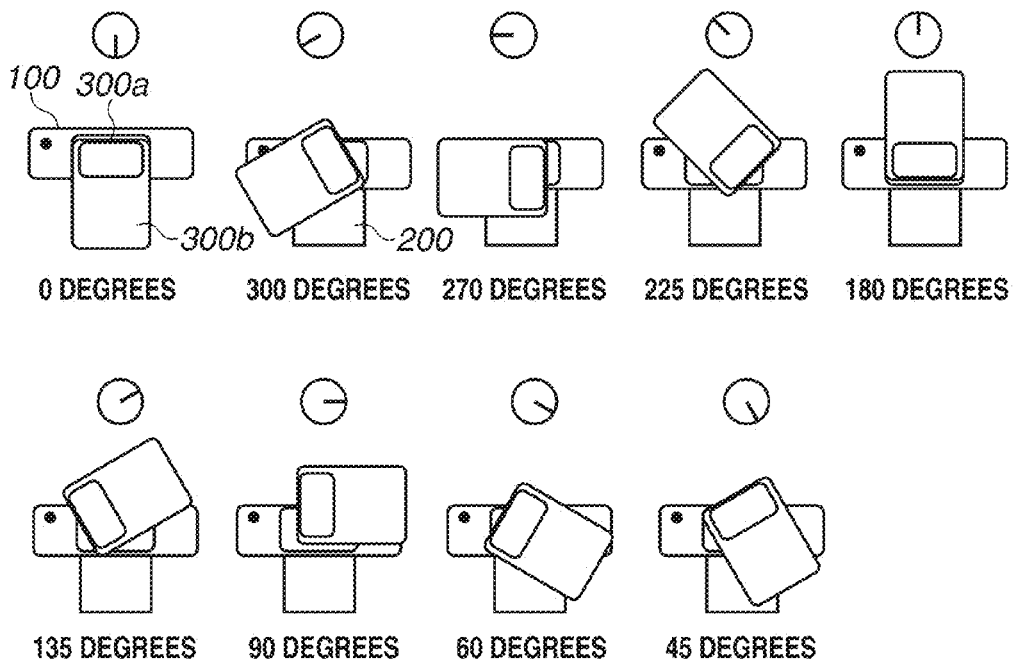


FIG.7A

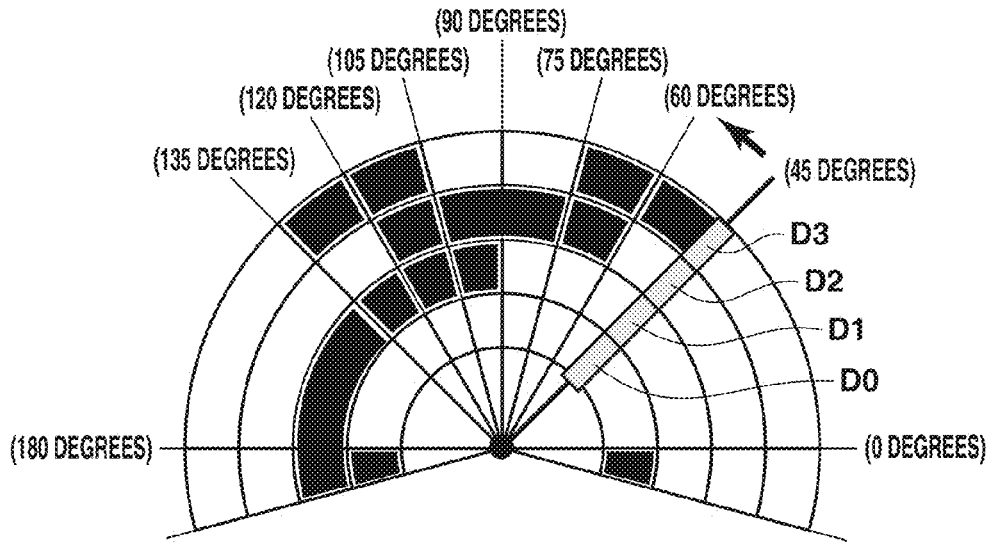


FIG.7B

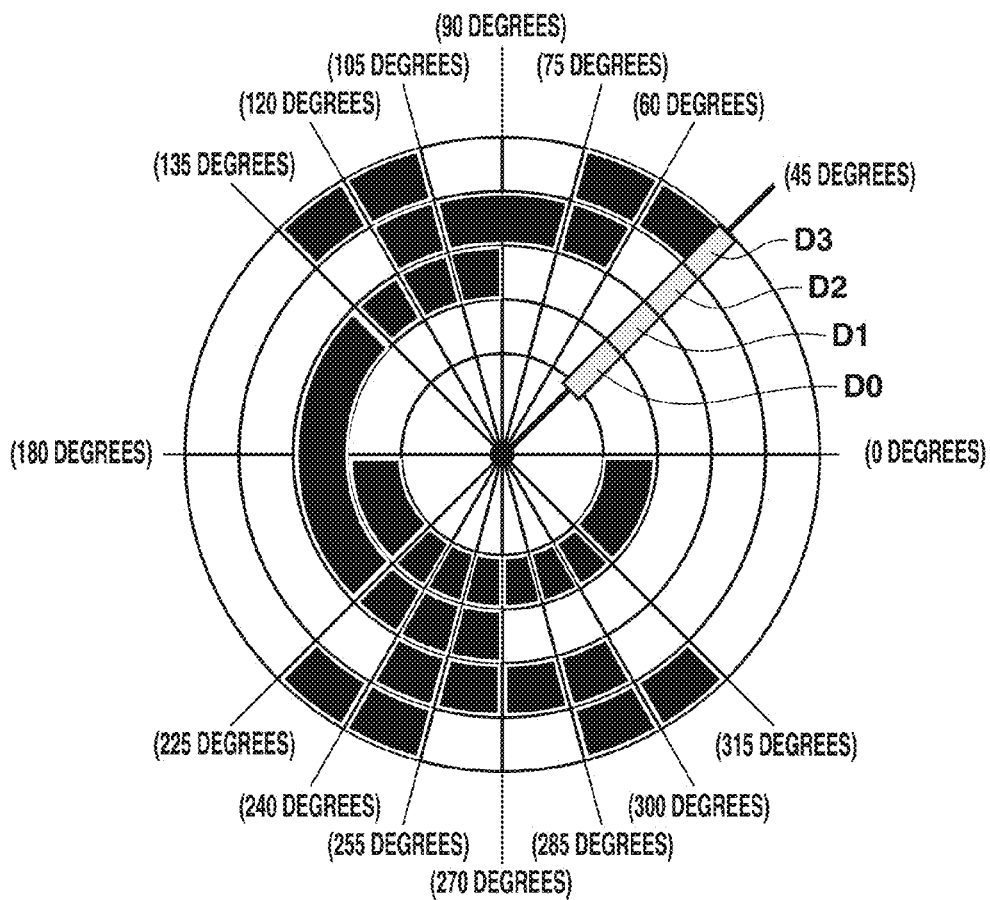


FIG.8A

UP AND
DOWN

ANGLES	D0	D1	D2	D3
0	0	0	0	0
45	0	0	0	1
60	0	0	1	1
75	0	0	1	0
90	0	1	1	0
105	0	1	1	1
120	0	1	0	1
135	0	1	0	0
180	1	1	0	0

FIG.8B

RIGHT
AND LEFT

ANGLES	D0	D1	D2	D3
0	0	0	0	0
45	0	0	0	1
60	0	0	1	1
75	0	0	1	0
90	0	1	1	0
105	0	1	1	1
120	0	1	0	1
135	0	1	0	0
180	1	1	0	0
225	1	1	0	1
240	1	1	1	1
255	1	1	1	0
270	1	0	1	0
285	1	0	1	1
300	1	0	0	1
315	1	0	0	0

FIG.9

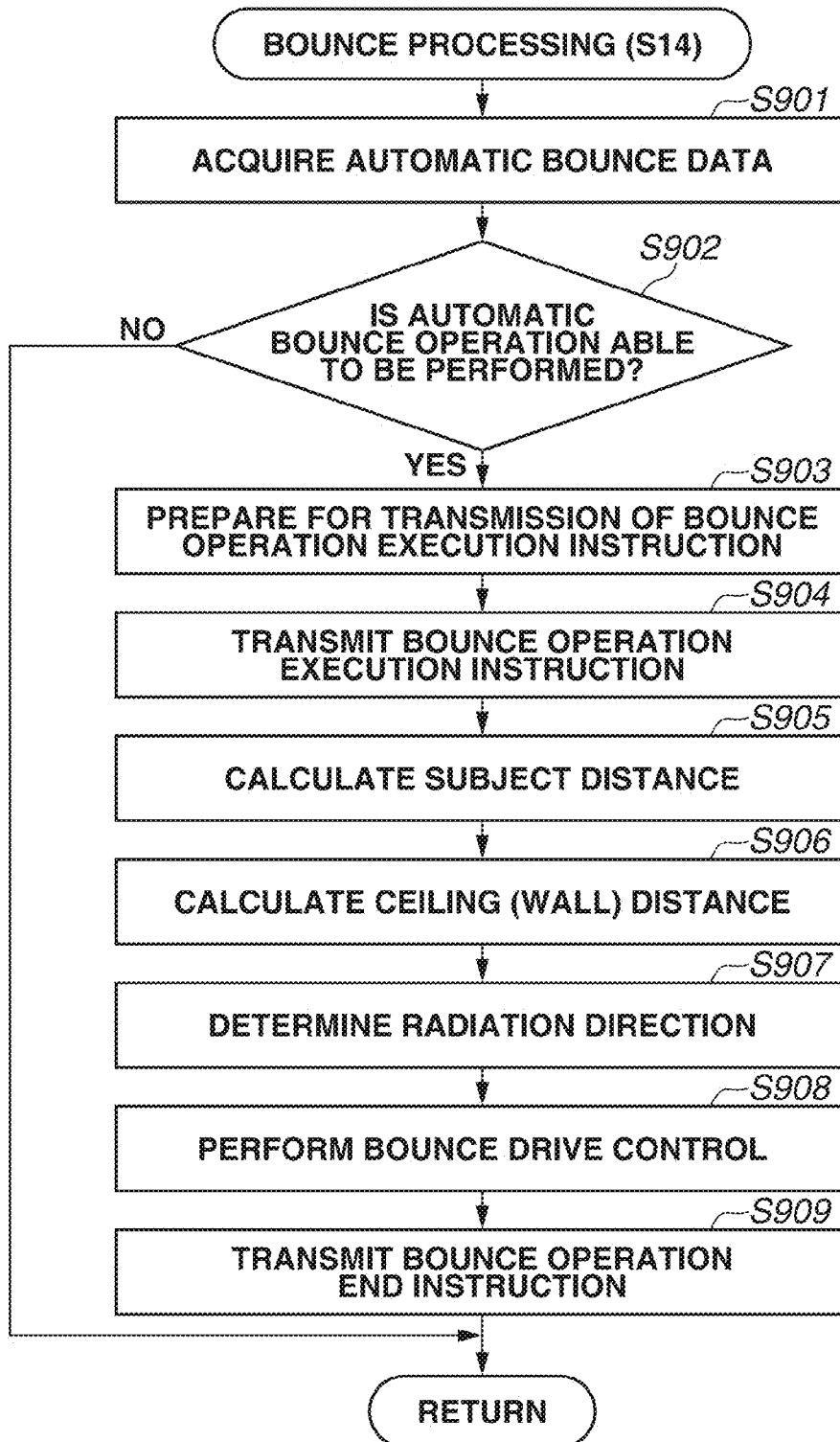


FIG.10

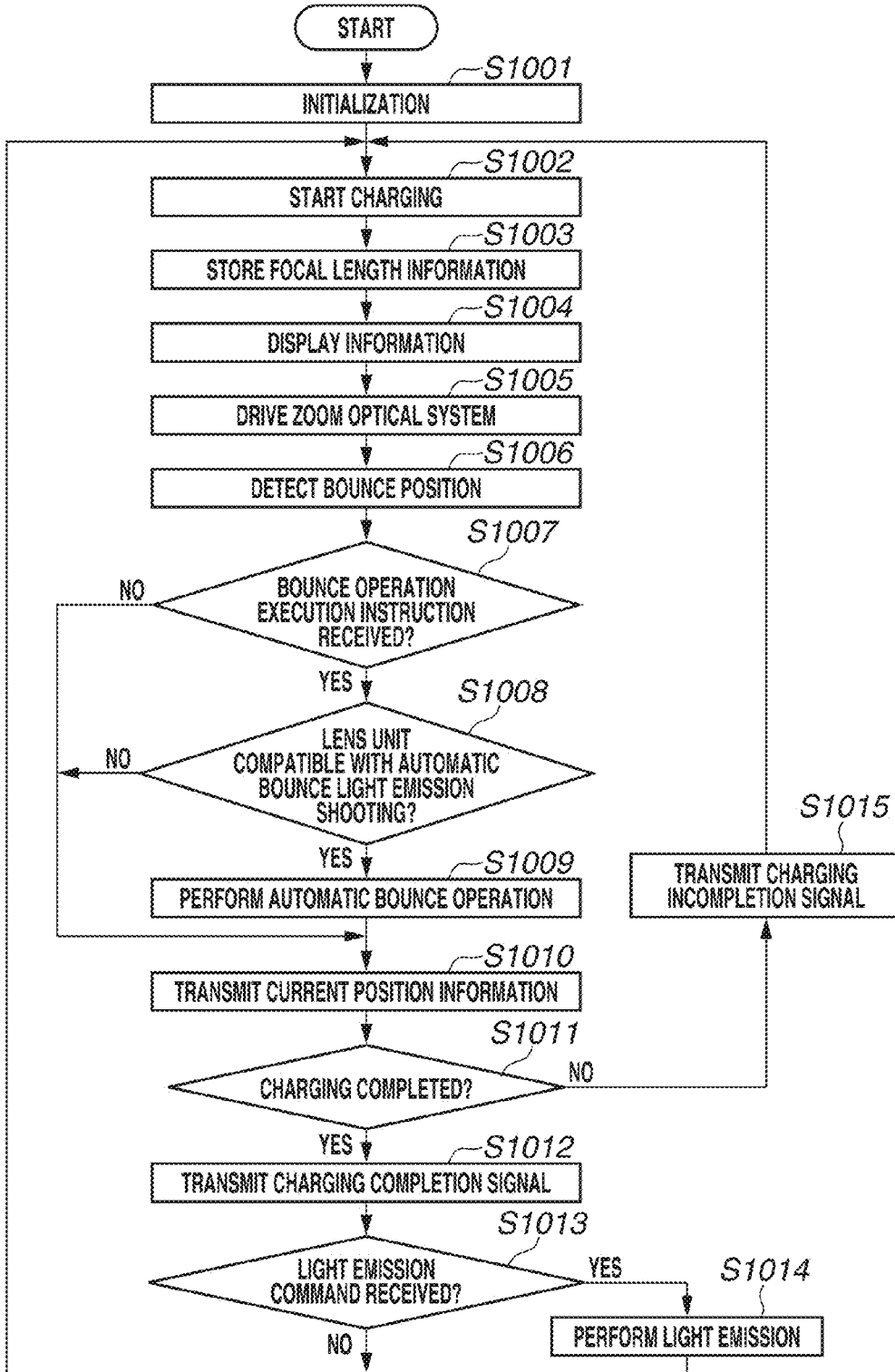


FIG. 11

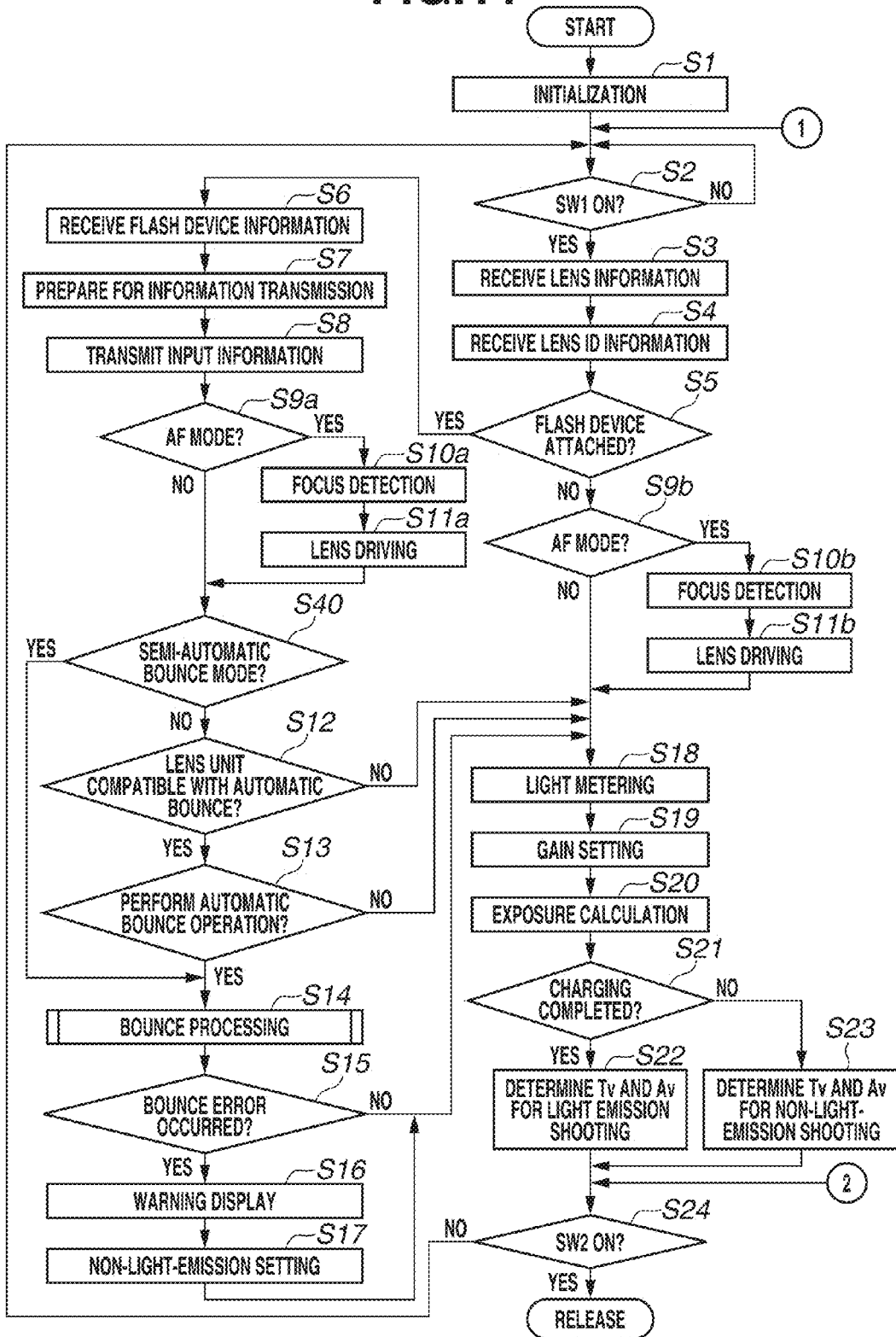


FIG.12

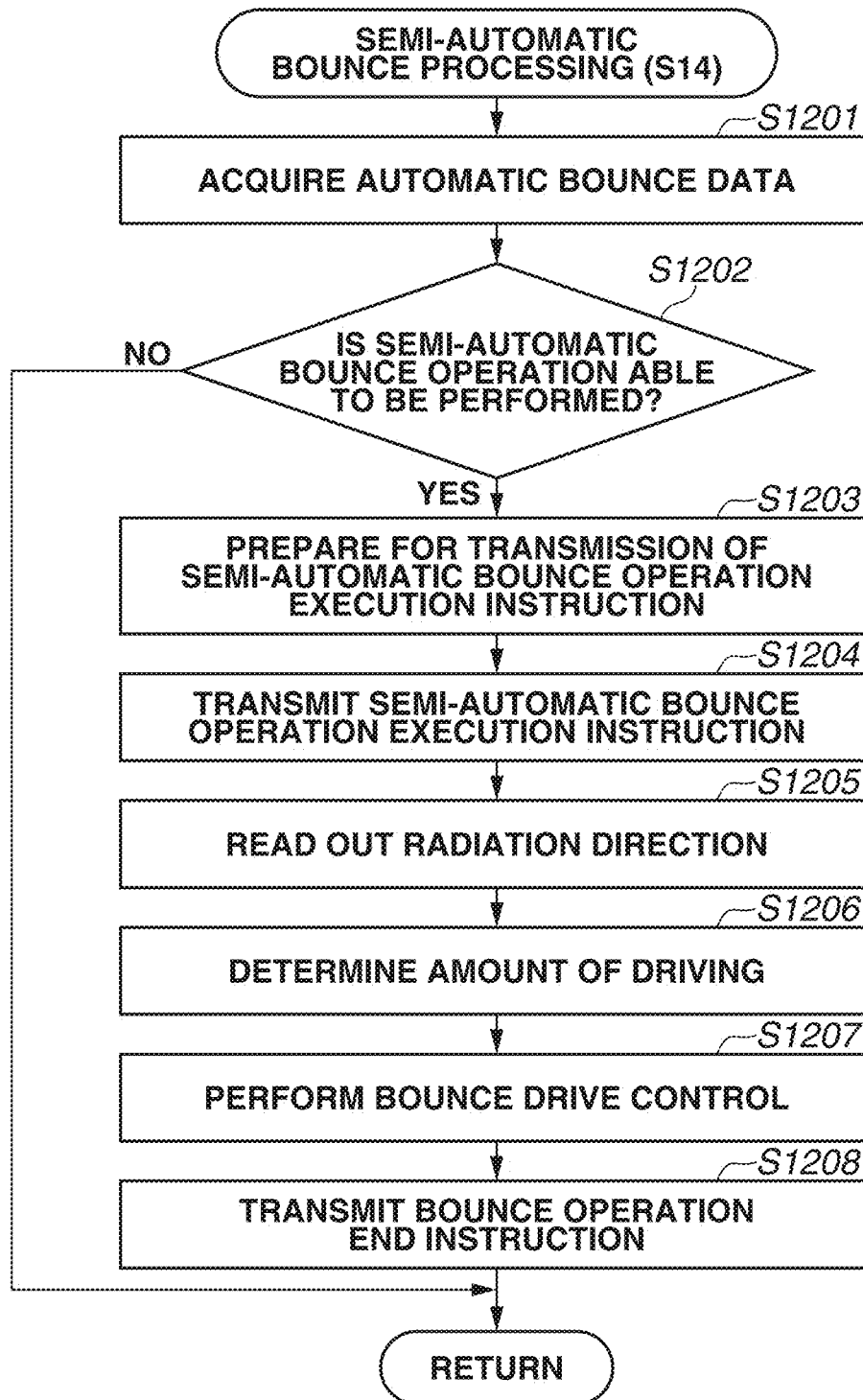


FIG.13

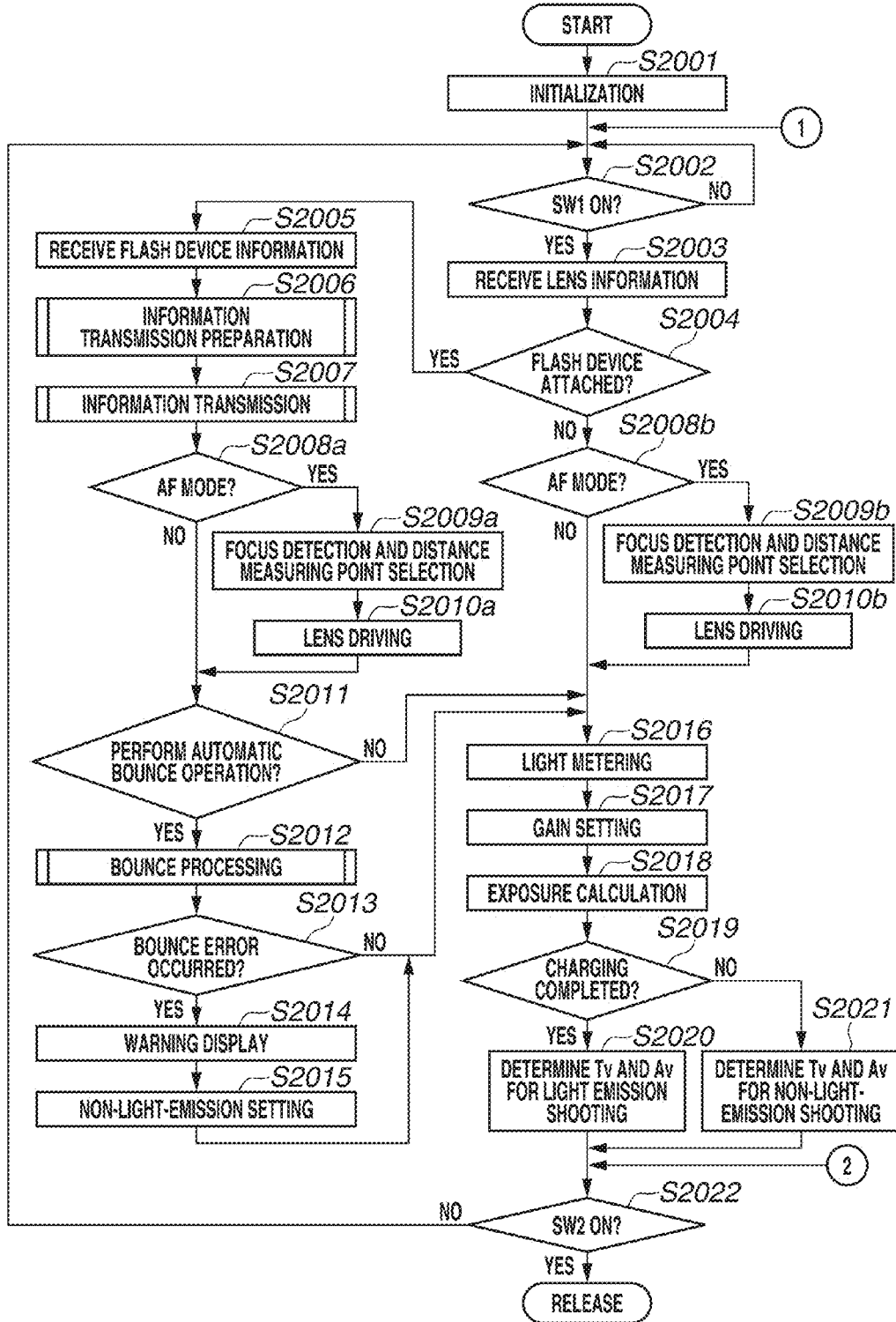


FIG.14

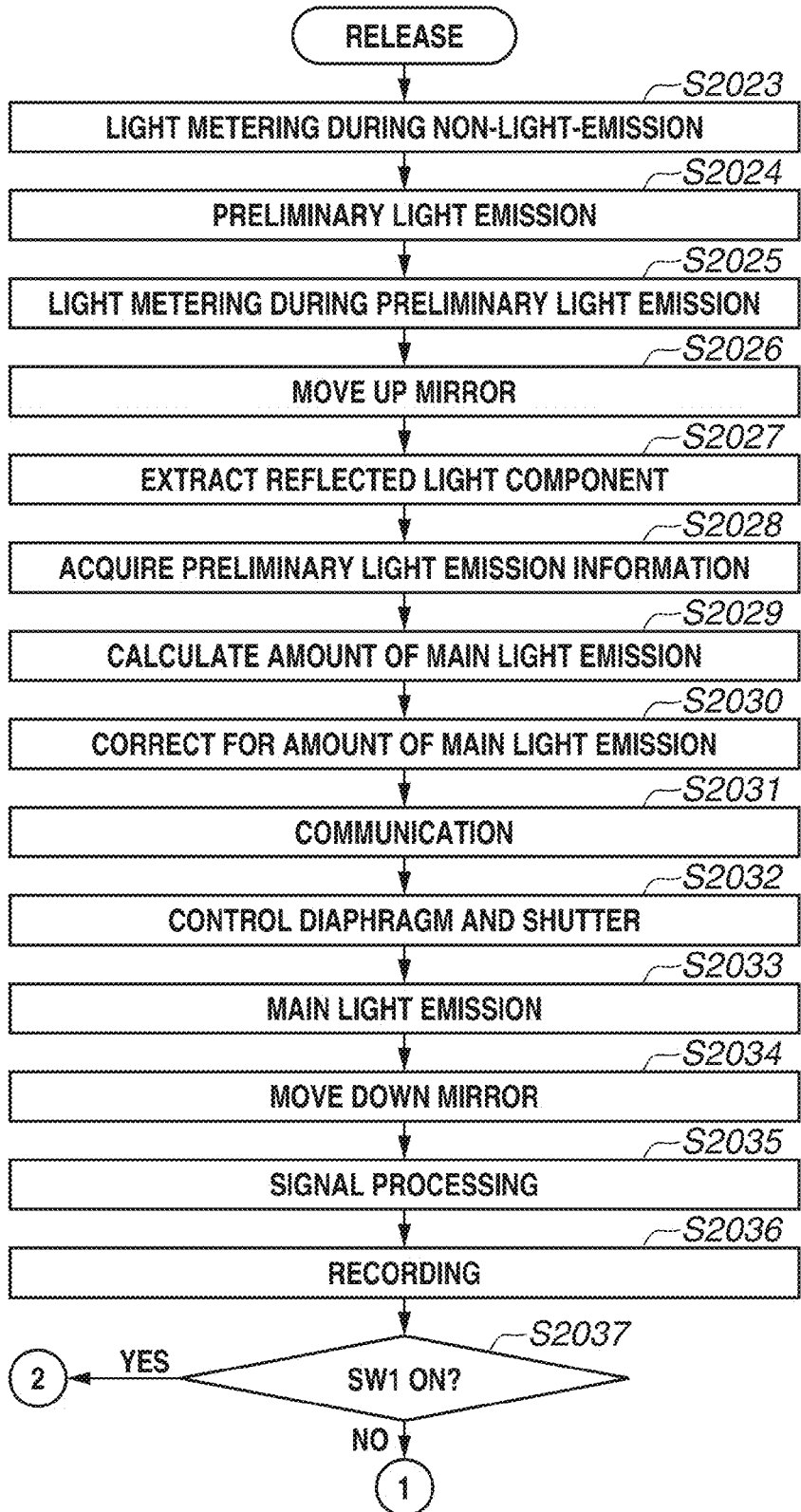


FIG.15

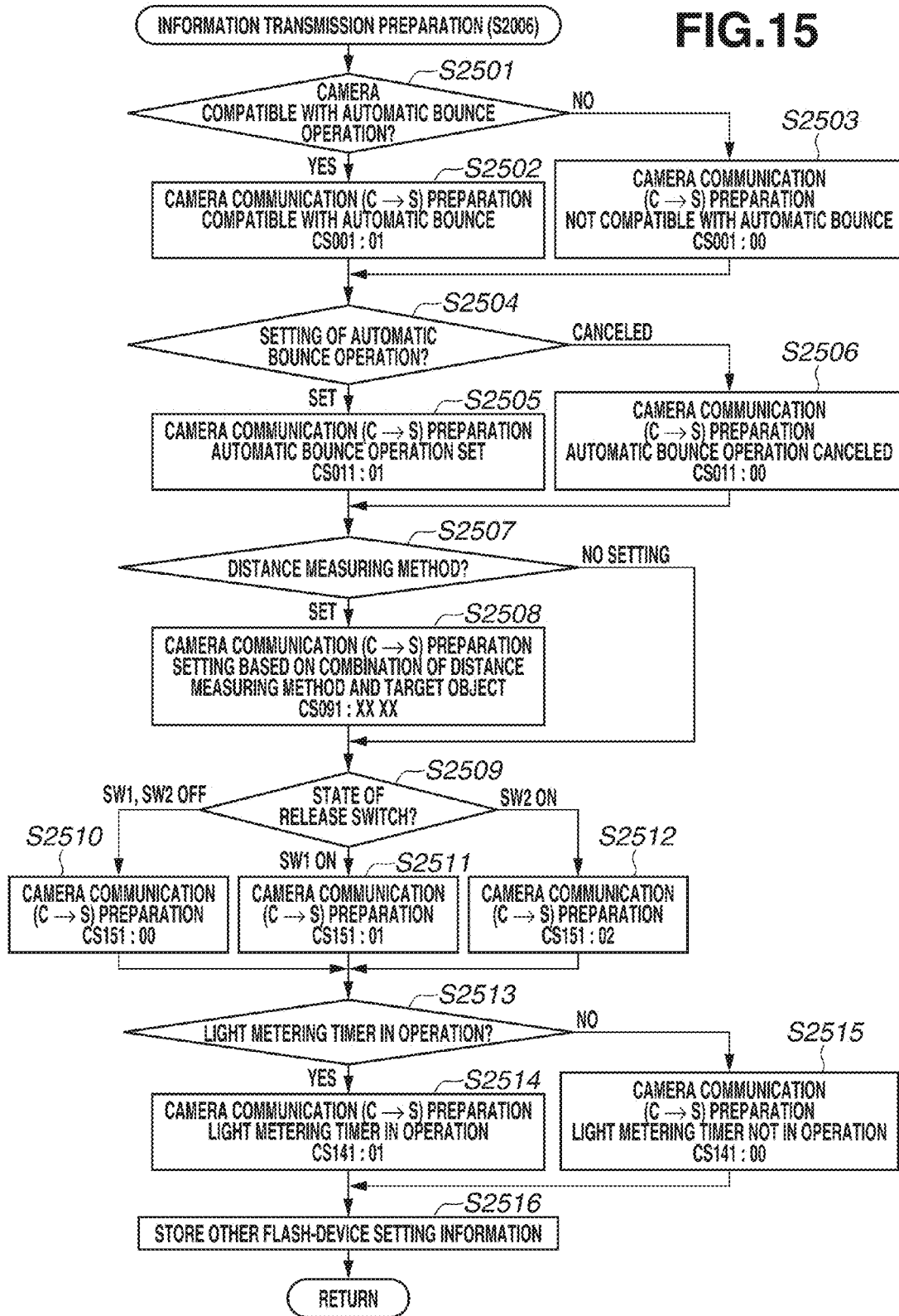


FIG.16

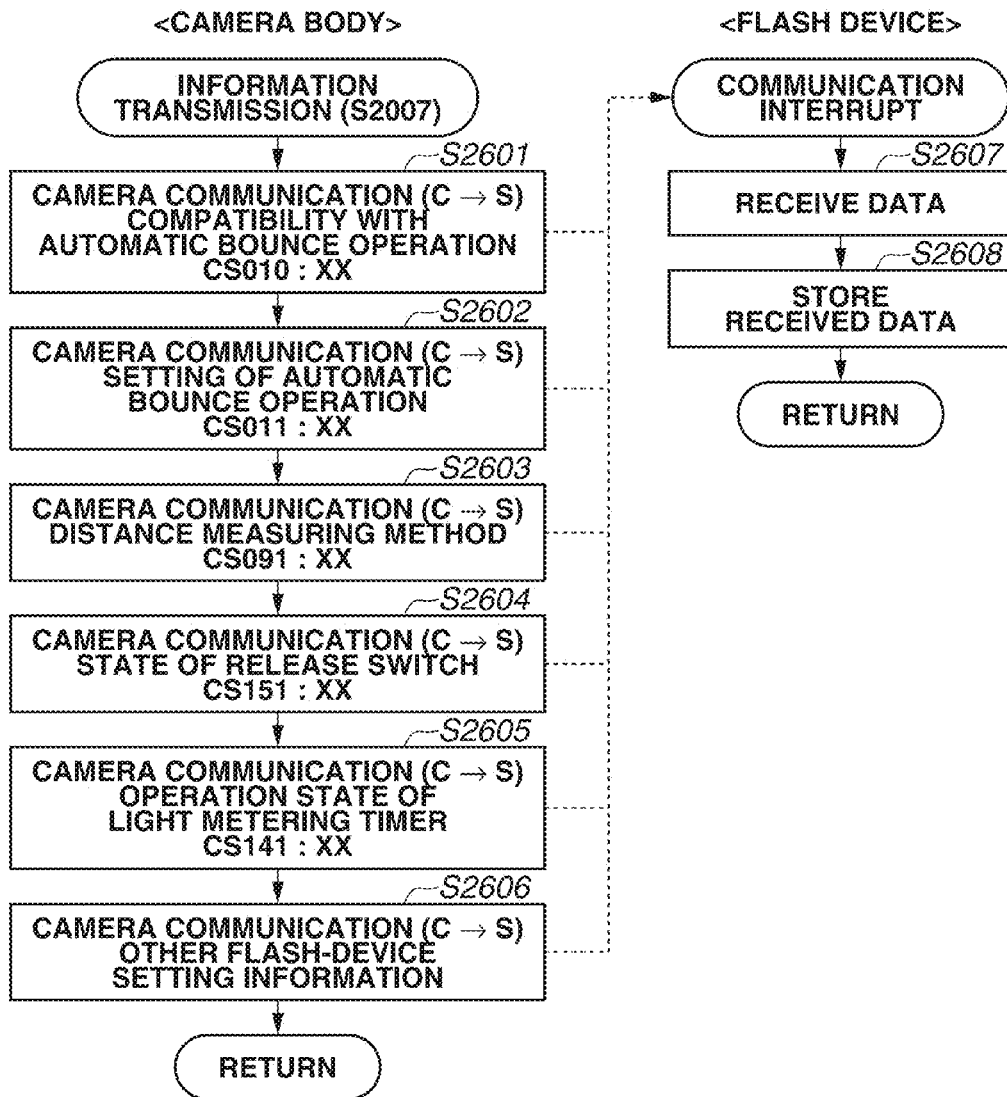


FIG.17

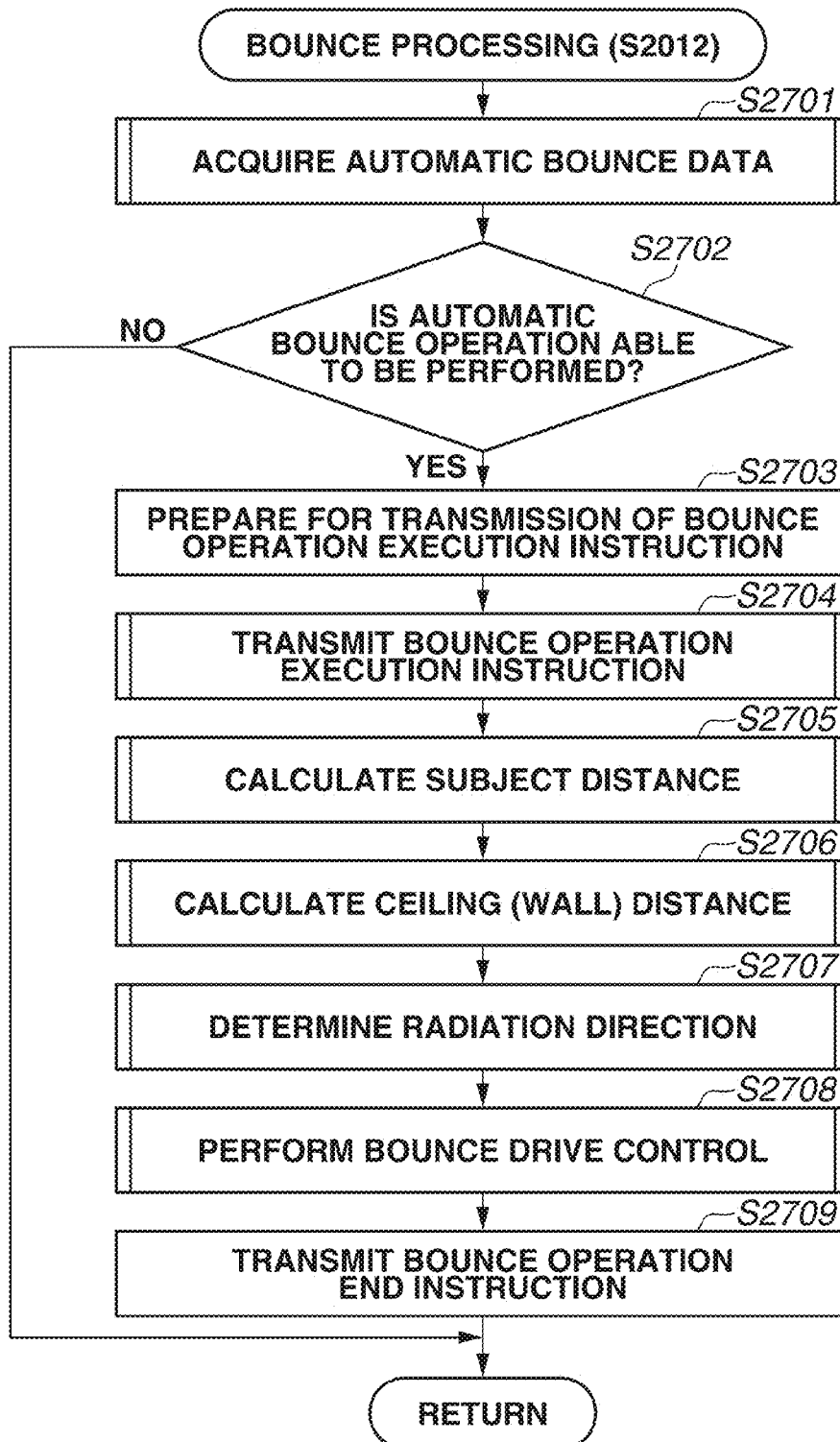


FIG.18A

<CAMERA BODY>

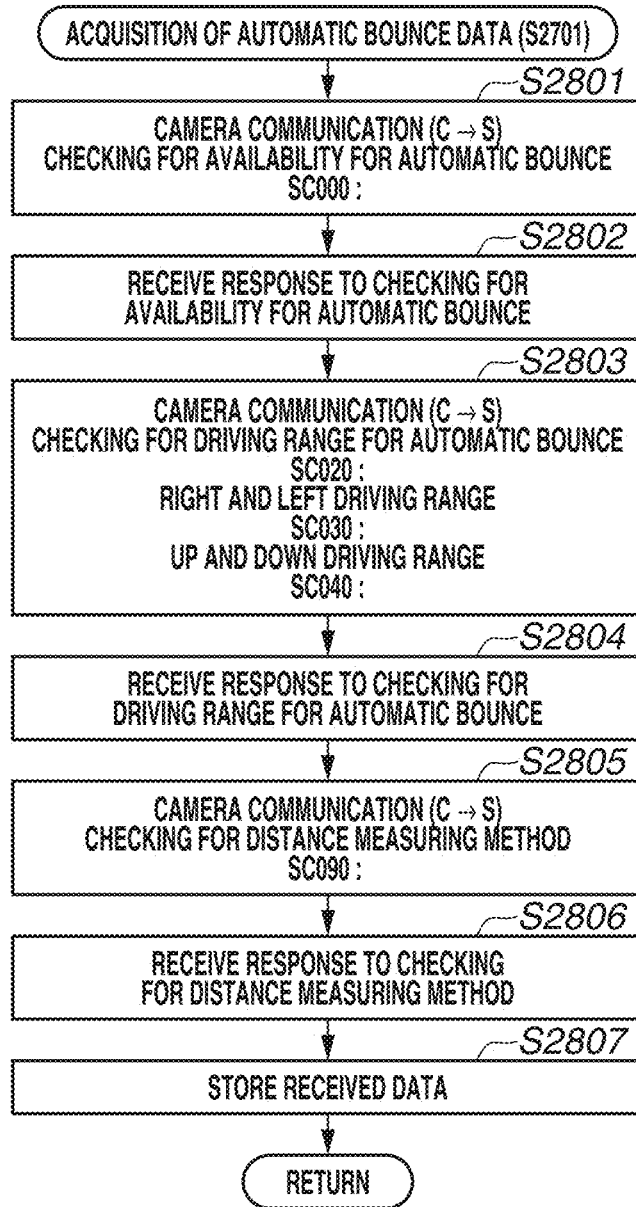


FIG.18B

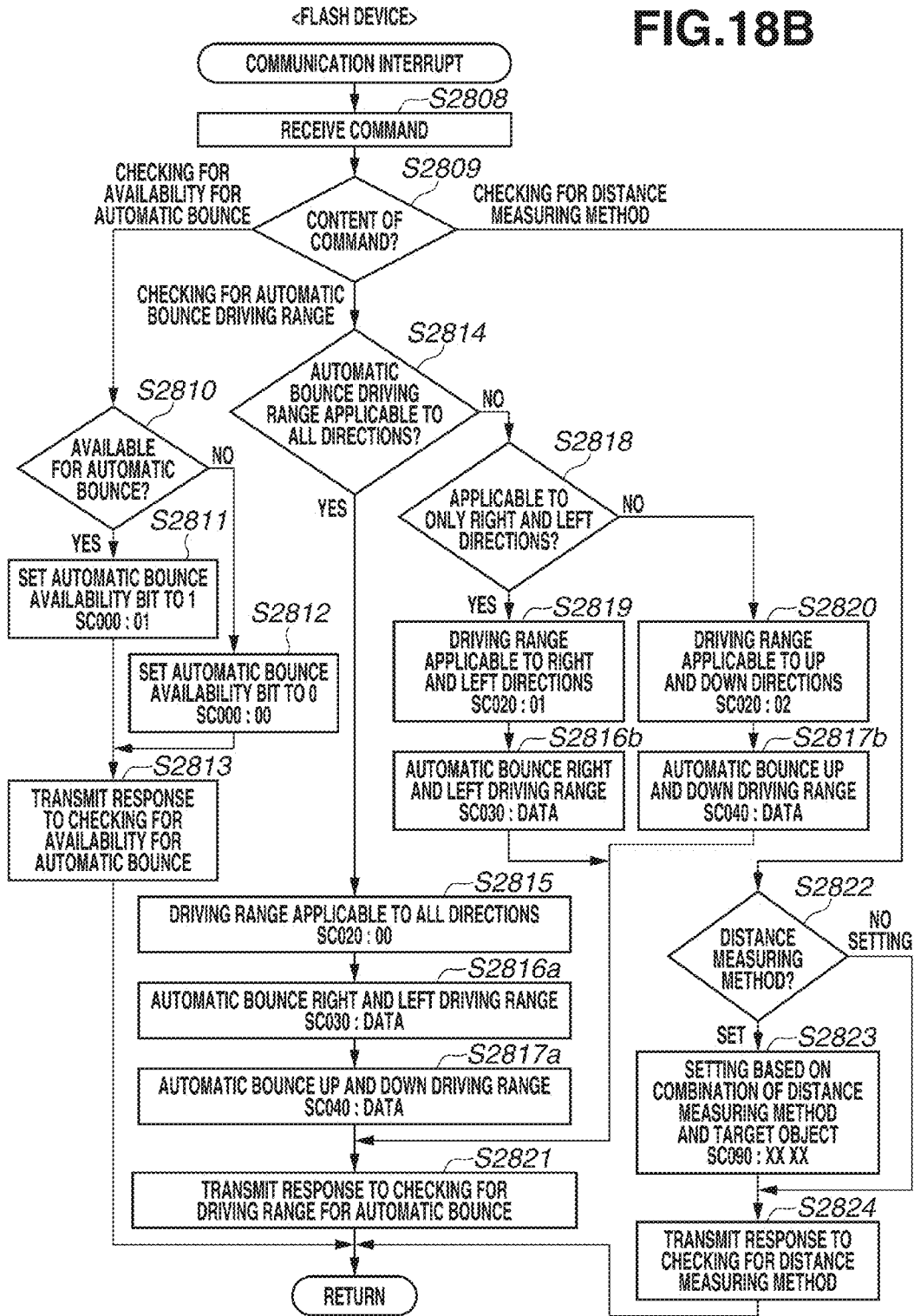


FIG.19

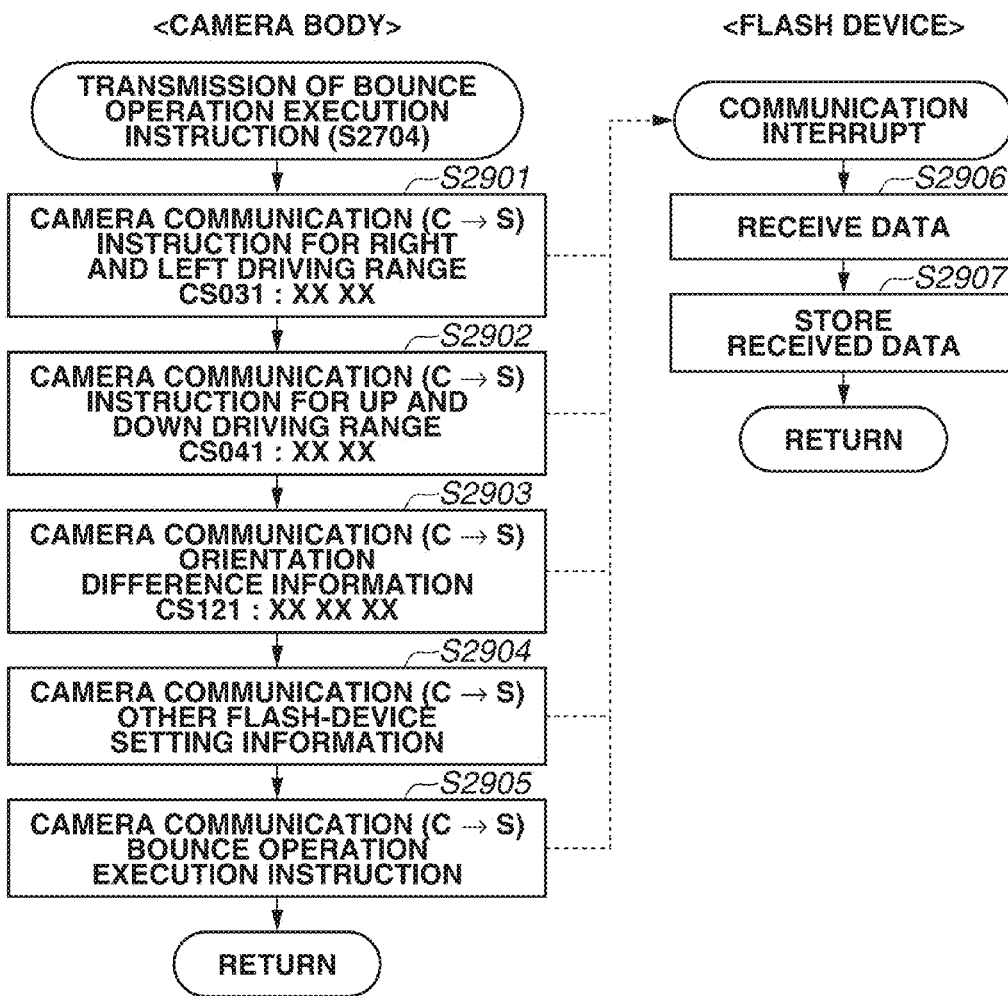


FIG.20A

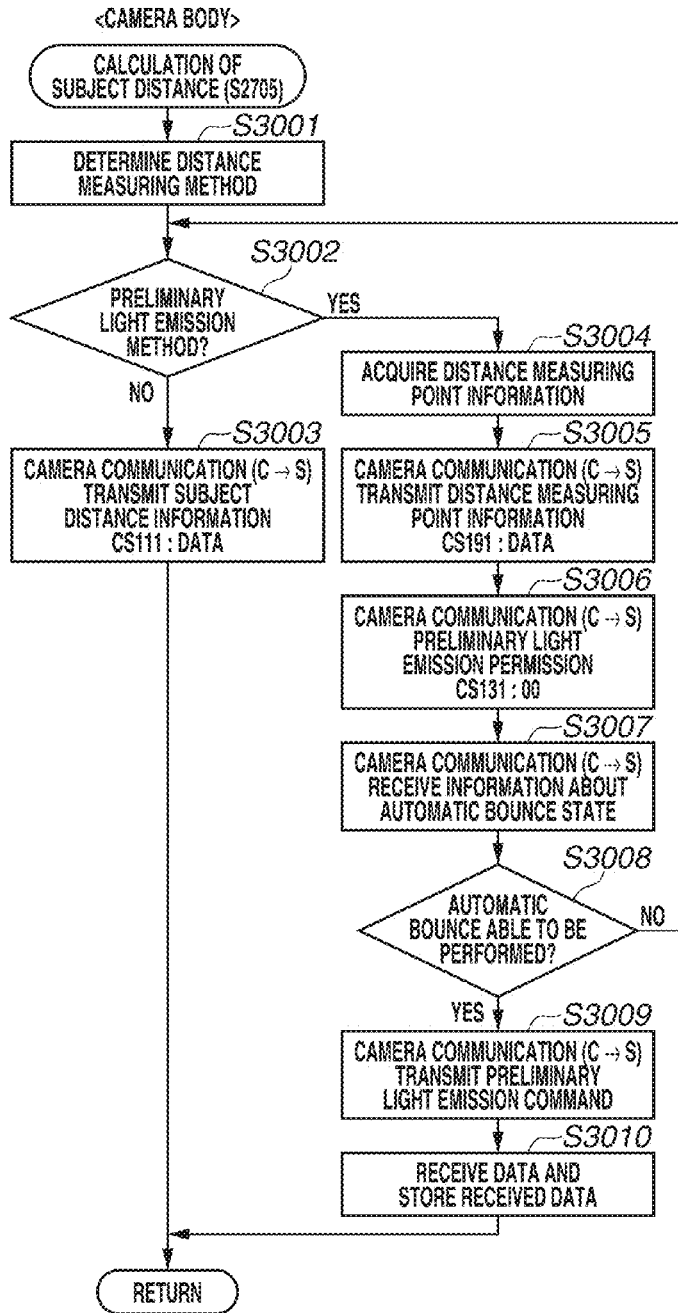


FIG.20B

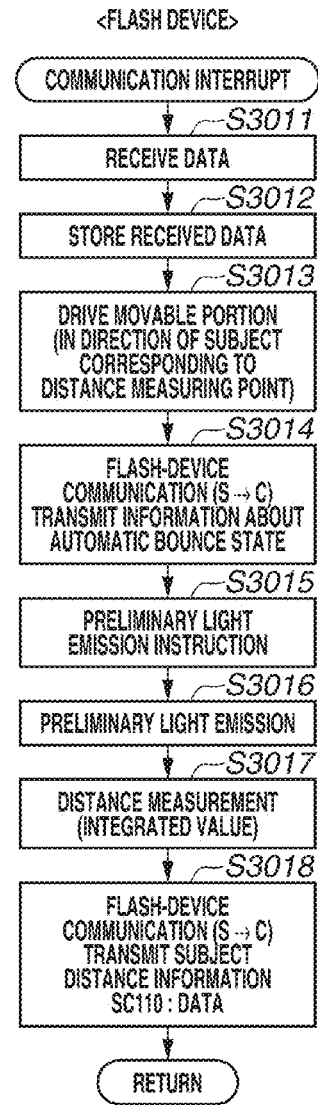


FIG.21A

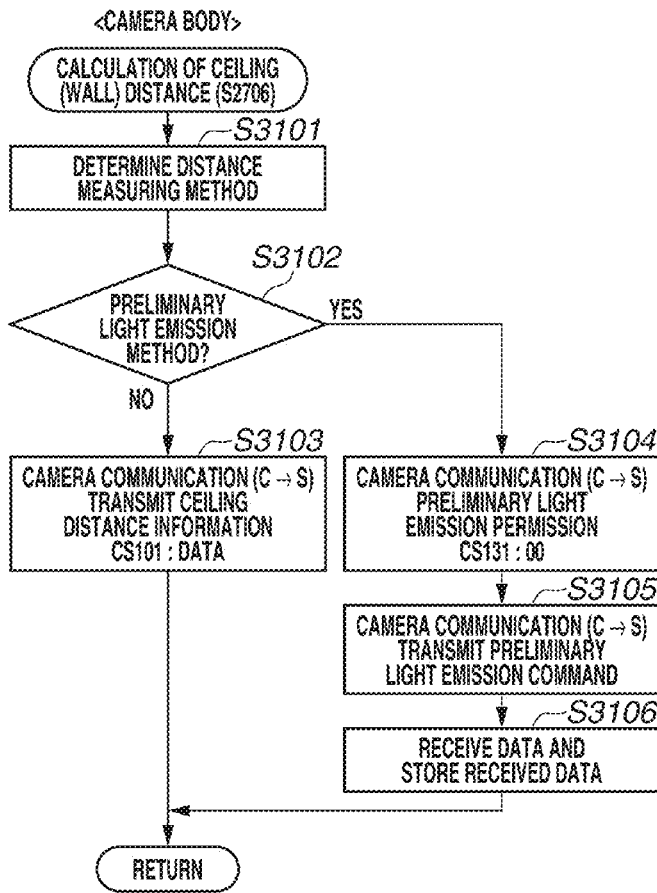


FIG.21B

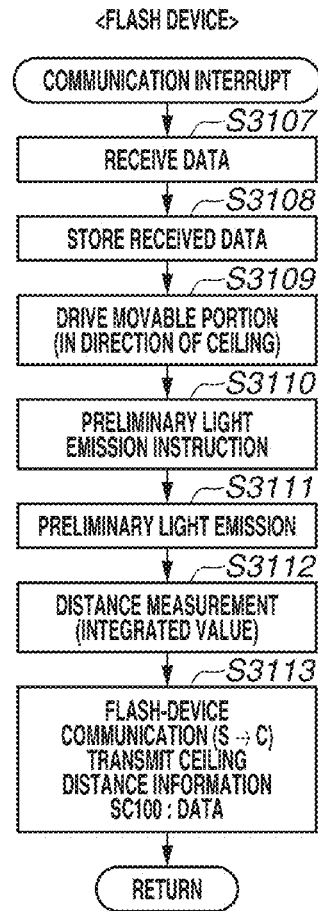


FIG.22A

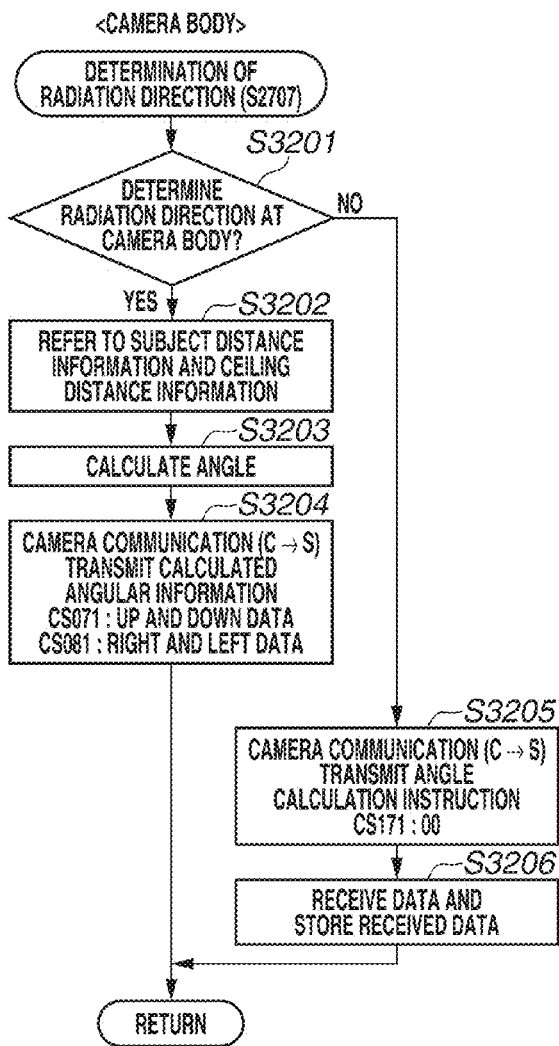


FIG.22B

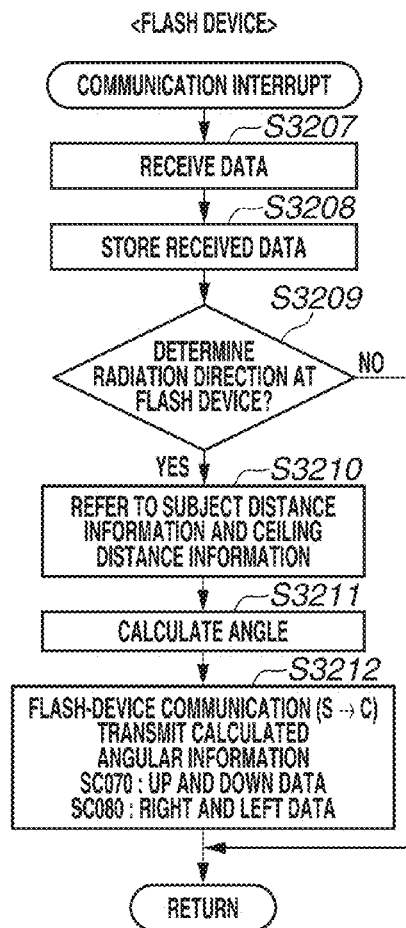


FIG.23A

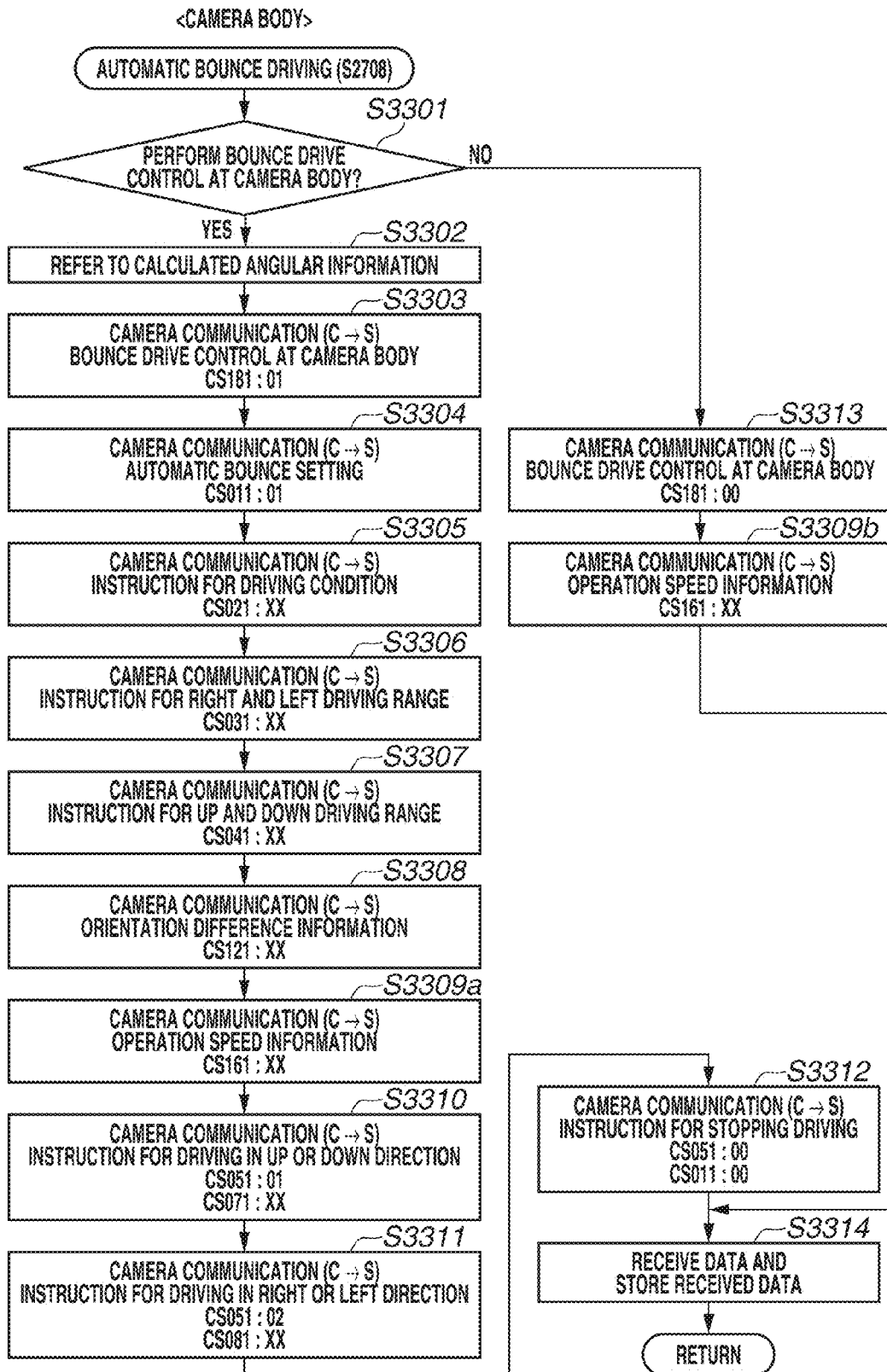


FIG.23B

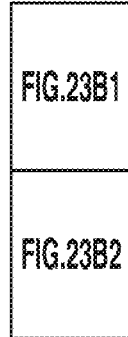


FIG.23B1

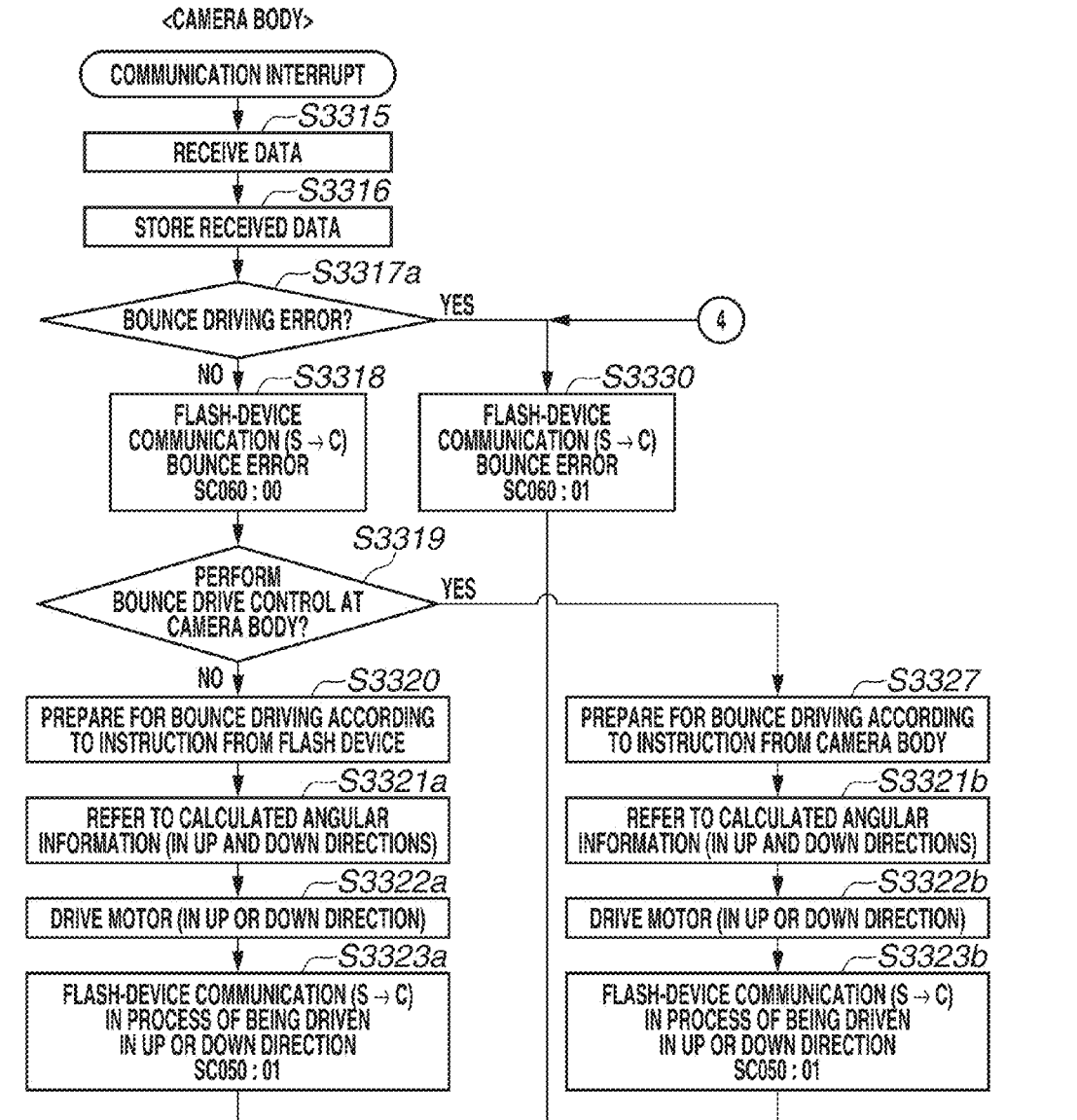


FIG.23B2

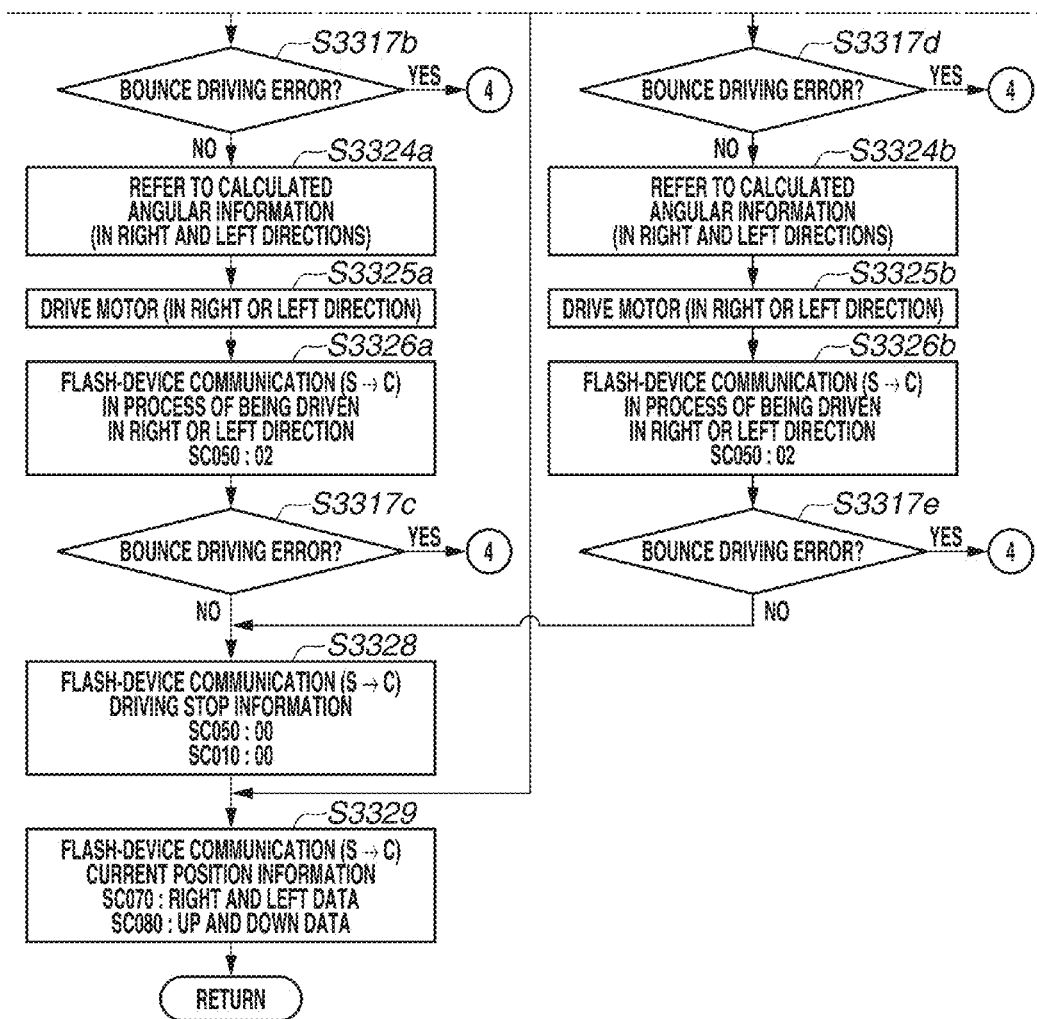


FIG.24

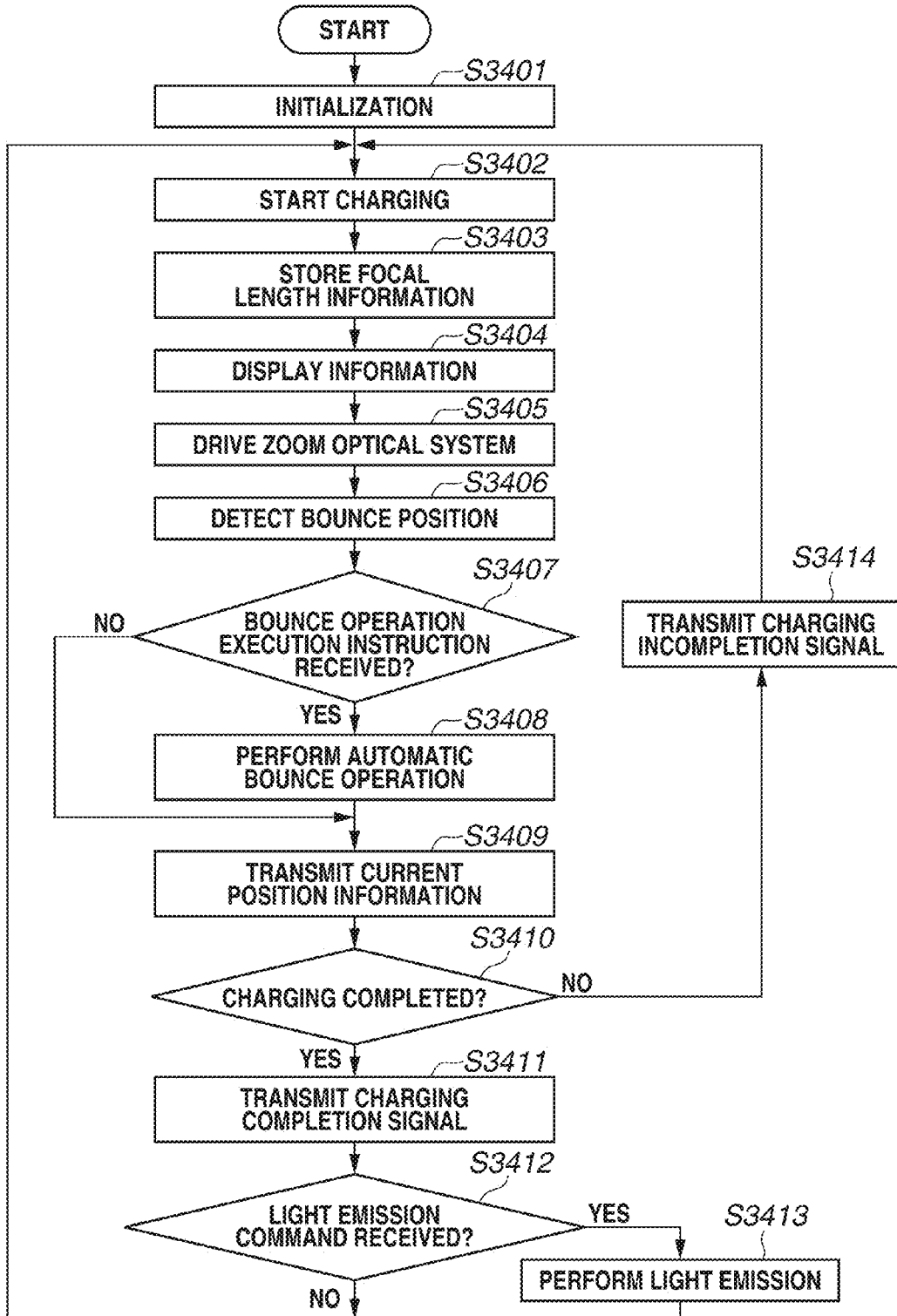


FIG.25A

EXAMPLE OF 8-BIT (1-BYTE) COMMUNICATION (DETECTION OF BIT RISE)

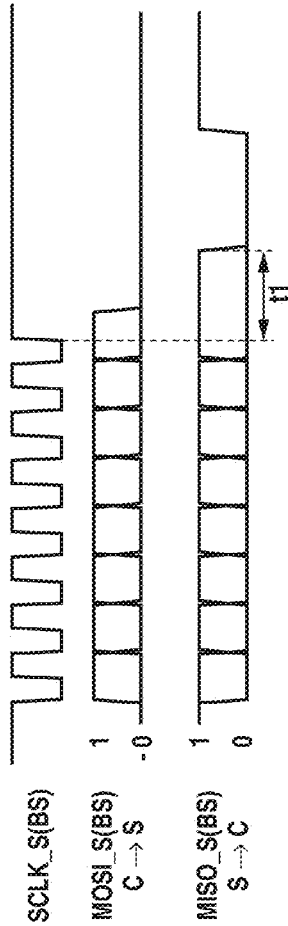


FIG.25B

EXAMPLE: AUTOMATIC BOUNCE SETTING/CANCELLATION

	FIRST BYTE	SECOND BYTE	THIRD BYTE
CAMERA BODY	COMMAND CS 80H	COMMAND NUMBER 011(05H)	DATA 1 01
FLASH DEVICE	XX	XX	XX

EXAMPLE: AUTOMATIC BOUNCE DISTANCE MEASURING METHOD

	FIRST BYTE	SECOND BYTE	THIRD BYTE	FOURTH BYTE
CAMERA BODY	COMMAND CS 80H	COMMAND NUMBER 091(5BH)	DATA 1 02	DATA 2 10
FLASH DEVICE	XX	XX	XX	XX

EXAMPLE: AUTOMATIC BOUNCE SETTING/CANCELLATION

	FIRST BYTE	SECOND BYTE	THIRD BYTE
CAMERA BODY	COMMAND SC 01H	XX	XX
FLASH DEVICE	XX	COMMAND NUMBER 010(0AH)	DATA 1 01

EXAMPLE: AUTOMATIC BOUNCE DISTANCE MEASURING METHOD

	FIRST BYTE	SECOND BYTE	THIRD BYTE	FOURTH BYTE
CAMERA BODY	COMMAND SC 01H	XX	XX	XX
FLASH DEVICE	XX	COMMAND NUMBER 090(5AH)	DATA 1 02	DATA 2 10

FIG.26A



FIG.26A1

COMMAND	COMMAND NUMBER	CONTENT	DATA ITEM
SC	000	AUTOMATIC BOUNCE FUNCTION	
HEX: 01	HEX: 00		0: ABSENT
			1: PRESENT
SC	010	AUTOMATIC BOUNCE SETTING/CANCELLATION	
HEX: 01	HEX: A		0: CANCELLATION
			1: SETTING
SC	020	AUTOMATIC BOUNCE DRIVING RANGE	
HEX: 01	HEX: 14		0: ALL DIRECTIONS AVAILABLE
			1: HORIZONTAL DIRECTIONS AVAILABLE
			2: VERTICAL DIRECTIONS AVAILABLE
SC	030	AUTOMATIC BOUNCE HORIZONTAL DRIVING RANGE	START - END
HEX: 01	HEX: 1E		
SC	040	AUTOMATIC BOUNCE VERTICAL DRIVING RANGE	START - END
HEX: 01	HEX: 28		
SC	050	IN PROCESS OF AUTOMATIC BOUNCE DRIVING (MOTOR)	
HEX: 01	HEX: 32		0: STOP
			1: IN PROCESS OF UP OR DOWN OPERATION
			2: IN PROCESS OF RIGHT OR LEFT OPERATION

FIG.26A2

SC	060	AUTOMATIC BOUNCE ERROR	
HEX: 01	HEX: 3C		0: NORMAL
			1: ERROR
SC	070	CURRENT POSITION BOUNCE ANGULAR INFORMATION IN UP AND DOWN DIRECTIONS	
HEX: 01	HEX: 46		000H - 168H
SC	080	CURRENT POSITION BOUNCE ANGULAR INFORMATION IN RIGHT AND LEFT DIRECTIONS	
HEX: 01	HEX: 50		000H - 168H
SC	090	AUTOMATIC BOUNCE DISTANCE MEASURING METHOD	0x: SUBJECT
HEX: 01	HEX: 5A		1x: CEILING (WALL)
			x0: PRELIMINARY LIGHT EMISSION
			x1: FLASH-DEVICE BUILT-IN AF
			x2: CAMERA AF
SC	100	CEILING DISTANCE INFORMATION	
HEX: 01	HEX: 64		DATA
SC	110	SUBJECT DISTANCE INFORMATION	
HEX: 01	HEX: 6e		DATA
SC	120	FLASH-DEVICE ORIENTATION DIFFERENCE INFORMATION	
HEX: 01	HEX: 78		HORIZONTAL DATA
			VERTICAL DATA
			ANTERIOR-POSTERIOR DATA
SC	130	IN PROCESS OF AUTOMATIC BOUNCE PRELIMINARY LIGHT EMISSION	
HEX: 01	HEX: 82		0: IN PROCESS OF WAITING
			1: IN PROCESS OF LIGHT EMISSION

FIG.26B

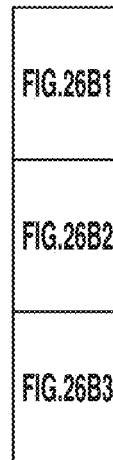


FIG.26B1

COMMAND	COMMAND NUMBER	CONTENT	DATA ITEM
CS	001	AUTOMATIC BOUNCE COMPATIBLE CAMERA	
HEX: 08	HEX: 01		0: INCOMPATIBLE
			1: COMPATIBLE
CS	011	AUTOMATIC BOUNCE SETTING/CANCELLATION	
HEX: 08	HEX: 0B		0: CANCELLATION
			1: SETTING
CS	021	AUTOMATIC BOUNCE DRIVING CONDITION INSTRUCTION	
HEX: 08	HEX: 15		0: ALL DIRECTIONS AVAILABLE
			1: HORIZONTAL DIRECTIONS
			2: VERTICAL DIRECTIONS
CS	031	AUTOMATIC BOUNCE HORIZONTAL DRIVING RANGE INSTRUCTION	START - END
HEX: 08	HEX: 1F		
CS	041	AUTOMATIC BOUNCE VERTICAL DRIVING RANGE INSTRUCTION	START - END
HEX: 08	HEX: 29		

FIG.26B2

CS	051	AUTOMATIC BOUNCE DRIVING INSTRUCTION (MOTOR)	
HEX: 08	HEX: 33		0: STOP
			1: UP OR DOWN OPERATION
			2: RIGHT OR LEFT OPERATION
CS	071	POSITION BOUNCE ANGLE IN UP AND DOWN DIRECTIONS	
HEX: 08	HEX: 47		000H - 168H
CS	081	POSITION BOUNCE ANGLE IN RIGHT AND LEFT DIRECTIONS	
HEX: 08	HEX: 51		000H - 168H
CS	091	AUTOMATIC BOUNCE DISTANCE MEASURING METHOD INSTRUCTION	0x: SUBJECT
HEX: 08	HEX: 5B		1x: CEILING (WALL)
			x0: PRELIMINARY LIGHT EMISSION
			x1: FLASH-DEVICE BUILT-IN AF
			x2: CAMERA AF
CS	101	CEILING DISTANCE INFORMATION	
HEX: 08	HEX: 65		DATA
CS	111	SUBJECT DISTANCE INFORMATION	
HEX: 08	HEX: 6F		DATA
CS	121	CAMERA ORIENTATION DIFFERENCE INFORMATION	
HEX: 08	HEX: 79		HORIZONTAL DATA
			VERTICAL DATA
			ANTERIOR-POSTERIOR DATA
CS	131	PRELIMINARY LIGHT EMISSION INHIBITION	
HEX: 08	HEX: 83		0: PERMIT
			1: INHIBIT
CS	141	LIGHT METERING TIMER IN OPERATION	
HEX: 08	HEX: 8D		0: NON-OPERATING
			1: OPERATING

FIG.26B3

CS	151	STATE OF RELEASE SWITCH	
HEX: 08	HEX: 97		0: SWITCHES OFF
			1: SW1 ON
			2: SW2 ON
CS	161	CHANGE OF OPERATION SPEED	
HEX: 08	HEX: A1		0: NORMAL
			1: LOW SPEED (SILENT)
			2: HIGH SPEED
CS	171	CALCULATION OF BOUNCE ANGLE	
HEX: 08	HEX: AB		0: FLASH DEVICE
			1: CAMERA BODY
CS	181	SELECTION OF BOUNCE DRIVING INSTRUCTION	
HEX: 08	HEX: B5		0: FLASH DEVICE
			1: CAMERA BODY
CS	191	DISTANCE MEASURING POINT INFORMATION	
HEX: 08	HEX: BF		DATA XX, XX

FIG.27

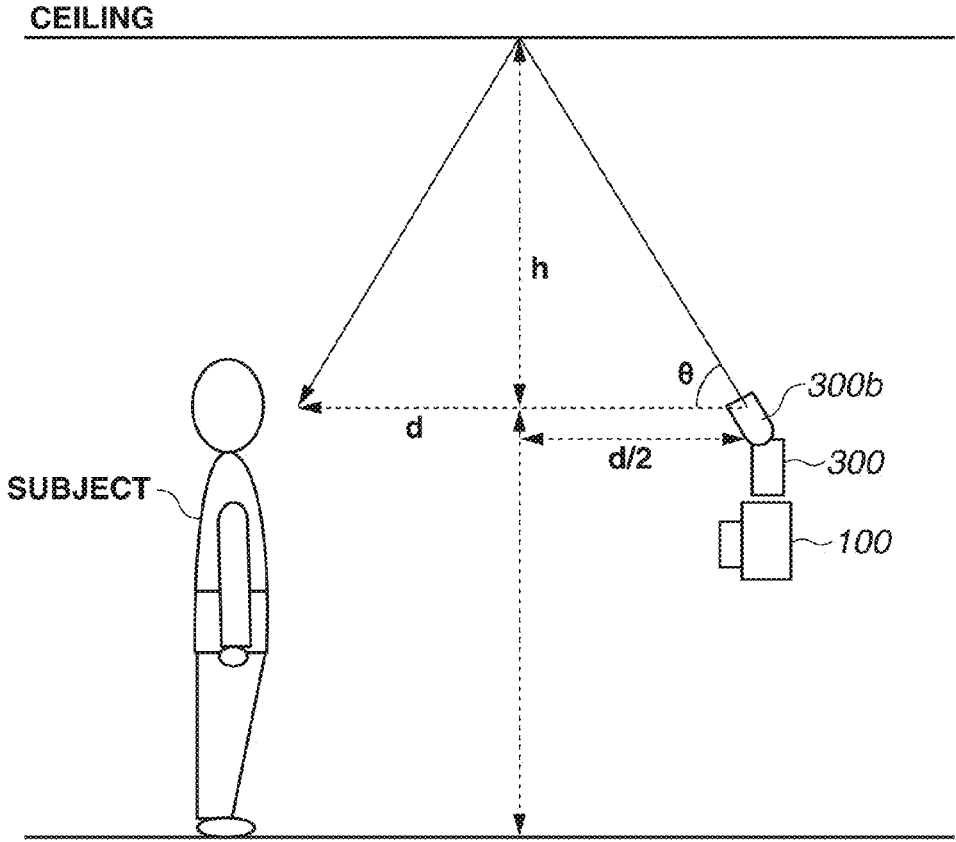


FIG.28A

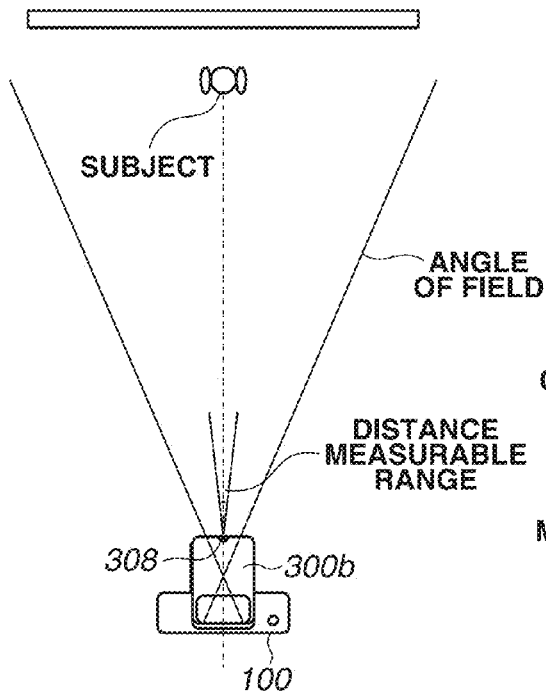


FIG.28C

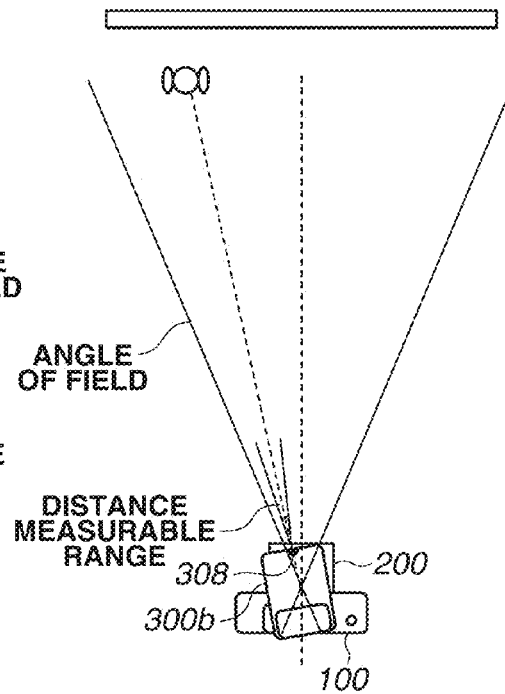
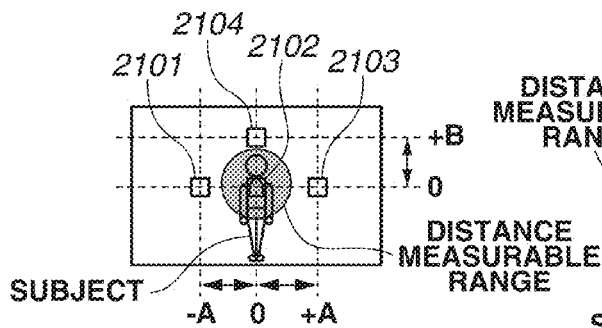
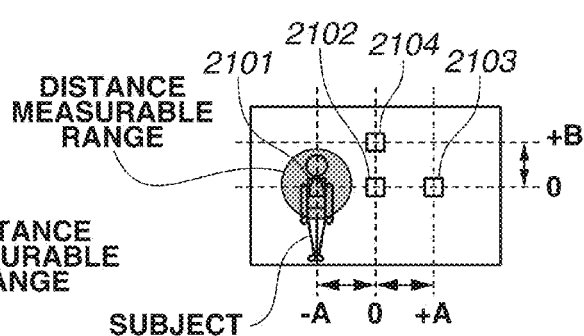


FIG.28B



DISTANCE MEASURING POINT COORDINATE DATA (HORIZONTAL, VERTICAL) = (0, 0)

FIG.28D



DISTANCE MEASURING POINT COORDINATE DATA (HORIZONTAL, VERTICAL) = (-A, 0)

FIG.29

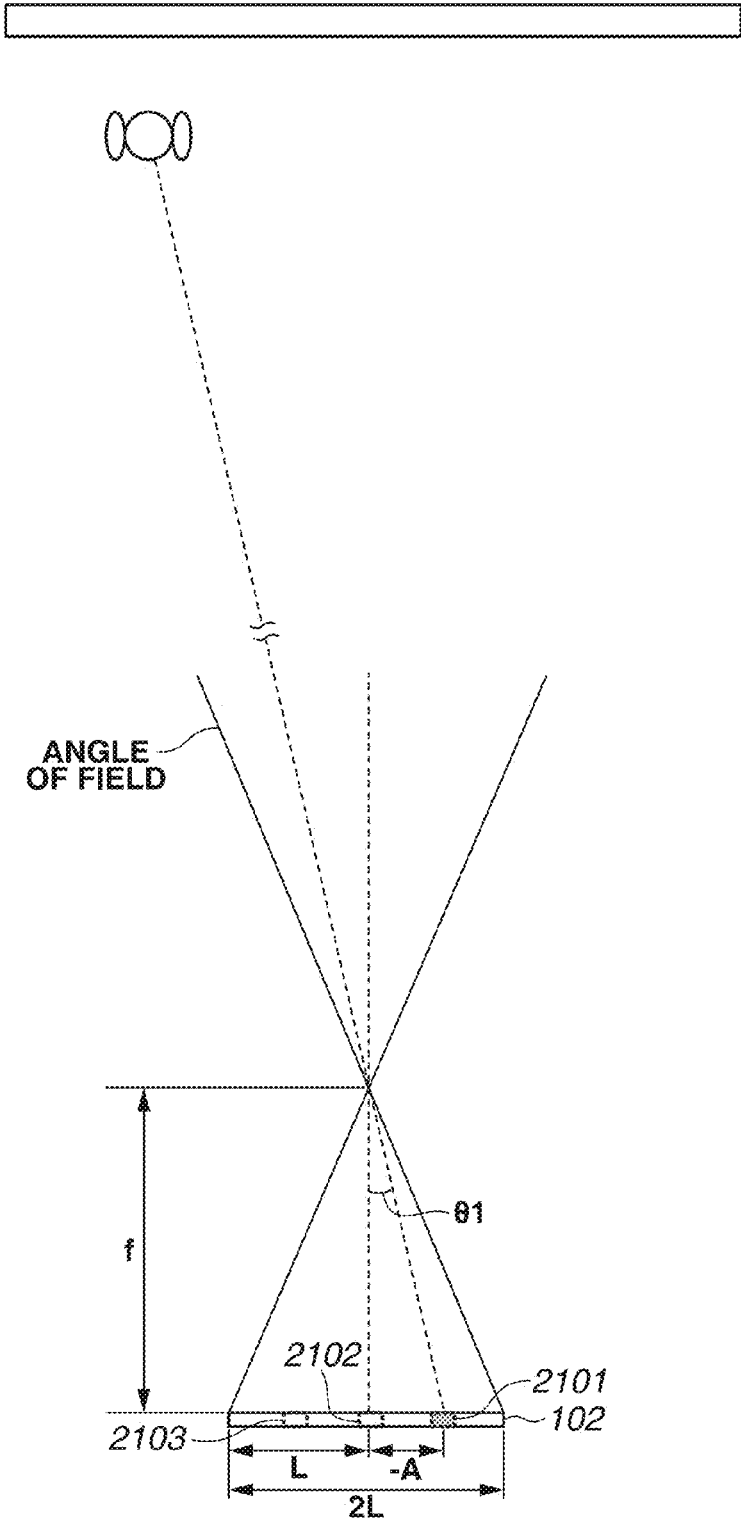


FIG.30A

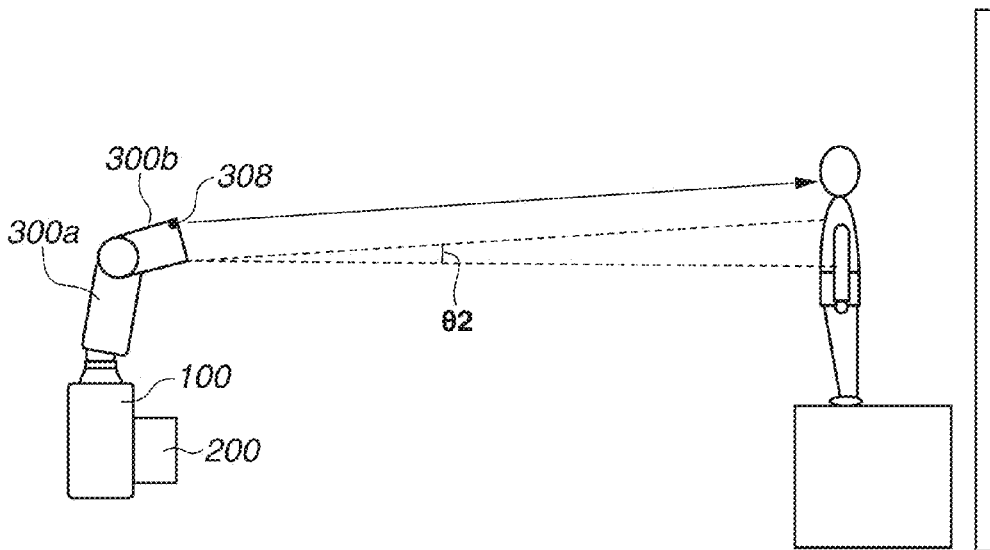


FIG.30B

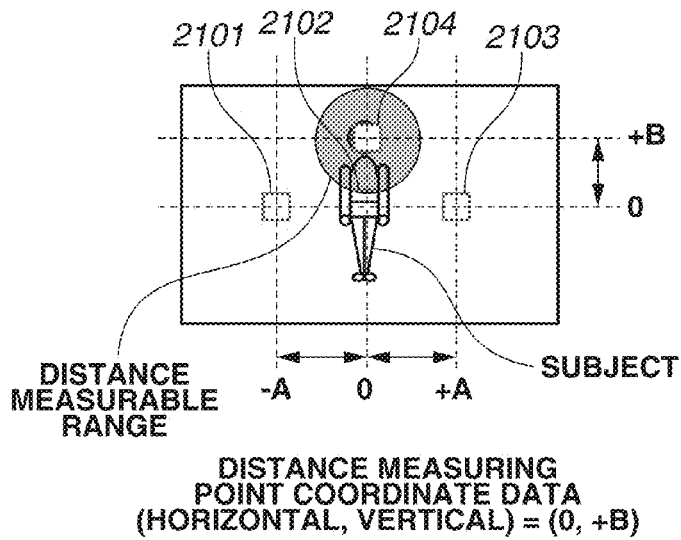


FIG.31A

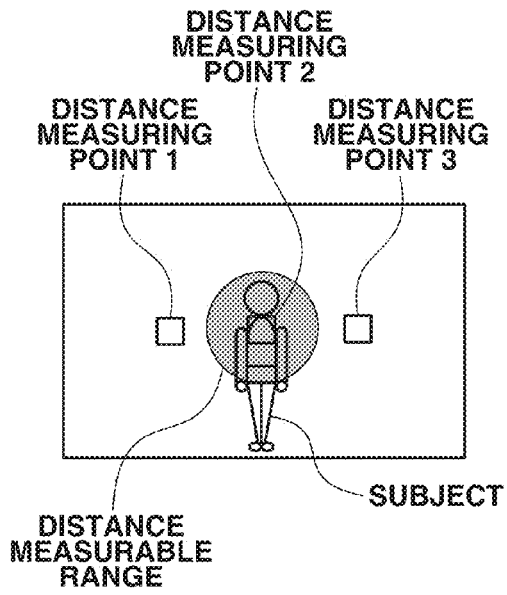


FIG.31B

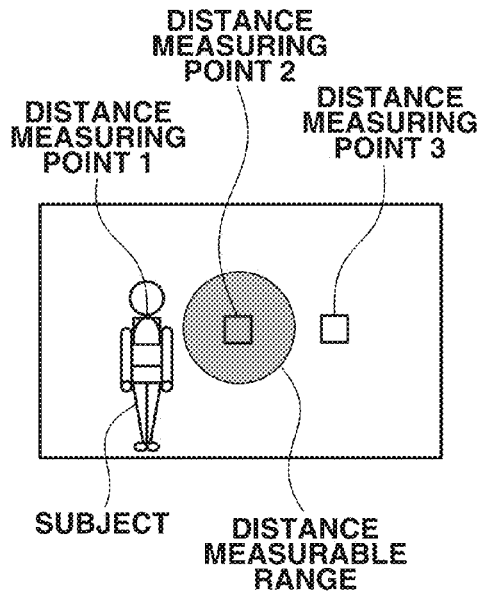


FIG.32

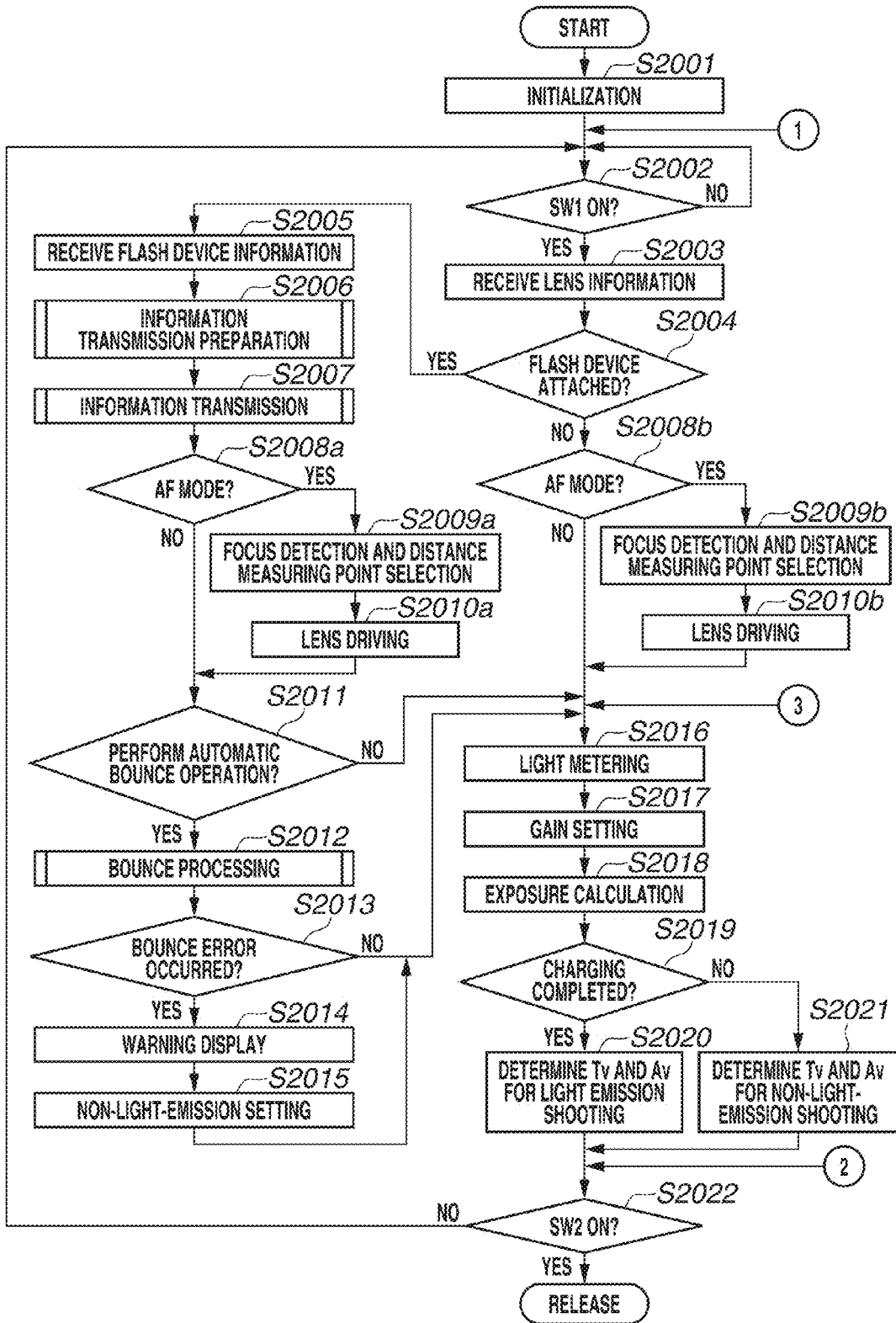


FIG.33A

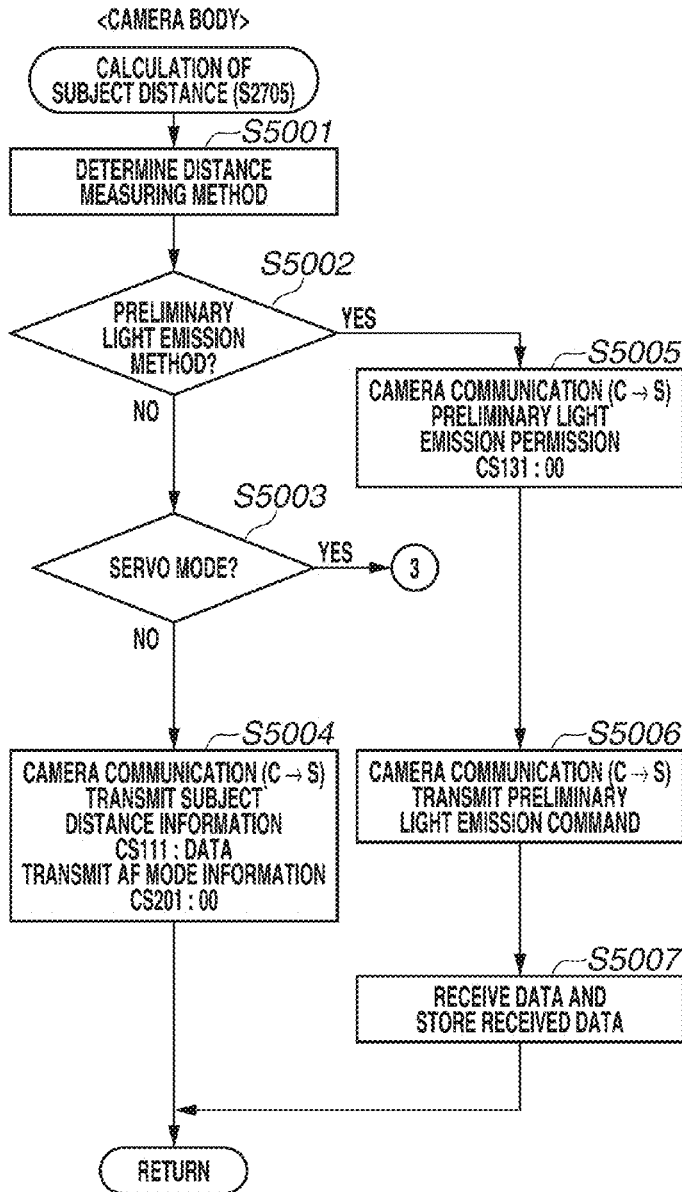


FIG.33B

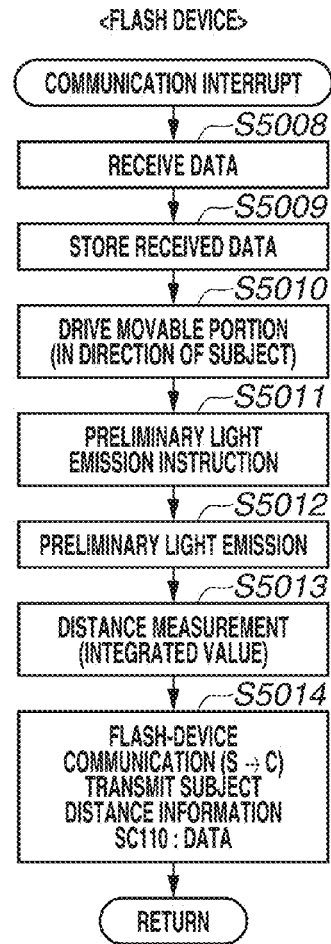


FIG.34A

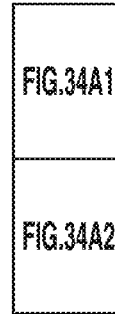


FIG.34A1

COMMAND	COMMAND NUMBER	CONTENT	DATA ITEM
SC	000	AUTOMATIC BOUNCE FUNCTION	
HEX: 01	HEX: 00		0: ABSENT
			1: PRESENT
SC	010	AUTOMATIC BOUNCE SETTING/CANCELLATION	
HEX: 01	HEX: A		0: CANCELLATION
			1: SETTING
SC	020	AUTOMATIC BOUNCE DRIVING RANGE	
HEX: 01	HEX: 14		0: ALL DIRECTIONS AVAILABLE
			1: HORIZONTAL DIRECTIONS AVAILABLE
			2: VERTICAL DIRECTIONS AVAILABLE
SC	030	AUTOMATIC BOUNCE HORIZONTAL DRIVING RANGE	START - END
HEX: 01	HEX: 1E		
SC	040	AUTOMATIC BOUNCE VERTICAL DRIVING RANGE	START - END
HEX: 01	HEX: 28		
SC	050	IN PROCESS OF AUTOMATIC BOUNCE DRIVING (MOTOR)	
HEX: 01	HEX: 32		0: STOP
			1: IN PROCESS OF UP OR DOWN OPERATION
			2: IN PROCESS OF RIGHT OR LEFT OPERATION

FIG.34A2

SC	060	AUTOMATIC BOUNCE ERROR	
HEX: 01	HEX: 3C		0: NORMAL
			1: ERROR
SC	070	CURRENT POSITION BOUNCE ANGULAR INFORMATION IN UP AND DOWN DIRECTIONS	
HEX: 01	HEX: 46		000H ~ 168H
SC	080	CURRENT POSITION BOUNCE ANGULAR INFORMATION IN RIGHT AND LEFT DIRECTIONS	
HEX: 01	HEX: 50		000H ~ 168H
SC	090	AUTOMATIC BOUNCE DISTANCE MEASURING METHOD	0x: SUBJECT
HEX: 01	HEX: 5A		1x: CEILING (WALL)
			x0: PRELIMINARY LIGHT EMISSION
			x1: FLASH-DEVICE BUILT-IN AF
			x2: CAMERA AF
SC	100	CEILING DISTANCE INFORMATION	
HEX: 01	HEX: 64		DATA
SC	110	SUBJECT DISTANCE INFORMATION	
HEX: 01	HEX: 6e		DATA
SC	120	FLASH-DEVICE ORIENTATION DIFFERENCE INFORMATION	
HEX: 01	HEX: 78		HORIZONTAL DATA
			VERTICAL DATA
			ANTERIOR-POSTERIOR DATA
SC	130	IN PROCESS OF AUTOMATIC BOUNCE PRELIMINARY LIGHT EMISSION	
HEX: 01	HEX: 82		0: IN PROCESS OF WAITING
			1: IN PROCESS OF LIGHT EMISSION

FIG.34B

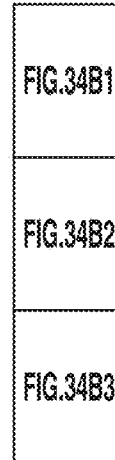


FIG.34B1

COMMAND	COMMAND NUMBER	CONTENT	DATA ITEM
CS	001	AUTOMATIC BOUNCE COMPATIBLE CAMERA	
HEX: 08	HEX: 01		0: INCOMPATIBLE 1: COMPATIBLE
CS	011	AUTOMATIC BOUNCE SETTING/CANCELLATION	
HEX: 08	HEX: 0B		0: CANCELLATION 1: SETTING
CS	021	AUTOMATIC BOUNCE DRIVING CONDITION INSTRUCTION	
HEX: 08	HEX: 15		0: ALL DIRECTIONS AVAILABLE 1: RIGHT AND LEFT DIRECTIONS 2: UP AND DOWN DIRECTIONS
CS	031	AUTOMATIC BOUNCE RIGHT AND LEFT DRIVING RANGE INSTRUCTION	START - END
HEX: 08	HEX: 1F		
CS	041	AUTOMATIC BOUNCE VERTICAL DRIVING RANGE INSTRUCTION	START - END
HEX: 08	HEX: 29		

FIG.34B2

CS	051	AUTOMATIC BOUNCE DRIVING INSTRUCTION (MOTOR)	
HEX: 08	HEX: 33		0: STOP
			1: UP OR DOWN OPERATION
			2: RIGHT OR LEFT OPERATION
CS	071	POSITION BOUNCE ANGLE IN UP AND DOWN DIRECTIONS	
HEX: 08	HEX: 47		000H ~ 168H
CS	081	POSITION BOUNCE ANGLE IN RIGHT AND LEFT DIRECTIONS	
HEX: 08	HEX: 51		000H ~ 168H
CS	091	AUTOMATIC BOUNCE DISTANCE MEASURING METHOD INSTRUCTION	0x: SUBJECT
HEX: 08	HEX: 5B		1x: CEILING (WALL)
			x0: PRELIMINARY LIGHT EMISSION
			x1: FLASH-DEVICE BUILT-IN AF
			x2: CAMERA AF
CS	101	CEILING DISTANCE INFORMATION	
HEX: 08	HEX: 65		DATA
CS	111	SUBJECT DISTANCE INFORMATION	
HEX: 08	HEX: 6F		DATA
CS	121	CAMERA ORIENTATION DIFFERENCE INFORMATION	
HEX: 08	HEX: 79		HORIZONTAL DATA
			VERTICAL DATA
			ANTERIOR-POSTERIOR DATA
CS	131	PRELIMINARY LIGHT EMISSION INHIBITION	
HEX: 08	HEX: 83		0: PERMIT
			1: INHIBIT
CS	141	LIGHT METERING TIMER IN OPERATION	
HEX: 08	HEX: 8D		0: NON-OPERATING
			1: OPERATING

FIG.34B3

CS	151	STATE OF RELEASE SWITCH	
HEX: 08	HEX: 97		0: SWITCHES OFF
			1: SW1 ON
			2: SW2 ON
CS	161	CHANGE OF OPERATION SPEED	
HEX: 08	HEX: A1		0: NORMAL
			1: LOW SPEED (SILENT)
			2: HIGH SPEED
CS	171	CALCULATION OF BOUNCE ANGLE	
HEX: 08	HEX: AB		0: FLASH DEVICE
			1: CAMERA BODY
CS	181	SELECTION OF BOUNCE DRIVING INSTRUCTION	
HEX: 08	HEX: B5		0: FLASH DEVICE
			1: CAMERA BODY
CS	201	AF MODE INFORMATION	
HEX: 08	HEX: C9		0: SINGLE
			1: SERVO

FIG.35A

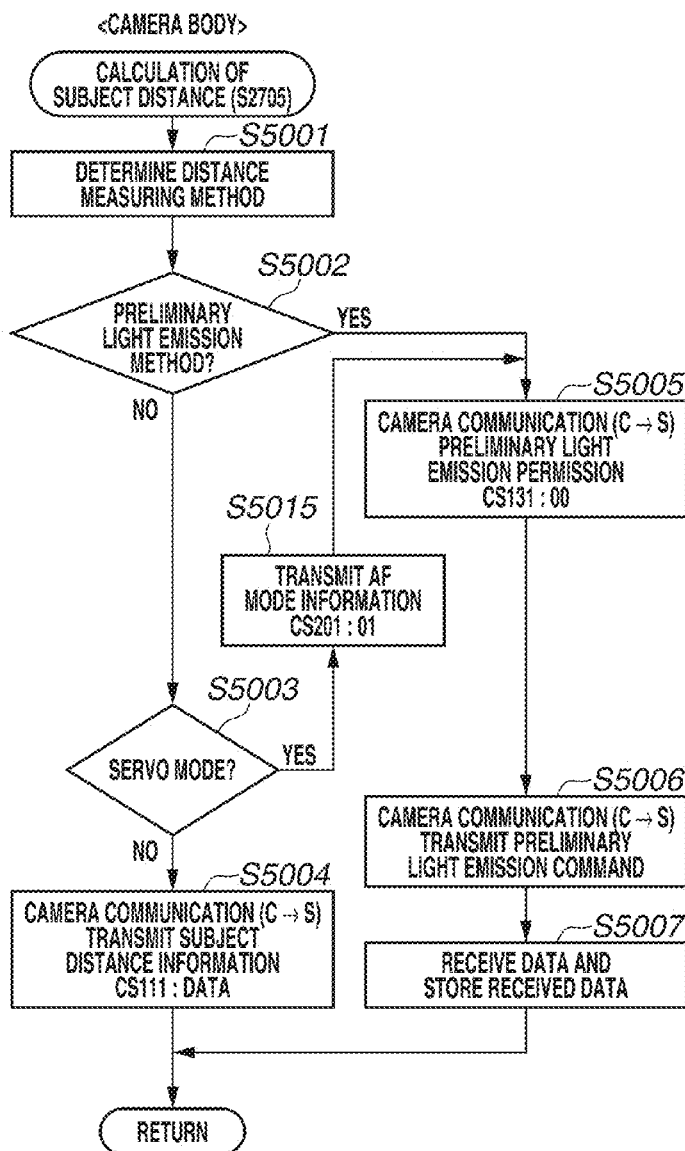


FIG.35B

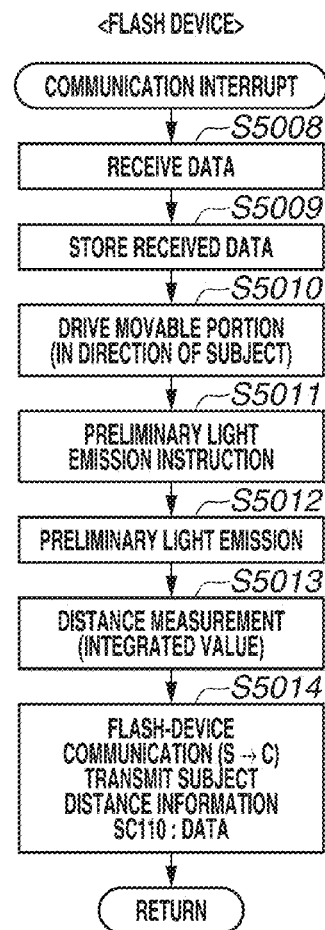


FIG.36A

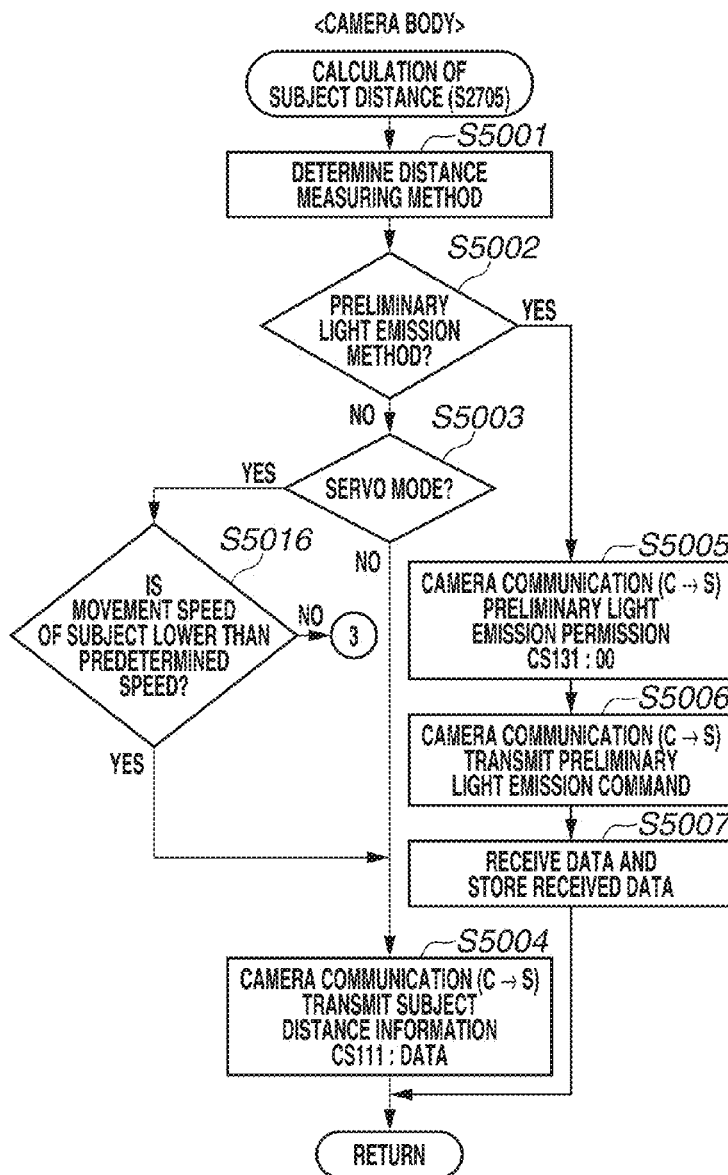
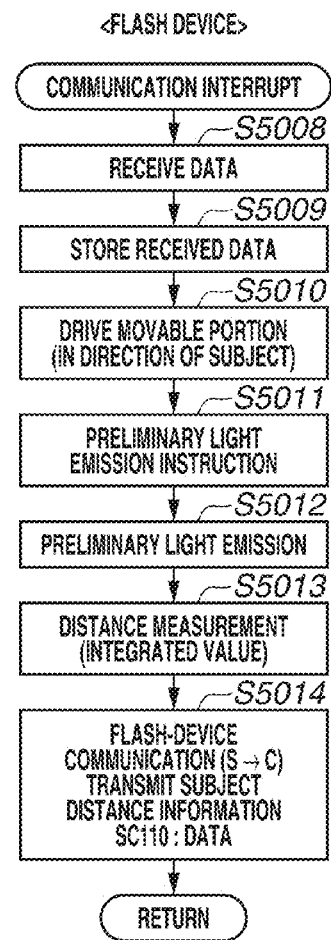


FIG.36B



IMAGING SYSTEM, ILLUMINATION DEVICE, AND CONTROL METHOD

BACKGROUND OF THE INVENTION

Field of the Invention

Aspects of the present invention generally relate to control for an illumination device capable of automatically changing a radiation direction.

Description of the Related Art

There is conventionally known light emission shooting in which light from an illumination device is radiated toward a ceiling or the like to irradiate the subject with diffused light reflected from (bouncing off) the ceiling or the like (hereinafter referred to as "bounce light emission shooting"). According to bounce light emission shooting, since light from the illumination device can be radiated not directly but indirectly onto the subject, images shot with soft light can be captured.

Japanese Patent Application Laid-Open No. 2010-8717 discusses an imaging apparatus that finds a high reflective area from a difference in luminance between image signals acquired from an image sensor at the time of emission of light and at the time of non-emission of light from a flash device and, when the proportion of the largeness of the high reflective area is equal to or greater than a predetermined value, determines that a high reflective object is present in the field of view and performs bounce light emission shooting.

However, the imaging apparatus discussed in Japanese Patent Application Laid-Open No. 2010-8717 determines whether to perform bounce light emission shooting based on the proportion of a high reflective area to the field of view and, therefore, may determine to perform bounce light emission shooting even under a condition unsuitable for bounce light emission shooting.

For example, because the imaging apparatus discussed in Japanese Patent Application Laid-Open No. 2010-8717 does not take into consideration the type of an interchangeable lens that is attached to the imaging apparatus, the imaging apparatus may determine to perform bounce light emission shooting even under a condition in which a super-telephoto lens with the focal length of more than 300 mm is attached to the imaging apparatus and light from the illumination device does not reach the subject.

SUMMARY OF THE INVENTION

Aspects of the present invention are generally directed to enabling performing light emission shooting according to the condition of an imaging apparatus.

According to an aspect of the present invention, an imaging system, which includes an illumination device capable of automatically driving a movable portion including a light emission unit to change a radiation direction of the light emission unit and an imaging apparatus, includes an acquisition unit configured to acquire information classifying a lens unit attached to the imaging apparatus, and a control unit configured to control the radiation direction of the light emission unit based on the information classifying the lens unit acquired by the acquisition unit.

Further features of the present invention will become apparent from the following description of exemplary embodiments with reference to the attached drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1, which is composed of FIGS. 1A and 1B, is a block diagram illustrating a schematic configuration of an imaging system according to a first exemplary embodiment of the present invention.

FIG. 2 is a sectional view illustrating the schematic configuration of the imaging system according to the first exemplary embodiment.

FIG. 3 is a flowchart illustrate various processing operations performed by a camera body relating to automatic bounce light emission shooting according to the first exemplary embodiment.

FIG. 4 is a flowchart illustrate various processing operations performed by the camera body relating to the automatic bounce light emission shooting according to the first exemplary embodiment.

FIG. 5 illustrates a list indicating the relationships between pieces of lens identification (ID) information and various pieces of information corresponding to the respective pieces of lens ID information.

FIGS. 6A and 6B illustrate swiveling ranges in the up and down directions and in the right and left directions of a movable portion.

FIGS. 7A and 7B illustrate results of detection obtained by a rotary encoder in the up and down directions and in the right and left directions.

FIGS. 8A and 8B illustrate the allocation between gray codes and swiveling angles in the rotary encoder.

FIG. 9 is a flowchart illustrating bounce processing according to the first exemplary embodiment.

FIG. 10 is a flowchart illustrating various processing operations accompanied by a light emitting operation of a flash device including a bounce operation according to the first exemplary embodiment.

FIG. 11 is a flowchart illustrating various processing operations performed by the camera body relating to automatic bounce light emission shooting according to a second exemplary embodiment of the present invention.

FIG. 12 is a flowchart illustrating semiautomatic bounce processing according to the second exemplary embodiment.

FIG. 13 is a flowchart illustrating various processing operations performed by the camera body relating to automatic bounce light emission shooting according to a third exemplary embodiment of the present invention.

FIG. 14 is a flowchart illustrating various processing operations performed by the camera body relating to the automatic bounce light emission shooting according to the third exemplary embodiment.

FIG. 15 is a flowchart illustrating information transmission preparatory processing performed by the camera body according to the third exemplary embodiment.

FIG. 16 is a flowchart illustrating information transmission processing performed by the camera body according to the third exemplary embodiment.

FIG. 17 is a flowchart illustrating bounce processing according to the third exemplary embodiment.

FIGS. 18A and 18B are flowcharts illustrating automatic bounce data acquisition processing according to the third exemplary embodiment.

FIG. 19 is a flowchart illustrating bounce operation execution instruction transmission processing according to the third exemplary embodiment.

FIGS. 20A and 20B are flowcharts illustrating subject distance calculation processing according to the third exemplary embodiment.

FIGS. 21A and 21B are flowcharts illustrating ceiling (wall) distance calculation processing according to the third exemplary embodiment.

FIGS. 22A and 22B are flowcharts illustrating radiation direction determination processing according to the third exemplary embodiment.

FIG. 23A and FIG. 23B, which is composed of FIGS. 23B1 and 23B2, are flowcharts illustrating bounce drive control processing according to the third exemplary embodiment.

FIG. 24 is a flowchart illustrating various processing operations accompanied by a light emitting operation of the flash device including a bounce operation according to the third exemplary embodiment.

FIGS. 25A and 25B illustrate examples of data communication between the camera body and the flash device according to the third exemplary embodiment.

FIG. 26A, which is composed of FIGS. 26A1 and 26A2, and FIG. 26B, which is composed of FIGS. 26B1, 26B2, and 26B3, illustrate examples of command lists for communication between the camera body and the flash device according to the third exemplary embodiment.

FIG. 27 illustrates an example of a bounce light emission shooting scene according to the third exemplary embodiment.

FIGS. 28A, 28B, 28C, and 28D illustrate the positional relationships between a determined distance measuring point and a distance measurable range according to the third exemplary embodiment.

FIG. 29 illustrates a swiveling angle in the right and left directions of the movable portion corresponding to a determined distance measuring point according to the third exemplary embodiment.

FIGS. 30A and 30B illustrate a swiveling angle in the up and down directions of the movable portion corresponding to a determined distance measuring point according to the third exemplary embodiment.

FIGS. 31A and 31B illustrate conventional positional relationships between a determined distance measuring point and a distance measurable range.

FIG. 32 is a flowchart illustrating various processing operations performed by the camera body relating to automatic bounce light emission shooting according to a fourth exemplary embodiment of the present invention.

FIGS. 33A and 33B are flowcharts illustrating subject distance calculation processing according to the fourth exemplary embodiment.

FIG. 34A, which is composed of FIGS. 34A1 and 34A2, and FIG. 34B, which is composed of FIGS. 34B1, 34B2, and 34B3, illustrate examples of command lists for communication between the camera body and the flash device according to the fourth exemplary embodiment.

FIGS. 35A and 35B are flowcharts illustrating subject distance calculation processing according to a fifth exemplary embodiment of the present invention.

FIGS. 36A and 36B are flowcharts illustrating subject distance calculation processing according to a sixth exemplary embodiment of the present invention.

DESCRIPTION OF THE EMBODIMENTS

Various exemplary embodiments, features, and aspects of the invention will be described in detail below with reference to the drawings.

FIG. 1, which is composed of FIGS. 1A and 1B, and FIG. 2 are a block diagram and a sectional view, respectively, illustrating a schematic configuration of an imaging system,

which includes a digital camera, a lens, and a flash device, according to a first exemplary embodiment of the present invention. The imaging system according to the present exemplary embodiment includes a camera body 100, which is an imaging apparatus, a lens unit 200 detachably attached to the camera body 100, and a flash device 300, which is an illumination device, detachably attached to the camera body 100. In FIGS. 1 and 2, the same components are assigned with the respective same reference numerals.

First, the configuration of the camera body 100 is described. A microcomputer camera central processing unit (CCPU) (hereinafter referred to as a "camera microcomputer") 101 controls each unit of the camera body 100. The camera microcomputer 101 has a one-chip integrated circuit (IC) configuration including, for example, a central processing unit (CPU), a read-only memory (ROM), a random access memory (RAM), an input-output (I/O) control circuit, a multiplexer, a timer circuit, an electrically erasable read-only memory (EEPROM), an analog-to-digital (A/D) converter, and a digital-to-analog (D/A) converter. The camera microcomputer 101 controls the imaging system using software and performs various conditional determinations.

An image sensor 102 is, for example, a charge-coupled device (CCD) sensor or a complementary metal-oxide semiconductor (CMOS) sensor containing an infrared cut filter and a low-pass filter, and a subject image can be formed on the image sensor 102 by a lens group 202, which is described below, during shooting. A shutter 103 is movable between a position to block the image sensor 102 from light and a position to expose the image sensor 102 to light.

A main mirror (half mirror) 104 is movable between a position to receive part of light entering from the lens group 202 to form an image on a focusing screen 105 and a position to withdraw from within an optical path of light entering from the lens group 202 to the image sensor 102 (a shooting optical path). A subject image formed on the focusing screen 105 can be viewed for confirmation by the user via an optical viewfinder (not illustrated).

A light metering circuit (automatic exposure (AE) circuit) 106, which contains a light metering sensor, divides a subject into a plurality of areas and performs light metering for each area. The light metering sensor contained in the light metering circuit 106 senses a subject image formed on the focusing screen 105 via a pentaprism 114, which is described below. A focus detection circuit (automatic distance measuring (AF) circuit) 107, which contains a distance measuring sensor having a plurality of distance measuring points, outputs focus information such as the defocus amount of each distance measuring point.

A gain switching circuit 108, which amplifies a signal output from the image sensor 102, switches the gain of the signal by being controlled by the camera microcomputer 101 according to a shooting condition or a user operation.

An A/D converter 109 converts the analog signal output from the image sensor 102 and amplified by the gain switching circuit 108 into a digital signal. A timing generator (TG) 110 synchronizes the input of the analog signal output from the image sensor 102 and amplified by the gain switching circuit 108 with the conversion timing of the A/D converter 109.

A signal processing circuit 111 performs signal processing on image data which is a digital signal output from the A/D converter 109.

A communication line SC is a signal line used for an interface between the camera body 100, the lens unit 200, and the flash device 300. For example, the camera microcomputer 101 serves as a host to mutually perform infor-

mation communication, such as exchange of data and transmission of commands, with the lens unit **200** and the flash device **300**. The communication line SC is used for serial communication of the three-terminal type using, for example, a terminal group **120** and a terminal group **130**, illustrated in FIG. 1. The terminal group **120** includes an SCLK_L terminal used to perform communication synchronization between the camera body **100** and the lens unit **200**, an MOSI_L terminal used to transmit data to the lens unit **200**, and an MISO_L terminal used to receive data transmitted from the lens unit **200**. The terminal group **120** further includes a ground (GND) terminal used to connect both of the camera body **100** and the lens unit **200**.

The terminal group **130** includes an SCLK_S terminal used to perform communication synchronization between the camera body **100** and the flash device **300**, an MOSI_S terminal used to transmit data from the camera body **100** to the flash device **300**, and an MISO_S terminal used to receive data transmitted from the flash device **300**. The terminal group **130** further includes a ground (GND) terminal used to connect both of the camera body **100** and the flash device **300**.

An input unit **112** includes operation portions, such as a power switch, a release switch, and a setting button. The camera microcomputer **101** performs various processing operations according to the inputs to the input unit **112**. When the release switch is operated one step (half pressed), an SW1 switch is turned on and the camera microcomputer **101** starts a shooting preparatory operation, such as focus adjustment and light metering. Furthermore, when the release switch is operated two steps (fully pressed), an SW2 switch is turned on and the camera microcomputer **101** starts a shooting operation, such as exposure and development processing. Moreover, the user can operate the setting button contained in the input unit **112** to perform various settings of the flash device **300** attached to the camera body **100**. A display unit **113**, which includes a liquid crystal device and a light emitting element, displays various set modes and other shooting information.

The pentaprism **114** leads a subject image formed on the focusing screen **105** to the light metering sensor contained in the light metering circuit **106** and to the optical viewfinder (not illustrated). A sub mirror **115** leads light entering from the lens group **202** and passing through the main mirror **104** to the distance measuring sensor contained in the focus detection circuit **107**.

An orientation detection circuit **140** includes an orientation H detection unit **140a**, which detects an orientation difference in the horizontal direction, an orientation V detection unit **140b**, which detects an orientation difference in the vertical direction, and an orientation Z detection unit **140c**, which detects an orientation difference in the antero-posterior direction. For example, an angular velocity sensor or a gyro sensor is used as the orientation detection circuit **140**. Orientation information detected by the orientation detection circuit **140** about orientation differences in the respective directions is fed to the camera microcomputer **101**.

Next, the configuration and operation of the lens unit **200** is described. A microcomputer lens processing unit (LPU) (hereinafter referred to as a "lens microcomputer") **201** controls each unit of the lens unit **200**.

The lens microcomputer **201** has a one-chip integrated circuit (IC) configuration including, for example, a CPU, a ROM, a RAM, an I/O control circuit, a multiplexer, a timer circuit, an EEPROM, an A/D converter, and a D/A converter.

The lens group **202** includes a plurality of lenses, such as a focus lens and a zoom lens. However, the lens group **202** does not need to include a zoom lens. A lens drive unit **203** is a driving system for moving a lens included in the lens group **202**. The amount of driving by which to drive the lens group **202** is calculated by the camera microcomputer **101** based on the output of the focus detection circuit **107**, which is included in the camera body **100**. The calculated amount of driving is transmitted from the camera microcomputer **101** to the lens microcomputer **201**. An encoder **204** detects the position of the lens group **202** to output drive information. The lens drive unit **203** moves the lens group **202** by the amount of driving based on the drive information output from the encoder **204**, thus performing focus adjustment. A diaphragm **205**, which adjusts the amount of passing light, is controlled by the lens microcomputer **201** via a diaphragm control unit **206**.

Next, the configuration of the flash device **300** is described. The flash device **300** includes a body portion **300a**, which is detachably attachable to the camera body **100**, and a movable portion **300b**, which is held in such a way as to be able to be swiveled in the up and down directions and in the right and left directions relative to the body portion **300a**. In the present exemplary embodiment, the swiveling direction of the movable portion **300b** is defined assuming that the side of the body portion **300a** coupled to the movable portion **300a** is the upper side. Furthermore, the side of the imaging system facing the subject is set as the front side, and the radiation direction parallel to the shooting optical axis is set as the frontal direction.

A microcomputer flash-device processing unit (FPU) (hereinafter referred to as a "flash-device microcomputer") **310** controls each unit of the flash device **300**. The flash-device microcomputer **310** has a one-chip integrated circuit (IC) configuration including, for example, a CPU, a ROM, a RAM, an I/O control circuit, a multiplexer, a timer circuit, an EEPROM, an A/D converter, and a D/A converter.

A battery **301** serves as the power source (VBAT) of the flash device **300**. A booster circuit block **302** includes a booster unit **302a**, resistors **302b** and **302c** used for voltage detection, and a main capacitor **302d**. The booster circuit block **302** causes the booster unit **302a** to increase the voltage of the battery **301** to several hundred volts and causes the main capacitor **302d** to store electric energy to be used for light emission.

The charging voltage of the main capacitor **302d** is divided by the resistors **302b** and **302c**, and the output of the divided voltage is input to an A/D conversion terminal of the flash-device microcomputer **310**. A trigger circuit **303** applies, to a discharge tube **305**, which is described below, a pulse voltage for exciting the discharge tube **305**. A light emission control circuit **304** controls starting and stopping of light emission of the discharge tube **305**. The discharge tube **305**, having received a pulse voltage of several kV applied from the trigger circuit **303**, is excited to emit light using electric energy stored in the main capacitor **302d**.

A distance measuring unit **308** detects a distance therefrom to a target object using a known method. For example, the distance measuring unit **308**, which contains a light receiving sensor, receives, via the light receiving sensor, light reflected from the target object situated in the radiation direction resulting from the light emitted from the discharge tube **305** and detects a distance therefrom to the target object based on the received light. Alternatively, the distance measuring unit **308**, which further contains a light source for distance measurement, receives, via the light receiving sen-

sor, light reflected from the target object situated in the radiation direction resulting from the light emitted from the light source for distance measurement and detects a distance therefrom to the target object based on the received light.

An integration circuit **309** integrates received light current generated by a photodiode **314**, which is described below, and outputs a result of integration to the inverting input terminal of a comparator **315**, which is described below, and to the A/D converter terminal of the flash-device microcomputer **310**. The non-inverting input terminal of the comparator **315** is connected to the D/A converter terminal of the flash-device microcomputer **310**, and the output of the comparator **315** is connected to one input terminal of an AND gate **311**, which is described below. The other input terminal of the AND gate **311** is connected to the light emission control terminal of the flash-device microcomputer **310**, and the output of the AND gate **311** is input to the light emission control circuit **304**. The photodiode **314** is a sensor that directly receives light emitted from the discharge tube **305** or that receives light emitted from the discharge tube **305** via a glass fiber or the like.

A light reflector **306** reflects light emitted from the discharge tube **305** and guides the light in a predetermined direction. A zoom optical system **307**, which contains an optical panel, etc., is held in such a way as to be able to change its position relative to the discharge tube **305**. Changing the relative position between the discharge tube **305** and the zoom optical system **307** enables changing the guide number and radiation range of the flash device **300**. The light emission unit of the flash device **300** is composed mainly of the discharge tube **305**, the light reflector **306**, and the zoom optical system **307**. The radiation range of the light emission unit varies according to the movement of the zoom optical system **307**, and the radiation direction of the light emission unit varies according to the swiveling of the movable portion **300b**.

An input unit **312** includes operation portions, such as a power switch, a mode setting switch for setting the operation mode of the flash device **300**, and a setting button for setting various parameters. The flash-device microcomputer **310** performs various processing operations according to inputs to the input unit **312**.

A display unit **313**, which includes a liquid crystal device and a light emitting element, displays each status of the flash device **300**.

A zoom drive circuit **330** includes a zoom detection unit **330a**, which detects, via an encoder, information about the relative position between the discharge tube **305** and the zoom optical system **307**, and a zoom drive unit **330b**, which includes a motor for moving the zoom optical system **307**.

The amount of driving by which to drive the zoom optical system **307** is calculated by the flash-device microcomputer **310**, having acquired focal length information output from the lens microcomputer **201** via the camera microcomputer **101**, based on the focal length information.

A bounce circuit **340** includes bounce position detection circuits **340a** and **340c**, each of which detects the amount of driving of the movable portion **300b** (the swiveling angle of the movable portion **300b** relative to the body portion **300a**), and bounce drive circuits **340b** and **340d**, each of which swivels the movable portion **300b**.

The bounce position detection circuit (bounce H detection circuit) **340a** detects the amount of driving in the right or left direction of the movable portion **300b** and the bounce position detection circuit (bounce V detection circuit) **340c**

detects the amount of driving in the up or low direction of the movable portion **300b**, via a rotary encoder or an absolute encoder.

The bounce drive circuit (bounce H drive circuit) **340b** performs driving in the right and left directions of the movable portion **300b** and the bounce drive circuit (bounce V drive circuit) **340d** performs driving in the up and down directions of the movable portion **300b**, using known motors.

Now, examples of the swiveling range of and the detection method for the movable portion **300b** of the flash device **300** are described with reference to FIGS. **6A** and **6B**, FIGS. **7A** and **7B**, and FIGS. **8A** and **8B**. FIGS. **6A** and **6B** illustrate the swiveling motions of the movable portion **300b** in the up and down directions and in the right and left directions, respectively. FIGS. **7A** and **7B** illustrate outputs of the rotary encoders for up and down directions and for right and left directions, respectively. FIGS. **8A** and **8B** illustrate the allocation between gray codes and swiveling angles in the rotary encoder.

As illustrated in FIG. **6A**, the movable portion **300b** is held in such a way as to be able to swivel in the up and down directions relative to the body portion **300a**, and, as illustrated in FIG. **6B**, the movable portion **300b** is held in such a way as to be able to swivel in the right and left directions relative to the body portion **300a**. Furthermore, the state in which the position in the up and down directions of the movable portion **300b** is 0 degrees in FIG. **6A** and the position in the right and left directions of the movable portion **300b** is 0 degrees in FIG. **6B** is defined as a reference position of the movable portion **300b**. An index expressed by a combination of a circle and a radial line segment in each state illustrated in FIGS. **6A** and **6B** corresponds to a position on each of the rotary encoders illustrated in FIGS. **7A** and **7B**.

FIG. **7A** illustrates a configuration for detecting the swiveling angle in the up and down directions via the rotary encoder using 4-bit gray codes, and FIG. **7B** illustrates a configuration for detecting the swiveling angle in the right and left directions via the rotary encoder using 4-bit gray codes.

The detection portions of the rotary encoder for detecting the swiveling in the up and down directions and the rotary encoder for detecting the swiveling in the right and left directions are configured with a known structure using photo-reflectors and photo-interrupters. In the present exemplary embodiment, the rotary encoder outputs "0" and "1" at each white portion and black portion, respectively, illustrated in FIGS. **7A** and **7B**. Furthermore, the output of the rotary encoder is determined at the rise of bit changes during the swiveling motion, and the pattern data is read during the stop of the rotary encoder.

As illustrated in FIGS. **8A** and **8B**, the rotary encoders output different signals according to the swiveling angles, so that the bounce position detection circuits **340a** and **340c** can detect the respective amounts of driving of the movable portion **300b**.

An orientation detection circuit **360**, which detects orientation differences, includes an orientation H detection unit **360a**, which detects an orientation difference in the horizontal direction, an orientation V detection unit **360b**, which detects an orientation difference in the vertical direction, and an orientation Z detection unit **360c**, which detects an orientation difference in the anteroposterior direction (z direction). For example, an angular velocity sensor or a gyro sensor is used as the orientation detection circuit **360**.

Next, various processing operations of the camera body **100** relating to automatic bounce light emission shooting are described with reference to FIGS. **3** and **4**. When the camera microcomputer **101** of the camera body **100** is activated in response to the power switch included in the input unit **112** being turned on, the camera microcomputer **101** starts the flowchart illustrated in FIG. **3**.

In step **S1**, the camera microcomputer **101** performs initialization of its memories and ports. Furthermore, the camera microcomputer **101** reads the states of switches included in the input unit **112** and previously set pieces of input information, and performs setting of various shooting modes, such as the method of determining a shutter speed and the method of determining an aperture value.

In step **S2**, the camera microcomputer **101** determines whether the SW1 switch is turned on with the release switch included in the input unit **112** being operated. If the camera microcomputer **101** determines that the SW1 switch is turned on (YES in step **S2**), the processing proceeds to step **S3**. If the camera microcomputer **101** determines that the SW1 switch is off (NO in step **S2**), the processing repeats step **S2**.

In step **S3**, the camera microcomputer **101** performs communication with the lens microcomputer **201** included in the lens unit **200** via the communication line SC. Then, the camera microcomputer **101** acquires focal length information and optical information required for focus adjustment and light metering about the lens unit **200**.

In step **S4**, the camera microcomputer **101** acquires lens ID information as information about the classification of the lens unit **200**. Based on the lens ID information, the camera microcomputer **101** can discriminate which of a plurality of classifications of lenses, such as a standard lens (fixed focal length lens), a standard zoom lens, a wide-angle lens, a super-wide-angle lens (fisheye lens), a telephoto lens, and a super-telephoto lens, the lens unit **200** is. FIG. **5** illustrates a tabulated list showing the relationship between the lens ID information and the various pieces of information corresponding to the lens ID information. As illustrated in FIG. **5**, the lens ID information is associated with the focal length, full-aperture F-number, classification (standard, wide-angle, telephoto, and others), and compatibility with automatic bounce light emission shooting. The list illustrated in FIG. **5** is stored in a memory included in the camera microcomputer **101**. The camera microcomputer **101** can acquire individual lens ID information from the lens unit **200** attached to the camera body **100**, thus grasping various pieces of information about the attached lens unit **200**.

In step **S5**, the camera microcomputer **101** determines whether the flash device **300** is attached to the camera body **100**. If the camera microcomputer **101** determines that the flash device **300** is attached to the camera body **100** (YES in step **S5**), the processing proceeds to step **S6**. If the camera microcomputer **101** determines that the flash device **300** is not attached to the camera body **100** (NO in step **S5**), the processing proceeds to step **S9b**.

In step **S6**, the camera microcomputer **101** performs communication with the flash-device microcomputer **310** included in the flash device **300** via the communication line SC and acquires flash device information, such as a flash device ID and charging information indicating the charging status of the main capacitor **302d**, from the flash-device microcomputer **310**. Furthermore, the camera microcomputer **101** performs communication with the flash-device microcomputer **310** via the communication line SC and transmits the focal length information acquired in step **S3** to the flash-device microcomputer **310**. Accordingly, the flash-

device microcomputer **310** calculates the amount of driving of the zoom optical system **307** based on the received focal length information and moves the zoom optical system **307** based on the calculated amount of driving to change the radiation range of the flash device **300** to a range matched with the focal length.

In step **S7**, the camera microcomputer **101** makes preparations to transmit the information about the flash device **300** input via the input unit **112** to the flash-device microcomputer **310** included in the flash device **300**. Here, the camera microcomputer **101** determines the information about the flash device **300** input via the input unit **112** and converts the information into commands to be transmitted.

In step **S8**, the camera microcomputer **101** transmits, to the flash device **300**, the input information about the flash device **300** prepared for transmission in step **S7**.

In step **S9a**, the camera microcomputer **101** determines whether the focus adjustment mode currently set is an automatic focusing (AF) mode. If the camera microcomputer **101** determines that the focus adjustment mode currently set is the AF mode (YES in step **S9a**), the processing proceeds to step **S10a**. If the camera microcomputer **101** determines that the focus adjustment mode currently set is a manual focusing (MF) mode (NO in step **S9a**), the processing proceeds to step **S12**. In the flowchart of FIG. **3**, steps for performing the same processing are assigned with the same numeral, such as step **S9a** and step **S9b**. In step **S10a**, the camera microcomputer **101** drives the focus detection circuit **107** to perform a focus detecting operation using a known phase-difference detection method.

Furthermore, in step **S10a**, the camera microcomputer **101** determines a distance measuring point, which is to be focused on, from among a plurality of distance measuring points during focus adjustment, according to a known automatic selection algorithm basically based on near-point priority or a user operation on the input unit **112**.

In step **S11a**, the camera microcomputer **101** stores the distance measuring point determined in step **S10a** into a RAM included in the camera microcomputer **101**. Furthermore, in step **S11a**, the camera microcomputer **101** calculates the amount of driving of the lens group **202** based on focus information output from the focus detection circuit **107**. Then, the camera microcomputer **101** performs communication with the lens microcomputer **201** included in the lens unit **200** via the communication line SC and moves the lens group **202** based on the calculated amount of driving.

In step **S12**, the camera microcomputer **101** determines whether the lens unit **200** is compatible with automatic bounce light emission shooting, based on the lens ID information acquired in step **S4**. The camera microcomputer **101** performs such determination based on the item of "compatibility with automatic bounce light emission shooting" set forth in the list illustrated in FIG. **5**. If the camera microcomputer **101** determines that the lens unit **200** is compatible with automatic bounce light emission shooting (YES in step **S12**), the processing proceeds to step **S13**. If the camera microcomputer **101** determines that the lens unit **200** is not compatible with automatic bounce light emission shooting (NO in step **S12**), the processing proceeds to step **S18**.

Referring to FIG. **5**, in the case of the lens ID=L01, the camera microcomputer **101** determines that the focal length=50 mm, the full-aperture F-number=1.8, the classification=standard, and the compatibility with automatic bounce light emission shooting=compatible. In the case of the lens ID=L04, the camera microcomputer **101** determines that the focal length=14 mm, the full-aperture F-number=2.8, the classification=super-wide-angle, and the

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compatibility with automatic bounce light emission shooting=incompatible. In the case of a lens unit with the lens ID=L04, since the focal length is short, a wide range containing a part of the ceiling or wall can be shot. Therefore, it is supposed that there may be captured an unnatural image containing a part of the ceiling or wall irradiated with light from the flash device 300 due to bounce light emission shooting. Accordingly, in the case of the lens ID=L04, the compatibility with automatic bounce light emission shooting is set to "incompatible". In a case where the compatibility with automatic bounce light emission shooting is set based on the above-mentioned condition, a lens unit with the focal length shorter than a first threshold value can be set to the compatibility with automatic bounce light emission shooting=incompatible. The first threshold value is not particularly limiting.

In the case of the lens ID=L06, the camera microcomputer 101 determines that the focal length=400 mm, the full-aperture F-number=2.8, the classification=super-telephoto, and the compatibility with automatic bounce light emission shooting=incompatible. In the case of a lens unit with the lens ID=L06, a sufficiently distant subject is set as the shooting target. Therefore, it is supposed that, even when a part of the ceiling or wall is irradiated with light from the flash device 300, the reflected light from the part of the ceiling or wall does not reach a subject. Accordingly, in the case of the lens ID=L06, the compatibility with automatic bounce light emission shooting is set to "incompatible". In a case where the compatibility with automatic bounce light emission shooting is set based on the above-mentioned condition, a lens unit with the focal length equal to or longer than a second threshold value can be set to the compatibility with automatic bounce light emission shooting=incompatible. The second threshold value is not particularly limiting as long as it is greater than the first threshold value.

In the case of the lens ID=L07, the camera microcomputer 101 determines that the focal length=24 mm, the full-aperture F-number=3.5, the classification=shift-tilt lens, and the compatibility with automatic bounce light emission shooting=incompatible. In the case of a lens unit with the lens ID=L07, when a lens is shifted or tilted, a wide range containing a part of the ceiling or wall can be shot. Therefore, it is supposed that there may be captured an unnatural image containing a part of the ceiling or wall irradiated with light from the flash device 300 due to bounce light emission shooting. Accordingly, in the case of the lens ID=L07, the compatibility with automatic bounce light emission shooting is set to "incompatible". Furthermore, besides a shift-tilt lens, a lens unit used for special shooting may be set to the compatibility with automatic bounce light emission shooting=incompatible.

In the case of a lens unit with no lens ID, in other words, in the case of the lens ID=N/A, the classification of the lens unit cannot be specified. Therefore, since it is not guaranteed that the lens unit is suited for bounce light emission shooting, the compatibility with automatic bounce light emission shooting is set to "incompatible". In the other lens units with the lens ID=L02 (standard zoom), the lens ID=L03 (wide-angle), and the lens ID=L05 (telephoto), the compatibility with automatic bounce light emission shooting is set to "compatible" as in the lens ID=L01 (standard lens).

In the above-described way, the camera microcomputer 101 determines whether to perform automatic bounce light emission shooting, based on information classifying the attached lens unit.

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In step S13, the camera microcomputer 101 determines whether to perform an operation for automatically determining the radiation direction for bounce light emission shooting (hereinafter referred to as an "automatic bounce operation"). Whether to perform the automatic bounce operation is determined based on the state of an automatic bounce switch, which is used to switch whether to perform the automatic bounce operation, included in the input unit 112 or the input unit 312 or the other state of the camera body 100. If the camera microcomputer 101 determines to perform the automatic bounce operation (YES in step S13), the processing proceeds to step S14. If the camera microcomputer 101 determines not to perform the automatic bounce operation (NO in step S13), the processing proceeds to step S18.

In step S14, the camera microcomputer 101 performs processing about the automatic bounce operation (hereinafter referred to as "bounce processing"). The details of the bounce processing are described below with reference to FIG. 9. Upon completion of the bounce processing, the processing proceeds to step S15. In step S15, the camera microcomputer 101 determines whether an error has occurred in the bounce processing. If the camera microcomputer 101 determines that an error has occurred in the bounce processing (YES in step S15), the processing proceeds to step S16. If the camera microcomputer 101 determines that no error has occurred in the bounce processing (NO in step S15), the processing proceeds to step S18. In a case where an error has occurred in the bounce processing, information indicating that an error has occurred in the bounce processing is transmitted from the flash-device microcomputer 310 to the camera microcomputer 101 during the bounce processing in step S14.

In step S16, the camera microcomputer 101 causes the display unit 113 to display the information indicating that an error has occurred in the bounce processing. Furthermore, the camera microcomputer 101 may perform communication with the flash-device microcomputer 310 and, then, the flash-device microcomputer 310 may cause the display unit 313 of the flash device 300 to display the information indicating that an error has occurred in the bounce processing.

In step S17, the camera microcomputer 101 switches over to a setting for not allowing light emission shooting (non-light-emission setting). Then, the processing proceeds to step S18.

If, in step S5, the camera microcomputer 101 determines that the flash device 300 is not attached to the camera body 100 (NO in step S5), the processing proceeds to step S9b. In step S9b, the camera microcomputer 101 determines whether the focus adjustment mode currently set is the AF mode, as in step S9a. If the camera microcomputer 101 determines that the focus adjustment mode currently set is the AF mode (YES in step S9b), the processing proceeds to step S10b. If the camera microcomputer 101 determines that the focus adjustment mode currently set is the MF mode (NO in step S9b), the processing proceeds to step S18.

In step S10b, the camera microcomputer 101 performs the same processing as in step S10a, and then in step S11b, performs the same processing as in step S11a. Then, the processing proceeds to step S18.

In step S18, the camera microcomputer 101 causes the light metering circuit 106 to perform a light metering operation and acquires a result of light metering from the light metering circuit 106. For example, in a case where the light metering sensor of the light metering circuit 106 performs light metering at each of six divisional areas, the

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camera microcomputer 101 stores the luminance value of each area, which is the acquired result of light metering, as

$$EVb(i)(i=0-5),$$

into the RAM.

In step S19, the camera microcomputer 101 causes the gain switching circuit 108 to switch the gain according to a gain setting input via the input unit 112. The gain setting is, for example, a setting for ISO sensitivity. Furthermore, in step S19, the camera microcomputer 101 performs communication with the flash-device microcomputer 310 via the communication line SC and transmits, for example, gain setting information indicating the switched gain to the flash-device microcomputer 310.

In step S20, the camera microcomputer 101 performs an exposure calculation using a known algorithm based on the result of light metering acquired in step S18 (the luminance value of each area stored in the RAM), thus determining an exposure value (EVs).

In step S21, the camera microcomputer 101 determines whether a charging completion signal has been received from the flash-device microcomputer 310. If the camera microcomputer 101 determines that the charging completion signal has been received (YES in step S21), the processing proceeds to step S22. If the camera microcomputer 101 determines that the charging completion signal has not been received (NO in step S21), the processing proceeds to step S23.

In step S22, the camera microcomputer 101 determines exposure control values (shutter speed (Tv) and aperture value (Av)) suitable for light emission shooting based on the exposure value calculated in step S20.

On the other hand, in step S23, the camera microcomputer 101 determines exposure control values suitable for non-light-emission shooting, in which the flash device 300 is not allowed to emit light, based on the exposure value calculated in step S20.

After the exposure control values are determined in step S22 or S23, the processing proceeds to step S24. In step S24, the camera microcomputer 101 determines whether the SW2 switch is turned on with the release switch included in the input unit 112 being operated. If the camera microcomputer 101 determines that the SW2 switch is turned on (YES in step S24), the processing proceeds to step S25 illustrated in FIG. 4. If the camera microcomputer 101 determines that the SW2 switch is off (NO in step S24), the processing returns to step S2.

Processing in step S25 and subsequent steps is processing associated with light emission shooting, and processing associated with non-light-emission shooting is processing obtained by omitting processing for performing main light emission from the processing in step S25 and subsequent steps.

In step S25, the camera microcomputer 101 causes the light metering circuit 106 to perform light metering without the flash device 300 performing light emission, and acquires a result of light metering during non-light-emission (the luminance value during non-light-emission) from the light metering circuit 106. At this time, the camera microcomputer 101 stores the luminance value during non-light-emission of each area, which is the acquired result of light metering, as

$$EVa(i)(i=0-5),$$

into the RAM.

In step S26, the camera microcomputer 101 issues an instruction to the flash-device microcomputer 310 via the

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communication line SC to perform preliminary light emission. The flash-device microcomputer 310 controls the trigger circuit 303 and the light emission control circuit 304 according to the instruction from the camera microcomputer 101, thus performing preliminary light emission with a predetermined amount of light.

In step S27, the camera microcomputer 101 causes the light metering circuit 106 to perform light metering with the flash device 300 performing preliminary light emission, and acquires a result of light metering during preliminary light emission (the luminance value during preliminary light emission) from the light metering circuit 106. At this time, the camera microcomputer 101 stores the luminance value during preliminary light emission of each area, which is the acquired result of light metering, as

$$EVf(i)(i=0-5),$$

into the RAM.

In step S28, the camera microcomputer 101 moves up the main mirror 104 prior to exposure, thus retracting the main mirror 104 from within a shooting optical path.

In step S29, the camera microcomputer 101 extracts a luminance value EVdf(i) of only a reflected light component during preliminary light emission based on the luminance value during non-light-emission and the luminance value during preliminary light emission, as expressed in the following formula. This extraction is performed for each of six areas.

$$EVdf(i) \leftarrow LN_2(2^{EVf(i)} - 2^{EVa(i)})(i=0-5)$$

In step S30, the camera microcomputer 101 acquires, from the flash-device microcomputer 310 via the communication line SC, preliminary light emission information (Qpre) indicating the amount of light emission during preliminary light emission.

In step S31, the camera microcomputer 101 selects an area a subject in which is to be subjected to an appropriate amount of light emission from among the six areas, based on the distance measuring point, the focal length information, the preliminary light emission information (Qpre), and the bounce communication content, and calculates the amount of main light emission.

In calculating the amount of main light emission, the camera microcomputer 101 obtains, for the subject in the selected area (P), the relative ratio (r) of the appropriate amount of main light emission to the amount of preliminary light emission based on the exposure value (EVs), the subject luminance (EVb(p)), and the luminance value EVdf(p) of only a reflected light component during preliminary light emission, as expressed in the following formula.

$$r \leftarrow LN_2(2^{EVs} - 2^{EVb(p)}) - EVdf(p)$$

The reason why a difference is obtained between the exposure value (EVs) as expanded and the subject luminance (EVb(p)) as expanded is to perform control such that the exposure with radiated flash light becomes appropriate in view of the addition of flash light to ambient light.

Furthermore, in order to prevent the amount of main light emission from being calculated smaller than necessary due to the increase of a reflected light component of preliminary light emission in a case where a high reflective subject (for example, a gilded folding screen) is present within a shooting image plane, there is known processing for performing such corrections as to increase the calculated amount of main light emission if a high reflective object is detected within a shooting image plane.

However, in the case of performing bounce light emission shooting, the camera microcomputer **101** does not detect any high reflective object and does not perform the above-mentioned corrections. This is because, in the case of bounce light emission shooting, even when a high reflective object is present within a shooting image plane, the object is not directly irradiated with flash light and, therefore, the influence of a high reflective object in a reflected light component of preliminary light emission is small.

Besides, in the case of bounce light emission shooting, the camera microcomputer **101** does not perform corrections of the amount of main light emission according to the position of a subject present within a shooting image plane.

As described above, in the case of performing bounce light emission shooting, the camera microcomputer **101** does not perform corrections of the amount of main light emission according to the reflectance of a subject present within a shooting image plane or the position of a subject within a shooting image plane, which would be performed at the time of ordinary light emission shooting, and thus can calculate the amount of main light emission suitable for bounce light emission shooting.

The ordinary light emission shooting as mentioned herein is light emission shooting that is performed with the movable portion **300b** located in the reference position illustrated in FIGS. **6A** and **6B**.

In step **S32**, the camera microcomputer **101** has correction for the relative ratio (r) using the shutter speed (T_v) during light emission shooting, the time period of preliminary light emission (t_{pre}), and a correction coefficient (c) previously set via the input unit **112**, thus calculating a new relative ratio (r), as expressed in the following formula.

$$r \leftarrow r + T_v - t_{pre} + c$$

The reason why the shutter speed (T_v) and the time period of preliminary light emission (t_{pre}) are used for correction is to correctly compare a light metering integration value during preliminary light emission (INT_p) with a light metering integration value during main light emission (INT_m).

In step **S33**, the camera microcomputer **101** transmits, to the flash-device microcomputer **310** via the communication line **SC**, information about the relative ratio (r) used to determine the amount of main light emission.

In step **S34**, the camera microcomputer **101** issues a command to the lens microcomputer **201** to set the aperture value (Av) as determined in step **S22**, and controls the shutter **103** to be set to the determined shutter speed (T_v).

In step **S35**, the camera microcomputer **101** issues an instruction to the flash-device microcomputer **310** via the communication line **SC** to perform main light emission. Then, the flash-device microcomputer **310** performs main light emission based on the relative ratio (r) transmitted from the camera microcomputer **101**.

Upon completion of a series of exposure operations in the above-described way, in step **S36**, the camera microcomputer **101** moves down the main mirror **104**, which has been so far retracted from within the shooting optical path, thus inclining the main mirror **104** within the shooting optical path again.

In step **S37**, the camera microcomputer **101** amplifies the signal output from the image sensor **102** at the gain set by the gain switching circuit **108**, and then causes the A/D converter **109** to convert the amplified signal into a digital signal. Then, the signal processing circuit **111** performs predetermined signal processing, such as white balance processing, on image data, which is the digital signal output from the A/D converter **109**.

In step **S38**, the camera microcomputer **101** records the image data subjected to the signal processing on a memory (not illustrated), and terminates a series of processing operations associated with shooting. Then, in step **S39**, the camera microcomputer **101** determines whether the **SW1** switch is on. If the camera microcomputer **101** determines that the **SW1** switch is on (YES in step **S39**), the processing returns to step **S24**. If the camera microcomputer **101** determines that the **SW1** switch is off (NO in step **S39**), the processing returns to step **S2**.

Next, the details of step **S14** are described with reference to FIG. **9**. FIG. **9** is a flowchart illustrating the bounce processing, which is performed by the camera microcomputer **101** and the flash-device microcomputer **310**.

In step **S901**, the camera microcomputer **101** receives automatic bounce data from the flash-device microcomputer **310**. Then, the processing proceeds to step **S902**. The automatic bounce data includes information indicating whether the flash device **300** is available for automatic bounce. Furthermore, in a case where the flash device **300** is available for automatic bounce, the automatic bounce data further includes information indicating a range within which the movable portion **300b** is able to swivel.

In step **S902**, the camera microcomputer **101** determines whether the automatic bounce operation is able to be performed. Here, whether the automatic bounce operation is able to be performed is determined based on the setting of the automatic bounce operation in the camera body **100** and the information indicating whether the flash device **300** is available for automatic bounce, which is included in the received automatic bounce data. If the camera microcomputer **101** determines that the automatic bounce operation is able to be performed (YES in step **S902**), the processing proceeds to step **S903**. If the camera microcomputer **101** determines that the automatic bounce operation is not able to be performed (NO in step **S902**), the processing exits the bounce processing and then proceeds to step **S15**.

In step **S903**, the camera microcomputer **101** makes preparations to transmit a bounce operation execution instruction, and then in step **S904**, transmits the bounce operation execution instruction to the flash-device microcomputer **310**.

In step **S905**, the camera microcomputer **101** calculates the distance to a subject to determine a radiation direction most appropriate for bounce light emission shooting. The method for calculating the distance to the subject is not particularly limiting, and the flash-device microcomputer **310** may calculate the subject distance using the distance measuring unit **308**, or the camera microcomputer **101** may calculate the subject distance based on information about the position of a lens in the lens unit **200**, which is received from the lens microcomputer **201**. Alternatively, the flash-device microcomputer **310** may calculate the subject distance using information about the position of a lens in the lens unit **200**, which is received from the camera microcomputer **101**.

Similarly, in step **S906**, the camera microcomputer **101** calculates the distance to a ceiling (wall) to determine a radiation direction most appropriate for bounce light emission shooting. The method for calculating the distance to the ceiling (wall) is not particularly limiting, and the flash-device microcomputer **310** may calculate the ceiling (wall) distance using the distance measuring unit **308**.

In step **S907**, the camera microcomputer **101** determines a radiation direction most appropriate for bounce light emission shooting. The method for determining the radiation direction is not particularly limiting, and the camera microcomputer **101** or the flash-device microcomputer **310** deter-

mines the radiation direction based on the distance to the subject calculated in step S905 and the distance to the ceiling (wall) calculated in step S906. For example, the camera microcomputer 101 calculates the radiation direction using the distance to the subject and the distance to the ceiling (wall) in such a way that the subject is irradiated at a predetermined angle with light reflected from the ceiling (wall).

In step S908, the flash-device microcomputer 310 performs bounce drive control using the bounce drive circuit 340b and the bounce drive circuit 340d in such a way as to attain the most appropriate radiation direction.

In step S909, the camera microcomputer 101 transmits a bounce operation end instruction to the flash-device microcomputer 310. Then, the processing proceeds to step S15.

As mentioned in the foregoing, in the case of not performing automatic bounce, since an operation for automatically determining a radiation direction for bounce light emission shooting is not performed, the camera microcomputer 101 determines whether to calculate the radiation direction based on information classifying a lens unit attached to the camera body 100.

As described above, according to the present exemplary embodiment, the radiation direction of an illumination device is automatically changed according to lens ID information of a lens unit attached to an imaging apparatus, so that bounce light emission shooting can be appropriately performed.

Furthermore, while, in the above-described exemplary embodiment, the camera microcomputer 101 determines whether to automatically change the radiation direction of the flash device 300 based on the lens ID information, the flash-device microcomputer 310 may make such a determination.

The processing for determining whether to automatically change the radiation direction of the flash device 300 and the processing associated with light emission of the flash device 300 including the bounce operation are described with reference to FIG. 10. When the flash-device microcomputer 310 of the flash device 300 is activated with the power switch included in the input unit 312 being turned on, the flash-device microcomputer 310 starts the flowchart of FIG. 10.

In step S1001, the flash-device microcomputer 310 performs initialization of its memories and ports. Furthermore, the flash-device microcomputer 310 reads the states of switches included in the input unit 312 and previously set pieces of input information, and performs setting of various light emission modes, such as the method of determining the amount of light emission and the timing of light emission.

In step S1002, the flash-device microcomputer 310 charges the main capacitor 302d by activating the booster circuit block 302.

In step S1003, the flash-device microcomputer 310 stores, into a memory built in the flash-device microcomputer 310, focal length information acquired from the camera microcomputer 101 via the communication line SC.

Furthermore, in a case where focal length information has previously been stored in the memory, the flash-device microcomputer 310 updates the stored focal length information with new focal length information.

In step S1004, the flash-device microcomputer 310 displays, on the display unit 313, an image relating to the light emission mode set via the input unit 312 and an image relating to the acquired focal length information.

In step S1005, the flash-device microcomputer 310 causes the zoom drive circuit 330 to move the zoom optical system

307 in such a way that the radiation range of flash light reaches a range corresponding to the acquired focal length information.

In step S1006, the flash-device microcomputer 310 causes the bounce position detection circuits 340a and 340c to detect the swiveling angle of the movable portion 300b relative to the body portion 300a.

In step S1007, the flash-device microcomputer 310 determines whether a bounce operation execution instruction has been received. If the flash-device microcomputer 310 determines that the bounce operation execution instruction has been received (YES in step S1007), the processing proceeds to step S1008. If the flash-device microcomputer 310 determines that the bounce operation execution instruction has not been received (NO in step S1007), the processing proceeds to step S1010.

In step S1008, the flash-device microcomputer 310 determines whether a lens unit attached to the camera body 100 is a lens unit suitable for bounce light emission shooting, based on the lens ID information acquired from the camera microcomputer 101 via the communication line SC. The lens ID information can be transmitted from the camera microcomputer 101 to the flash-device microcomputer 310 in step S6 illustrated in FIG. 3. Whether the attached lens unit is suitable for bounce light emission shooting is determined based on the compatibility with automatic bounce light emission shooting, which is shown in the list illustrated in FIG. 5, and the list illustrated in FIG. 5 is stored in a memory included in the flash-device microcomputer 310. Furthermore, since the flash-device microcomputer 310 only needs to determine whether the attached lens unit 200 is compatible with automatic bounce light emission shooting, at least information indicating the compatibility with automatic bounce light emission shooting in the list illustrated in FIG. 5 only needs to be stored in the memory. If the flash-device microcomputer 310 determines that the attached lens unit 200 is compatible with automatic bounce light emission shooting (YES in step S1008), the processing proceeds to step S1009. If the flash-device microcomputer 310 determines that the attached lens unit 200 is not compatible with automatic bounce light emission shooting (NO in step S1008), the processing proceeds to step S1010.

In other words, the flash-device microcomputer 310 determines whether to perform automatic bounce based on information classifying a lens unit attached to an imaging apparatus. In a case where the flash-device microcomputer 310 determines not to perform automatic bounce, automatic bounce is not performed even if a bounce operation execution instruction is issued from the camera microcomputer 101.

In step S1009, the flash-device microcomputer 310 performs the above-described automatic bounce operation. In a case where the automatic bounce operation is not performed, since an operation for automatically determining the radiation direction during bounce light emission shooting is not performed, the flash-device microcomputer 310 determines whether to calculate a radiation direction, based on information classifying the attached lens unit.

In step S1010, the flash-device microcomputer 310 transmits, to the camera microcomputer 101, current position information indicating a swiveling angle of the movable portion 300b relative to the body portion 300a after bounce driving.

In step S1011, the flash-device microcomputer 310 determines whether the charging voltage of the main capacitor 302d is equal to or higher than a predetermined value (charging completed). If the flash-device microcomputer

310 determines that the charging voltage is equal to or higher than the predetermined value (YES in step **S1011**), the processing proceeds to step **S1012**. If the flash-device microcomputer **310** determines that the charging voltage is lower than the predetermined value (NO in step **S1011**), the processing proceeds to step **S1015**.

In step **S1012**, the flash-device microcomputer **310** transmits a charging completion signal to the camera microcomputer **101**. Then, the processing proceeds to step **S1013**.

In step **S1013**, the flash-device microcomputer **310** determines whether a light emission start signal has been received as a light emission command. If the flash-device microcomputer **310** determines that the light emission start signal has been received (YES in step **S1013**), the processing proceeds to step **S1014**. If the flash-device microcomputer **310** determines that the light emission start signal has not been received (NO in step **S1013**), the processing returns to step **S1002**.

In step **S1014**, in response to the received light emission start signal, the flash-device microcomputer **310** instructs the light emission control circuit **304** to perform light emission. The light emission control circuit **304** causes the discharge tube **305** to emit light according to the light emission instruction. After completion of the light emission, the processing returns to step **S1002**. Furthermore, in step **S1014**, with respect to a series of light emission, such as preliminary light emission for flash control or main light emission, the processing does not return to step **S1002** even after each light emission ends, so that the processing does not return to step **S1002** until a series of light emission ends.

In a case where the charging voltage is lower than the predetermined value (NO in step **S1011**), then in step **S1015**, the flash-device microcomputer **310** transmits a charging incompletion signal to the camera microcomputer **101**. Then, the processing returns to step **S1002**.

In the above-described way, the flash-device microcomputer **310** performs processing for determining whether to automatically change the radiation direction of the flash device **300** based on the lens ID information and processing associated with light emission of the flash device **300** including the automatic bounce operation.

As described above, according to the present exemplary embodiment, the radiation direction of the flash device **300** is controlled based on the classification of a lens unit attached to an imaging apparatus, so that light emission shooting can be performed according to the condition of the imaging apparatus. Furthermore, the method for performing light emission shooting according to the condition of the imaging apparatus can be conceived in various ways besides a method for determining whether to automatically change the radiation direction of the flash device **300** based on the lens ID information. For example, in the case of a lens unit with a predetermined lens ID, there may be adopted a method for automatically setting the radiation direction to a predetermined radiation direction, such as a frontal direction, to drive the movable portion **300b**. In the case of this method, although, since the radiation direction is set to a predetermined radiation direction, the desired bounce light emission shooting cannot be performed, light emission shooting corresponding to the condition of the imaging apparatus can be performed. Moreover, in the case of the method for automatically setting the radiation direction to a predetermined radiation direction, such as a frontal direction, to drive the movable portion **300b**, if the radiation direction taken before shooting is other than the frontal direction, it is necessary to drive the movable portion **300b** in such a way as to set the radiation direction to the frontal

direction. Therefore, in the case of the method for automatically setting the radiation direction to a predetermined radiation direction, such as a frontal direction, to drive the movable portion **300b**, the flash-device microcomputer **310** drives the movable portion **300b** in between step **S1008** and step **S1010** illustrated in FIG. **10**.

Next, a second exemplary embodiment of the present invention is described with reference to FIG. **11**. An imaging system according to the present exemplary embodiment is basically the same as that in the first exemplary embodiment, but differs in that the flash device **300** is configured to allow the user to set both an automatic bounce mode for performing the automatic bounce operation and a semi-automatic bounce mode for performing a semi-automatic bounce operation. The semi-automatic bounce operation is to, while storing a radiation direction of the flash device **300** set by the user, automatically swivel the movable portion **300b** in such a way as to attain the stored radiation direction even when the orientation of the flash device varies. A mode switch that is operable to switch between the automatic bounce mode and the semi-automatic bounce mode is contained in the input unit **312**. Furthermore, as for the radiation direction used in the semi-automatic bounce operation, a radiation direction specified by the user operating a radiation direction storing button, which is contained in the input unit **312**, is stored in the memory of the flash-device microcomputer **310**.

The flowchart illustrated in FIG. **11** differs from the flowchart illustrated in FIG. **3** in that step **S40** is inserted between step **S9a** and step **S12**. Therefore, only differences between the flowcharts of FIGS. **3** and **11** are described in detail below.

Following step **S9a** or step **S11a**, the processing proceeds to step **S40**. In step **S40**, the camera microcomputer **101** determines whether the flash device **300** is in the semi-automatic bounce mode. Information indicating whether the flash device **300** is in the semi-automatic bounce mode is included in the flash device information acquired in step **S6**.

If the camera microcomputer **101** determines that the flash device **300** is in the semi-automatic bounce mode (YES in step **S40**), the processing proceeds to step **S14**, in which the camera microcomputer **101** performs the semi-automatic bounce processing. The above-mentioned automatic bounce operation and the semi-automatic bounce operation differ in whether the radiation direction of the flash device **300** is automatically determined or is determined by the user. Therefore, in the semi-automatic bounce operation, the processing is performed according to a flowchart illustrated in FIG. **12**, in which the operation for determining the radiation direction of the flash device **300** is not performed.

FIG. **12** is a flowchart illustrating the semi-automatic bounce processing, which is performed by the camera microcomputer **101** and the flash-device microcomputer **310**.

In step **S1201**, the camera microcomputer **101** receives automatic bounce data from the flash-device microcomputer **310**. Then, the processing proceeds to step **S1202**. The automatic bounce data includes information indicating whether the flash device **300** is available for semi-automatic bounce. Furthermore, in a case where the flash device **300** is available for semi-automatic bounce, the automatic bounce data further includes information indicating a range within which the movable portion **300b** is able to swivel.

In step **S1202**, the camera microcomputer **101** determines whether the semi-automatic bounce operation is able to be performed. Here, whether the semi-automatic bounce operation is able to be performed is determined based on the

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information indicating whether the flash device **300** is available for semi-automatic bounce, which is included in the received automatic bounce data. If the camera microcomputer **101** determines that the semi-automatic bounce operation is able to be performed (YES in step **S1202**), the processing proceeds to step **S1203**. If the camera microcomputer **101** determines that the semi-automatic bounce operation is not able to be performed (NO in step **S1202**), the processing exits the semi-automatic bounce processing and then proceeds to step **S15**.

In step **S1203**, the camera microcomputer **101** makes preparations to transmit a semi-automatic bounce operation execution instruction, and then in step **S1204**, transmits the semi-automatic bounce operation execution instruction to the flash-device microcomputer **310**.

The semi-automatic bounce operation execution instruction is issued based on a user operation on a semi-automatic bounce switch for executing the semi-automatic bounce operation, which is contained in the input unit **112** or the input unit **312**.

In step **S1205**, the flash-device microcomputer **310** reads out the radiation direction stored in the memory of the flash-device microcomputer **310**.

In step **S1206**, the flash-device microcomputer **310** determines the amount of driving of the movable portion **300b** based on the stored radiation direction, the orientation of the flash device **300** taken when the radiation direction was stored, and the current orientation of the flash device **300**. The orientation of the flash device **300** can be obtained using the orientation detection circuit **140** or the orientation detection circuit **360**. The orientation of the flash device **300** taken when the radiation direction was stored is previously stored together with the radiation direction in the memory of the flash-device microcomputer **310**.

In step **S1207**, the flash-device microcomputer **310** performs bounce drive control using the bounce drive circuit **340b** and the bounce drive circuit **340d** based on the amount of driving determined in step **S1206**.

In step **S1208**, the camera microcomputer **101** transmits a bounce operation end instruction to the flash-device microcomputer **310**. Then, the processing proceeds to step **S15**.

On the other hand, if, in step **S40**, the camera microcomputer **101** determines that the flash device **300** is not in the semi-automatic bounce mode (NO in step **S40**), the processing proceeds to step **S12**.

As described above, with regard to the semi-automatic bounce operation, the camera microcomputer **101** does not determine whether to automatically change the radiation direction of the flash device **300** based on the lens ID information. This is because, in the semi-automatic bounce operation, unlike the automatic bounce operation, the radiation direction of the flash device **300** is determined by the user. In a case where the user sets the radiation direction, such an effect that a ceiling irradiated with light from the flash device **300** during bounce light emission shooting is contained in a captured image or that a part of reflected light from a ceiling or wall does not reach the subject may be supposed to be an intention of the user. Therefore, the camera microcomputer **101** is configured not to take the classification of a lens unit into consideration.

As described above, according to the present exemplary embodiment, the radiation direction of the flash device **300** can also be controlled based on a radiation direction of the flash device **300** set by the user and stored in the memory, so that light emission shooting can also be performed according to the intention of the user.

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Japanese Patent Application Laid-Open No. 4-340527 discusses a technique to acquire the distance to a subject and the distance to an object located above the camera and calculate the angle of a flash emission portion based on the acquired distances.

However, in the technique discussed in Japanese Patent Application Laid-Open No. 4-340527, the distance to a subject is acquired by projecting spot light from a light-emitting diode (LED) onto the subject and receiving reflected light from the subject with a position sensor device (PSD). Therefore, in a case where, for example, the light receiving range of the PSD is only near the center of the shooting image plane, as illustrated in FIGS. **31A** and **31B**, if the subject is located at the center as illustrated in FIG. **31A**, the subject is within the light receiving range, but if the subject is located at other than the center as illustrated in FIG. **31B**, the subject is outside the light receiving range.

In a case where the subject is located at other than the center, since the distance to an object (for example, a wall behind the subject) that is different from the subject, the distance to which is to be acquired, may be acquired, an optimum angle of the flash emission portion cannot be calculated.

Therefore, according to a third exemplary embodiment of the present invention, an imaging system is configured to accurately obtain a radiation direction appropriate for bounce light emission shooting in a manner described below.

The imaging system according to the third exemplary embodiment is almost similar to that illustrated in FIGS. **1** and **2**, and, therefore, the description of the same portions as those illustrated in FIGS. **1** and **2** is not repeated. Examples of data communications performed via the terminal group **130** in the present exemplary embodiment are illustrated in FIGS. **25A** and **25B**. FIG. **25A** illustrates the timing of data communications. In the case of transmitting data from the camera microcomputer **101** to the flash-device microcomputer **310**, data is serially transmitted with each bit set to 0 or 1 from the MOSI_S terminal in synchronization with clocks of 8 bits from the SCLK_S terminal. Furthermore, in the case of transmitting data from the flash-device microcomputer **310** to the camera microcomputer **101**, data is serially received with each bit set to 0 or 1 from the MOSI_S terminal in synchronization with clocks of 8 bits from the SCLK_S terminal. In the example illustrated in FIG. **25A**, while reading and writing of signals is performed at the rise of the SCLK_S signal during 8-bit (1-byte) communication, this 8-bit communication is sequentially performed a plurality of times in the order of command, command data, and data. FIG. **25B** illustrates a specific example of information to be communicated, which is transmitted from the camera microcomputer **101** to the flash-device microcomputer **310** according to command lists illustrated in FIG. **26A**, which is composed of FIGS. **26A1** and **26A2**, and FIG. **26B**, which is composed of FIGS. **26B1**, **26B2**, and **26B3**, which are described below.

For example, as for “automatic bounce setting/canceling from camera body to flash device”, “80H” of CS communication at the first byte, “011 (0BH)” of command number at the second byte, and “01 (setting)” of data (content) at the third byte are transmitted after being converted from hexadecimal to binary.

Then, at the first byte, a command CS: 80H in the case of the camera body **100** transmitting information to the flash device **300** or a command SC: 01H in the case of the camera body **100** acquiring information from the flash device **300** is transmitted from the camera body **100** to the flash device **300**.

Then, at the second byte, a command number: number following the SC or CS (converted into hexadecimal at the time of transmission) and, at the third byte or the fourth byte, setting item data are transmitted from one of the camera body **100** and the flash device **300** to the other. The communication of other information is described below as appropriate with reference to the command lists illustrated in FIGS. **26A** and **26B**.

Next, various processing operations of the camera body **100** relating to automatic bounce light emission shooting are described with reference to FIGS. **13** and **14**. When the camera microcomputer **101** of the camera body **100** is activated in response to the power switch included in the input unit **112** being turned on, the camera microcomputer **101** starts the flowchart illustrated in FIG. **13**.

In step **S2001**, the camera microcomputer **101** performs initialization of its memories and ports. Furthermore, the camera microcomputer **101** reads the states of switches included in the input unit **112** and previously set pieces of input information, and performs setting of various shooting modes, such as the method of determining a shutter speed and the method of determining an aperture value. In step **S2002**, the camera microcomputer **101** determines whether the SW1 switch is turned on with the release switch included in the input unit **112** being operated. If the camera microcomputer **101** determines that the SW1 switch is turned on (YES in step **S2002**), the processing proceeds to step **S2003**. If the camera microcomputer **101** determines that the SW1 switch is off (NO in step **S2002**), the processing repeats step **S2002**.

In step **S2003**, the camera microcomputer **101** performs communication with the lens microcomputer **201** included in the lens unit **200** via the communication line SC. Then, the camera microcomputer **101** acquires focal length information and optical information required for focus adjustment and light metering about the lens unit **200**. In step **S2004**, the camera microcomputer **101** determines whether the flash device **300** is attached to the camera body **100**. If the camera microcomputer **101** determines that the flash device **300** is attached to the camera body **100** (YES in step **S2004**), the processing proceeds to step **S2005**. If the camera microcomputer **101** determines that the flash device **300** is not attached to the camera body **100** (NO in step **S2004**), the processing proceeds to step **S2008b**.

In step **S2005**, the camera microcomputer **101** performs communication with the flash-device microcomputer **310** included in the flash device **300** via the communication line SC and acquires flash device information, such as a flash device ID and charging information indicating the charging status of the main capacitor **302d**, from the flash-device microcomputer **310**. Furthermore, the camera microcomputer **101** performs communication with the flash-device microcomputer **310** via the communication line SC and transmits the focal length information acquired in step **S2003** to the flash-device microcomputer **310**. Accordingly, the flash-device microcomputer **310** calculates the amount of driving of the zoom optical system **307** based on the received focal length information and moves the zoom optical system **307** based on the calculated amount of driving to change the radiation range of the flash device **300** to a range matched with the focal length.

In step **S2006**, the camera microcomputer **101** makes preparations to transmit the information about the flash device **300** input via the input unit **112** to the flash-device microcomputer **310** included in the flash device **300**.

Here, the camera microcomputer **101** assesses the information about the flash device **300** input via the input unit **112**

and converts the information into commands to be transmitted. The details of step **S2006** are described below with reference to FIG. **15**.

In step **S2007**, the camera microcomputer **101** transmits, to the flash device **300**, the input information about the flash device **300** prepared for transmission in step **S2006**. The details of step **S2007** are described below with reference to FIG. **16**.

In step **S2008a**, the camera microcomputer **101** determines whether the focus adjustment mode currently set is an automatic focusing (AF) mode. If the camera microcomputer **101** determines that the focus adjustment mode currently set is the AF mode (YES in step **S2008a**), the processing proceeds to step **S2009a**. If the camera microcomputer **101** determines that the focus adjustment mode currently set is a manual focusing (MF) mode (NO in step **S2008a**), the processing proceeds to step **S2011**. In the flowchart of FIG. **13**, steps for performing the same processing are assigned with the same numeral, such as step **S2008a** and step **S2008b**. In step **S2009a**, the camera microcomputer **101** drives the focus detection circuit **107** to perform a focus detecting operation using a known phase-difference detection method. Furthermore, in step **S2009a**, the camera microcomputer **101** determines (selects) a distance measuring point (also referred to as a "target area for focus adjustment"), which is to be focused on, from among a plurality of distance measuring points during focus adjustment, according to a known automatic selection algorithm basically based on near-point priority or a user operation on the input unit **112**.

In step **S2010a**, the camera microcomputer **101** stores information about the distance measuring point determined in step **S2009a** (distance measuring point information) into a RAM included in the camera microcomputer **101**. Furthermore, in step **S2010a**, the camera microcomputer **101** calculates the amount of driving of the lens group **202** based on focus information output from the focus detection circuit **107**. Then, the camera microcomputer **101** performs communication with the lens microcomputer **201** included in the lens unit **200** via the communication line SC and moves the lens group **202** based on the calculated amount of driving.

In step **S2011**, the camera microcomputer **101** determines whether to perform an operation for automatically determining the radiation direction for bounce light emission shooting (hereinafter referred to as an "automatic bounce operation"). Whether to perform the automatic bounce operation is determined based on the state of an automatic bounce switch, which is used to switch whether to perform the automatic bounce operation, included in the input unit **112** or the input unit **312** or based on the other state of the camera body **100**. If the camera microcomputer **101** determines to perform the automatic bounce operation (YES in step **S2011**), the processing proceeds to step **S2012**. If the camera microcomputer **101** determines not to perform the automatic bounce operation (NO in step **S2011**), the processing proceeds to step **S2016**.

In step **S2012**, the camera microcomputer **101** performs processing about the automatic bounce operation (hereinafter referred to as "bounce processing"). The details of the bounce processing are described below with reference to FIG. **17**.

Upon completion of the bounce processing, the processing proceeds to step **S2013**. In step **S2013**, the camera microcomputer **101** determines whether an error has occurred in the bounce processing. If the camera microcomputer **101** determines that an error has occurred in the bounce processing (YES in step **S2013**), the processing

proceeds to step S2014. If the camera microcomputer 101 determines that no error has occurred in the bounce processing (NO in step S2013), the processing proceeds to step S2016.

In a case where an error has occurred in the bounce processing, information indicating that an error has occurred in the bounce processing is transmitted from the flash-device microcomputer 310 to the camera microcomputer 101 during the bounce processing in step S2012.

In step S2014, the camera microcomputer 101 causes the display unit 113 to display the information indicating that an error has occurred in the bounce processing. Furthermore, the camera microcomputer 101 may perform communication with the flash-device microcomputer 310 and, then, the flash-device microcomputer 310 may cause the display unit 313 of the flash device 300 to display the information indicating that an error has occurred in the bounce processing.

In step S2015, the camera microcomputer 101 switches over to a setting for not allowing light emission shooting (non-light-emission setting). Then, the processing proceeds to step S2016.

If, in step S2004, the camera microcomputer 101 determines that the flash device 300 is not attached to the camera body 100 (NO in step S2004), the processing proceeds to step S2008b. In step S2008b, the camera microcomputer 101 determines whether the focus adjustment mode currently set is the AF mode, as in step S2008a. If the camera microcomputer 101 determines that the focus adjustment mode currently set is the AF mode (YES in step S2008b), the processing proceeds to step S2009b. If the camera microcomputer 101 determines that the focus adjustment mode currently set is the MF mode (NO in step S2008b), the processing proceeds to step S2016.

In step S2009b, the camera microcomputer 101 performs the same processing as in step S2009a, and then in step S2010b, performs the same processing as in step S2010a. Then, the processing proceeds to step S2016.

In step S2016, the camera microcomputer 101 causes the light metering circuit 106 to perform a light metering operation and acquires a result of light metering from the light metering circuit 106. For example, in a case where the light metering sensor of the light metering circuit 106 performs light metering at each of six divisional areas, the camera microcomputer 101 stores the luminance value of each area, which is the acquired result of light metering, as

$$EVb(i)(i=0-5),$$

into the RAM.

In step S2017, the camera microcomputer 101 causes the gain switching circuit 108 to switch the gain according to a gain setting input via the input unit 112. The gain setting is, for example, a setting for ISO sensitivity. Furthermore, in step S2017, the camera microcomputer 101 performs communication with the flash-device microcomputer 310 via the communication line SC and transmits, for example, gain setting information indicating the switched gain to the flash-device microcomputer 310.

In step S2018, the camera microcomputer 101 performs an exposure calculation using a known algorithm based on the result of light metering acquired in step S2016 (the luminance value of each area stored in the RAM), thus determining an exposure value (EVs).

In step S2019, the camera microcomputer 101 determines whether a charging completion signal has been received from the flash-device microcomputer 310. If the camera microcomputer 101 determines that the charging completion

signal has been received (YES in step S2019), the processing proceeds to step S2020. If the camera microcomputer 101 determines that the charging completion signal has not been received (NO in step S2019), the processing proceeds to step S2021.

In step S2020, the camera microcomputer 101 determines exposure control values (shutter speed (Tv) and aperture value (Av)) suitable for light emission shooting based on the exposure value calculated in step S2018.

On the other hand, in step S2021, the camera microcomputer 101 determines exposure control values suitable for non-light-emission shooting, in which the flash device 300 is not allowed to emit light, based on the exposure value calculated in step S2018.

After the exposure control values are determined in step S2020 or S2021, the processing proceeds to step S2022. In step S2022, the camera microcomputer 101 determines whether the SW2 switch is turned on with the release switch included in the input unit 112 being operated. If the camera microcomputer 101 determines that the SW2 switch is turned on (YES in step S2022), the processing proceeds to step S2023 illustrated in FIG. 14. If the camera microcomputer 101 determines that the SW2 switch is off (NO in step S2022), the processing returns to step S2002.

Processing in step S2023 and subsequent steps illustrated in FIG. 14 is processing associated with light emission shooting, and processing associated with non-light-emission shooting is processing obtained by omitting processing for performing main light emission from the processing in step S2023 and subsequent steps. Furthermore, processing in steps S2023 to S2037 is the same as processing in steps S25 to S39 illustrated in FIG. 4, respectively, and the description thereof is, therefore, omitted.

Next, the details of step S2006 are described with reference to FIG. 15. FIG. 15 is a flowchart illustrating information transmission preparation processing performed by the camera body 100. In step S2006, the camera microcomputer 101 performs the processing according to the flowchart of FIG. 15. The details of the setting commands as used herein are illustrated in FIGS. 26A and 26B.

In step S2501, the camera microcomputer 101 determines whether the camera body 100 is a camera capable of performing the automatic bounce operation (a compatible camera). If the camera microcomputer 101 determines that the camera body 100 is the compatible camera (YES in step S2501), the processing proceeds to step S2502. If the camera microcomputer 101 determines that the camera body 100 is not the compatible camera (NO in step S2501), the processing proceeds to step S2503.

In step S2502, the camera microcomputer 101 stores a "CS001 command: 01" into a built-in memory (not illustrated) of the camera microcomputer 101 as a preparation for camera body to flash device communication (C→S). Then, the processing proceeds to step S2504. On the other hand, in step S2503, the camera microcomputer 101 stores a "CS001 command: 00" into the built-in memory (not illustrated) of the camera microcomputer 101 as a preparation for camera body to flash device communication (C→S). Then, the processing proceeds to step S2504.

In step S2504, the camera microcomputer 101 determines whether the execution of the automatic bounce operation is set or canceled. If the camera microcomputer 101 determines that the execution of the automatic bounce operation is set (SET in step S2504), the processing proceeds to step S2505. If the camera microcomputer 101 determines that the

execution of the automatic bounce operation is canceled (CANCELED in step S2504), the processing proceeds to step S2506.

In step S2505, the camera microcomputer 101 stores a “CS011 command: 01” into the built-in memory (not illustrated) of the camera microcomputer 101 as a preparation for camera body to flash device communication (C→S). Then, the processing proceeds to step S2507. On the other hand, in step S2506, the camera microcomputer 101 stores a “CS011 command: 00” into the built-in memory (not illustrated) of the camera microcomputer 101 as a preparation for camera body to flash device communication (C→S). Then, the processing proceeds to step S2507.

In step S2507, the camera microcomputer 101 determines a method (distance measuring method) for obtaining the distance to a target object which is information that the camera body 100 uses to determine a radiation direction most appropriate for bounce light emission shooting. The target object as used herein includes a subject targeted for shooting and a reflective object (for example, a ceiling or wall) that reflects flash light during bounce light emission shooting. Examples of the distance measuring method include a “flash-device preliminary light emission distance measuring method” of measuring the distance to a target object based on the amount of reflected light from the target object caused by the preliminary light emission of a flash device (hereinafter referred to as a “preliminary light emission method”).

Besides, examples of the distance measuring method include a “flash-device non-light-emission distance measuring method” of measuring the distance to a target object, without flash light emission, using the distance measuring unit 308 included in the flash device 300 (hereinafter referred to as a “flash-device distance measuring method”). Furthermore, examples of the distance measuring method further include a “camera distance measuring method” of measuring the distance to a target object using a result of focus adjustment performed by the camera body 100 and the lens unit 200, and are not particularly limiting. If a distance measuring method is set (SET in step S2507), the processing proceeds to step S2508. If no distance measuring method is set (NO SETTING in step S2507), the processing proceeds to step S2509.

In step S2508, the camera microcomputer 101 stores a CS091 command into the built-in memory (not illustrated) of the camera microcomputer 101 according to the setting content of the distance measuring method as a preparation for camera body to flash device communication (C→S). Then, the processing proceeds to step S2509.

For example, the distinction between “subject” and “ceiling” is assigned to high 4 bits, and “subject” and “ceiling” are represented as “0” and “1”, respectively. The distinction between “preliminary light emission method”, “flash-device distance measuring method”, and “camera distance measuring method” is assigned to low 4 bits, and “preliminary light emission method”, “flash-device distance measuring method”, and “camera distance measuring method” are represented as “0”, “1”, and “2”, respectively. Then, the high 4 bits and the low 4 bits are combined. If the “preliminary light emission method” is set for both of the subject and the ceiling, the camera microcomputer 101 stores a “CS091 command: data 00 10” into the built-in memory (not illustrated) of the camera microcomputer 101. Similarly, if the “flash-device distance measuring method” is set for both of the subject and the ceiling, the camera microcomputer 101 stores a “CS091 command: data 01 11” into the built-in memory (not illustrated) of the camera microcomputer 101,

and if the “camera distance measuring method” is set for the subject and the “preliminary light emission method” is set for the ceiling, the camera microcomputer 101 stores a “CS091 command: data 02 10” into the built-in memory (not illustrated) of the camera microcomputer 101.

In step S2509, the camera microcomputer 101 determines the state of the release switch. If both the SW1 switch and the SW2 switch are off (SW1, SW2 OFF in step S2509), the processing proceeds to step S2510. If the SW1 switch is on (SW1 ON in step S2509), the processing proceeds to step S2511. If the SW2 switch is on (SW2 ON in step S2509), the processing proceeds to step S2512.

In step S2510, the camera microcomputer 101 stores a “CS151 command: data 00” into the built-in memory (not illustrated) of the camera microcomputer 101. Then, the processing proceeds to step S2513. In step S2511, the camera microcomputer 101 stores a “CS151 command: data 01” into the built-in memory (not illustrated) of the camera microcomputer 101. Then, the processing proceeds to step S2513. In step S2512, the camera microcomputer 101 stores a “CS151 command: data 02” into the built-in memory (not illustrated) of the camera microcomputer 101. Then, the processing proceeds to step S2513.

In step S2513, the camera microcomputer 101 determines whether a light metering timer is in operation. The light metering timer is a timer that sets a period for light metering, which is used to switch the camera microcomputer 101 into a power saving mode after light metering is performed for a predetermined time. During the time when light metering is performed for the predetermined time, the light metering timer is in operation. The light metering timer is contained in the camera microcomputer 101, and starts time measurement in synchronization with turning-on of the SW1 switch. If the camera microcomputer 101 determines that the light metering timer is in operation (YES in step S2513), the processing proceeds to step S2514. If the camera microcomputer 101 determines that the light metering timer is not in operation (NO in step S2513), the processing proceeds to step S2515.

In step S2514, the camera microcomputer 101 stores a “CS141 command: data 01” into the built-in memory (not illustrated) of the camera microcomputer 101 as a preparation for camera body to flash device communication (C→S). Then, the processing proceeds to step S2516. On the other hand, in step S2515, the camera microcomputer 101 stores a “CS141 command: data 00” into the built-in memory (not illustrated) of the camera microcomputer 101 as a preparation for camera body to flash device communication (C→S). Then, the processing proceeds to step S2516. In step S2516, the camera microcomputer 101 stores other flash-device setting information into the built-in memory (not illustrated) of the camera microcomputer 101. Then, the processing proceeds to step S2007.

Next, the details of step S2007 are described with reference to FIG. 16. FIG. 16 is a flowchart illustrating information transmission processing performed by the camera body 100. In step S2007, the camera microcomputer 101 performs the processing according to the flowchart of FIG. 16. The details of the setting commands as used herein are illustrated in FIGS. 26A and 26B. Furthermore, in each processing in the flowchart of FIG. 16, a serial communication between the camera body 100 and the flash device 300 illustrated in FIGS. 25A and 25B is used. Moreover, in FIG. 16, processing performed by the camera body 100 is indicated with steps S2601 to S2606 and the corresponding processing performed by the flash device 300 is indicated with steps S2607 and S2608.

First, processing performed by the camera body **100** is described. In step **S2601**, the camera microcomputer **101** transmits, to the flash-device microcomputer **310**, data corresponding to a result of determination made in step **S2501**. Then, the processing proceeds to step **S2602**. In step **S2602**, the camera microcomputer **101** transmits, to the flash-device microcomputer **310**, data corresponding to a result of determination made in step **S2504**. Then, the processing proceeds to step **S2603**. In step **S2603**, the camera microcomputer **101** transmits, to the flash-device microcomputer **310**, data corresponding to a result of determination made in step **S2507**. Then, the processing proceeds to step **S2604**.

In step **S2604**, the camera microcomputer **101** transmits, to the flash-device microcomputer **310**, data corresponding to a result of determination made in step **S2509**. Then, the processing proceeds to step **S2605**. In step **S2605**, the camera microcomputer **101** transmits, to the flash-device microcomputer **310**, data corresponding to a result of determination made in step **S2513**. Then, the processing proceeds to step **S2606**. In step **S2606**, the camera microcomputer **101** transmits, to the flash-device microcomputer **310**, the data stored in step **S2516**. Then, the processing proceeds to step **S2008**.

Next, processing performed by the flash device **300** is described. In step **S2607**, after a communication interrupt occurs, the flash-device microcomputer **310** receives data transmitted from the camera microcomputer **101**. Then, the processing proceeds to step **S2608**. In step **S2608**, the flash-device microcomputer **310** stores the received data into a built-in memory of the flash-device microcomputer **310**. Then, the processing ends.

Next, the details of step **S2012** are described with reference to FIG. 17. FIG. 17 is a flowchart illustrating bounce processing, in which processing performed by the camera microcomputer **101** and processing performed by the flash-device microcomputer **310** are included.

In step **S2701**, the camera microcomputer **101** receives automatic bounce data from the flash-device microcomputer **310**. Then, the processing proceeds to step **S2702**.

The details of step **S2701** are described below with reference to FIGS. **18A** and **18B**.

In step **S2702**, the camera microcomputer **101** determines whether the automatic bounce operation is able to be performed. Here, whether the automatic bounce operation is able to be performed is determined based on the setting of the automatic bounce operation in the camera body **100** and the information indicating whether the flash device **300** is available for automatic bounce, which is included in the received automatic bounce data. If the camera microcomputer **101** determines that the automatic bounce operation is able to be performed (YES in step **S2702**), the processing proceeds to step **S2703**. If the camera microcomputer **101** determines that the automatic bounce operation is not able to be performed (NO in step **S2702**), the processing exits the bounce processing and then proceeds to step **S2013**. In step **S2703**, the camera microcomputer **101** makes preparations to transmit a bounce operation execution instruction, and then in step **S2704**, transmits the bounce operation execution instruction to the flash-device microcomputer **310**. The details of step **S2704** are described below.

In step **S2705**, the camera microcomputer **101** or the flash-device microcomputer **310** calculates the distance to a subject to determine a radiation direction most appropriate for bounce light emission shooting. The details of step **S2705** are described below. Similarly, in step **S2706**, the camera microcomputer **101** or the flash-device microcomputer **310** calculates the distance to a ceiling (wall) to

determine a radiation direction most appropriate for bounce light emission shooting. The details of step **S2706** are described below. Furthermore, which of the camera microcomputer **101** and the flash-device microcomputer **310** calculates the distance to a subject and the distance to a ceiling (wall) is determined based on the distance measuring method set by the user.

In step **S2707**, the camera microcomputer **101** determines a radiation direction most appropriate for bounce light emission shooting. The details of step **S2707** are described below. In step **S2708**, the camera microcomputer **101** or the flash-device microcomputer **310** performs bounce drive control in such a way as to attain the most appropriate radiation direction. The details of step **S2708** are described below.

In step **S2709**, the camera microcomputer **101** or the flash-device microcomputer **310** transmits a bounce operation end instruction to the flash-device microcomputer **310**. Then, the processing proceeds to step **S2013**.

Next, each processing in the bounce processing is described in detail.

First, the automatic bounce data acquisition processing in step **S2701** is described with reference to FIGS. **18A** and **18B**.

In FIGS. **18A** and **18B**, processing performed by the camera body **100** is indicated with steps **S2801** to **S2807** and the corresponding processing performed by the flash device **300** is indicated with steps **S2808** to **S2824**.

First, processing performed by the camera body **100** is described. In step **S2801**, the camera microcomputer **101** transmits, to the flash-device microcomputer **310**, a command for checking whether the flash device **300** is available for automatic bounce. Then, in step **S2802**, the camera microcomputer **101** receives a response to checking for availability for automatic bounce, which is transmitted from the flash-device microcomputer **310**.

In step **S2803**, the camera microcomputer **101** transmits, to the flash-device microcomputer **310**, a command for checking for a driving range for automatic bounce. Then, in step **S2804**, the camera microcomputer **101** receives a response to checking for a driving range for automatic bounce, which is transmitted from the flash-device microcomputer **310**.

In step **S2805**, the camera microcomputer **101** transmits, to the flash-device microcomputer **310**, a command for checking for a distance measuring method for calculating the distance to an object targeted for automatic bounce. Then, in step **S2806**, the camera microcomputer **101** receives a response to checking for a distance measuring method, which is transmitted from the flash-device microcomputer **310**.

Finally, in step **S2807**, the camera microcomputer **101** stores the data acquired in steps **S2802**, **S2804**, and **S2806** into the built-in memory of the camera microcomputer **101**. Then, the processing ends.

Next, processing performed by the flash device **300** is described. In step **S2808**, after a communication interrupt occurs, the flash-device microcomputer **310** receives a command transmitted from the camera microcomputer **101**. Then, the processing proceeds to step **S2809**. In step **S2809**, the flash-device microcomputer **310** determines the content of the received command. If the flash-device microcomputer **310** determines that the content is "checking for availability for automatic bounce" (CHECKING FOR AVAILABILITY FOR AUTOMATIC BOUNCE in step **S2809**), the processing proceeds to step **S2810**. If the flash-device microcomputer **310** determines that the content is "checking for a driving range for automatic bounce" (CHECKING FOR

AUTOMATIC BOUNCE DRIVING RANGE in step S2809), the processing proceeds to step S2814. If the flash-device microcomputer 310 determines that the content is “checking for a distance measuring method” (CHECKING FOR DISTANCE MEASURING METHOD in step S2809), the processing proceeds to step S2822.

In step S2810, the flash-device microcomputer 310 determines whether the flash device 300 is available for automatic bounce. If the flash-device microcomputer 310 determines that the flash device 300 is available for automatic bounce (YES in step S2810), the processing proceeds to step S2811. If the flash-device microcomputer 310 determines that the flash device 300 is not available for automatic bounce (NO in step S2810), the processing proceeds to step S2812.

In step S2811, the flash-device microcomputer 310 stores an “SC000 command: 01” for flash device to camera body communication (S→C) into the built-in memory of the flash-device microcomputer 310. Then, the processing proceeds to step S2813. On the other hand, in step S2812, the flash-device microcomputer 310 stores an “SC000 command: 00” for flash device to camera body communication (S→C) into the built-in memory of the flash-device microcomputer 310. Then, the processing proceeds to step S2813.

In step S2813, the flash-device microcomputer 310 transmits, to the camera microcomputer 101, the data stored in step S2811 or S2812 as a response to checking for availability for automatic bounce. Then, the processing ends.

In step S2814, the flash-device microcomputer 310 determines whether the driving range for automatic bounce is applicable to both the up and down directions and the right and left directions. If the flash-device microcomputer 310 determines that it is applicable to both the up and down directions and the right and left directions (YES in step S2814), the processing proceeds to step S2815. If the flash-device microcomputer 310 determines that it is applicable to only the up and down directions or the right and left directions (NO in step S2814), the processing proceeds to step S2818. In step S2818, the flash-device microcomputer 310 determines whether the driving range for automatic bounce is applicable to only the right and left directions. If the flash-device microcomputer 310 determines that it is applicable to only the right and left directions (YES in step S2818), the processing proceeds to step S2819. If the flash-device microcomputer 310 determines that it is applicable to only the up and down directions (NO in step S2818), the processing proceeds to step S2820.

In a case where the flash-device microcomputer 310 determines that the driving range for automatic bounce is applicable to both the up and down directions and the right and left directions, then in step S2815, the flash-device microcomputer 310 stores an “SC020 command: data 00” for flash device to camera body communication (S→C) into the built-in memory of the flash-device microcomputer 310. Then, the processing proceeds to step S2816a.

In step S2816a, the flash-device microcomputer 310 stores an “SC030 command: data XX(start) XX(end)” for flash device to camera body communication (S→C) as the driving range in the right and left directions into the built-in memory of the flash-device microcomputer 310. Then, the processing proceeds to step S2817a.

In step S2817a, the flash-device microcomputer 310 stores an “SC040 command: data XX(start) XX(end)” for flash device to camera body communication (S→C) as the driving range in the up and down directions into the built-in memory of the flash-device microcomputer 310. Then, the processing proceeds to step S2821.

On the other hand, in a case where the flash-device microcomputer 310 determines that the driving range for automatic bounce is applicable to only the right and left directions, then in step S2819, the flash-device microcomputer 310 stores an “SC020 command: data 01” for flash device to camera body communication (S→C) into the built-in memory of the flash-device microcomputer 310. Then, the processing proceeds to step S2816b.

In step S2816b, the flash-device microcomputer 310 stores an “SC030 command: data XX(start) XX(end)” for flash device to camera body communication (S→C) as the driving range in the right and left directions into the built-in memory of the flash-device microcomputer 310. Then, the processing proceeds to step S2821.

Furthermore, in a case where the flash-device microcomputer 310 determines that the driving range for automatic bounce is applicable to only the up and down directions, then in step S2820, the flash-device microcomputer 310 stores an “SC020 command: data 02” for flash device to camera body communication (S→C) into the built-in memory of the flash-device microcomputer 310. Then, the processing proceeds to step S2817b.

In step S2817b, the flash-device microcomputer 310 stores an “SC030 command: data XX(start) XX(end)” for flash device to camera body communication (S→C) as the driving range in the up and down directions into the built-in memory of the flash-device microcomputer 310. Then, the processing proceeds to step S2821.

In step S2821, the flash-device microcomputer 310 transmits, to the camera microcomputer 101, the data stored in steps S2815, S2816a, and S2817a, the data stored in steps S2819 and S2816b, or the data stored in steps S2820 and S2817b, as a response to checking for the driving range for automatic bounce. Then, the processing ends.

In step S2822, the flash-device microcomputer 310 determines whether a distance measuring method for calculating the distance to an object targeted for automatic bounce is set in the flash-device microcomputer 310.

If the flash-device microcomputer 310 determines that a distance measuring method is set (SET in step S2822), the processing proceeds to step S2823. In step S2823, the flash-device microcomputer 310 stores an “SC090 command: XX XX” corresponding to the setting contents of the distance measuring method and the target object in the built-in memory of the flash-device microcomputer 310. Then, the processing proceeds to step S2824. In step S2824, the flash-device microcomputer 310 transmits, to the camera microcomputer 101, the data stored in step S2823 as a response to checking for a distance measuring method. Then, the processing ends. If the flash-device microcomputer 310 determines that no distance measuring method is set (NO SETTING in step S2822), then in step S2824, the flash-device microcomputer 310 transmits, to the camera microcomputer 101, data indicating that no distance measuring method is set. Then, the processing ends.

In the above-described way, the camera microcomputer 101 acquires the automatic bounce data.

Next, the processing for transmitting the bounce operation execution instruction in step S2704 in the bounce processing is described with reference to FIG. 19. The details of the setting commands as used herein are illustrated in FIGS. 26A and 26B.

Moreover, in FIG. 19, processing performed by the camera body 100 is indicated with steps S2901 to S2905 and the corresponding processing performed by the flash device 300 is indicated with steps S2906 and S2907.

First, processing performed by the camera body **100** is described. In step **S2901**, the camera microcomputer **101** transmits, to the flash-device microcomputer **310**, a “CS031 command: data XX XX” for setting the driving range in the right and left directions during the bounce operation. Then, the processing proceeds to step **S2902**. In a case where no driving range in the right and left directions is set, step **S2901** is omitted. In step **S2902**, the camera microcomputer **101** transmits, to the flash-device microcomputer **310**, a “CS041 command: data XX XX” for setting the driving range in the up and down directions during the bounce operation. Then, the processing proceeds to step **S2903**. In a case where no driving range in the up and down directions is set, step **S2902** is omitted. In step **S2903**, the camera microcomputer **101** transmits, to the flash-device microcomputer **310**, a “CS121 command: data XX XX XX” as orientation difference information indicating results of detection by the orientation V detection unit **140a**, the orientation H detection unit **140b**, and the orientation Z detection unit **140c**. In step **S2904**, the camera microcomputer **101** transmits, to the flash-device microcomputer **310**, other flash-device setting information. Then, the processing proceeds to step **S2905**. In step **S2905**, the camera microcomputer **101** transmits a bounce operation execution instruction to the flash-device microcomputer **310**. Then, the processing proceeds to step **S2705**.

Next, processing performed by the flash device **300** is described.

In step **S2906**, after a communication interrupt occurs, the flash-device microcomputer **310** receives data transmitted from the camera microcomputer **101**. Then, the processing proceeds to step **S2907**. In step **S2907**, the flash-device microcomputer **310** stores the received data into the built-in memory of the flash-device microcomputer **310**, and then starts the bounce operation.

In the above-described way, the camera microcomputer **101** transmits the bounce operation execution instruction to the flash-device microcomputer **310**.

Next, the processing for calculating the distance to a subject in step **S2705** in the bounce processing is described with reference to FIGS. **20A** and **20B**. The details of the setting commands as used herein are illustrated in FIGS. **26A** and **26B**. Moreover, in FIGS. **20A** and **20B**, processing performed by the camera body **100** is indicated with steps **S3001** to **S3010** and the corresponding processing performed by the flash device **300** is indicated with steps **S3011** to **S3018**.

First, processing performed by the camera body **100** is described. In step **S3001**, the camera microcomputer **101** determines a distance measuring method for calculating the distance to a subject (subject distance). Then, the processing proceeds to step **S3002**.

In step **S3002**, the camera microcomputer **101** determines whether the distance measuring method is the preliminary light emission method. If the camera microcomputer **101** determines that the distance measuring method is other than the preliminary light emission method (NO in step **S3002**), the processing proceeds to step **S3003**. If the camera microcomputer **101** determines that the distance measuring method is the preliminary light emission method (YES in step **S3002**), the processing proceeds to step **S3004**.

In step **S3003**, since the distance measuring method is not the preliminary light emission method, the camera microcomputer **101** transmits, to the flash-device microcomputer **310**, a “CS111 command: data XX” as subject distance information. Then, the processing proceeds to step **S2706**. In a case where information indicating that the distance mea-

suring method is the flash-device distance measuring method is included in the automatic bounce data received by the camera microcomputer **101**, step **S3003** is omitted.

In step **S3004**, the camera microcomputer **101** reads out, from the RAM, and acquires information about the distance measuring point determined in step **S2009a**.

In step **S3005**, the camera microcomputer **101** transmits, to the flash-device microcomputer **310**, a “CS191 command: data XX XX” as distance measuring point information. Then, the processing proceeds to step **S3006**.

Now, the positional relationship between distance measuring points and a range within which the distance to a target object is able to be measured by the distance measuring unit **308** (a distance measurable range) is described with reference to FIGS. **28A**, **28B**, **28C**, and **28D**. FIGS. **28A** and **28C** illustrate, in overhead view, the positions of the camera body **100**, the flash device **300**, the movable portion **300b**, and the distance measuring unit **308**. Furthermore, straight lines spreading from the vicinity of the center of the movable portion **300b** in the right and left directions indicate the angle of field determined by the focal length of the lens unit **200**. Moreover, straight lines spreading from the vicinity of the center of the distance measuring unit **308** in the right and left directions indicate the distance measurable range of the distance measuring unit **308**. In the present exemplary embodiment, the distance measurable range of the distance measuring unit **308** is a predetermined area in the vicinity of the center of the radiation range of the light emission unit.

FIGS. **28B** and **28D** illustrate the relationship between the subject and the distance measuring points within the shooting image plane. While, in FIGS. **28B** and **28D**, the distance measuring points include four distance measuring points **2101**, **2102**, **2103**, and **2104**, the number of distance measuring points does not need to be four, or the positions of the distance measuring points do not need to be the illustrated ones. In the present exemplary embodiment, the distance measuring point information is data generated based on coordinate information with the center set to “0”, right to “+”, left to “-”, up to “+”, and down to “-”.

FIGS. **28A** and **28B** illustrate a case where the subject is located in the center of the shooting image plane. FIGS. **28C** and **28D** illustrate a case where the subject is located near the left side of the shooting image plane. In the case of the position of the subject illustrated in FIGS. **28A** and **28B**, the distance measuring point information is the coordinates (0, 0) with the right-left position “0” and the up-down position “0”, so that a “CS191 command: data 00 00” is produced. On the other hand, in the case of the position of the subject illustrated in FIGS. **28C** and **28D**, the distance measuring point information is the coordinates (-A, 0) with the right-left position “-A” and the up-down position “0”, so that a “CS191 command: data (-A) 00” is produced. Furthermore, “(-A)” may be data expressed as the two’s complement of a one-byte hexadecimal number (F_xH).

In step **S3006**, the camera microcomputer **101** transmits, to the flash-device microcomputer **310**, a “CS131 command: data 00” as preliminary light emission permission. Then, the processing proceeds to step **S3007**.

In step **S3007**, the camera microcomputer **101** receives information about the automatic bounce state from the flash-device microcomputer **310**. Then, the processing proceeds to step **S3008**.

In step **S3008**, the camera microcomputer **101** determines whether the automatic bounce operation is able to be performed, based on the automatic bounce state received in step **S3007**. If the camera microcomputer **101** determines that the

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automatic bounce operation is able to be performed (YES in sep S3008), the processing proceeds to step S3009. If the camera microcomputer 101 determines that the automatic bounce operation is not able to be performed (NO in sep S3008), the processing returns to step S3002.

In step S3009, the camera microcomputer 101 transmits a preliminary light emission command to the flash-device microcomputer 310. Then, the processing proceeds to step S3010.

In step S3010, the camera microcomputer 101 receives subject distance information (data) from the flash-device microcomputer 310 and stores the received data into the built-in memory of the camera microcomputer 101. Then, the processing proceeds to step S2706.

Next, processing performed by the flash device 300 is described.

In step S3011, after a communication interrupt occurs, the flash-device microcomputer 310 receives data transmitted from the camera microcomputer 101. Then, the processing proceeds to step S3012. In step S3012, the flash-device microcomputer 310 stores the received data into the built-in memory of the flash-device microcomputer 310. Then, the processing proceeds to step S3013.

In step S3013, the flash-device microcomputer 310 instructs and causes the bounce circuit 340 to swivel the movable portion 300b in such a way that the distance measuring direction becomes a direction corresponding to the distance measuring point, based on the distance measuring point information and the lens focal length information.

The distance measuring point information and the lens focal length information as used herein are the distance measuring point information transmitted from the camera microcomputer 101 in step S3005 and the lens focal length information transmitted from the camera microcomputer 101 in step S2003. The swiveling angle in the right and left directions corresponding to the determined distance measuring point is described with reference to FIG. 29. FIG. 29 illustrates the swiveling angle in the right and left directions corresponding to the distance measuring point determined in a case where the subject is located in the same position as that illustrated in FIG. 28C. In FIG. 29, for ease of description, the position corresponding to each of the distance measuring points 2101, 2102, and 2103 on the image sensor 102 is indicated with a dotted square. Furthermore, the length of the imaging area in the horizontal direction of the image sensor 102 is denoted by 2L, the length from the center to the end of the imaging area in the horizontal direction of the image sensor 102 is denoted by L, and the focal length of the lens unit 200 is denoted by f.

For example, if the distance measuring point information transmitted in step S3005 is a "CS191 command: data 00 00" (in a case where the subject is located in the position corresponding to the distance measuring point 2102), the swiveling angle $\theta 1$ in the right and left directions of the movable portion 300b is calculated as 0 degrees (the frontal direction).

Furthermore, if the distance measuring point information is a "CS191 command: data (-A) 00" (in a case where the subject is located in the position corresponding to the distance measuring point 2101), it is necessary to swivel the movable portion 300b to the left to attain a distance measuring range corresponding to the determined distance measuring point. The swiveling angle $\theta 1$ in this instance is calculated as

$$\theta 1 = \tan^{-1}(A/f).$$

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After calculating the swiveling angle $\theta 1$ in the above-described manner, the flash-device microcomputer 310 selects a swiveling angle closest to the calculated swiveling angle $\theta 1$ from among the settable swiveling angles of the movable portion 300b, and determines the selected swiveling angle as the final swiveling angle of the movable portion 300b at the time of distance measurement. Then, the flash-device microcomputer 310 instructs and causes the bounce circuit 340 to swivel the movable portion 300b in such a way that the swiveling angle of the movable portion 300b reaches the determined swiveling angle.

Moreover, as illustrated in FIGS. 30A and 30B, if the distance measuring point information transmitted in step S3005 is a "CS191 command: data 00 (+B)" (in a case where the subject is located in the position corresponding to the distance measuring point 2104), it is necessary to swivel the movable portion 300b upward. The swiveling angle $\theta 2$ in this instance is calculated as

$$\theta 2 = \tan^{-1}(B/f).$$

After calculating the swiveling angle $\theta 2$ in the above-described manner, the flash-device microcomputer 310 selects a swiveling angle closest to the calculated swiveling angle $\theta 2$ from among the settable swiveling angles of the movable portion 300b, and determines the selected swiveling angle as the final swiveling angle of the movable portion 300b at the time of distance measurement. Then, the flash-device microcomputer 310 instructs and causes the bounce circuit 340 to swivel the movable portion 300b in such a way that the swiveling angle of the movable portion 300b reaches the determined swiveling angle.

Furthermore, to determine the swiveling angle of the movable portion 300b at the time of distance measurement, the above-described calculation may be performed, or a table, which is previously stored in the built-in memory of the flash-device microcomputer 310 and in which the distance measuring point information, the lens focal length information, and the swiveling angles are associated with one another, may be used. In addition, the camera microcomputer 101 may use the above-described methods to determine the swiveling angle $\theta 1$ or $\theta 2$ or determine the swiveling angle of the movable portion 300b at the time of distance measurement.

Although, as described above, the flash-device microcomputer 310 determines the swiveling angles of the movable portion 300b in the up and down directions and in the right and left directions at the time of measuring the subject distance according to the position of the determined distance measuring point, a case may be considered where the flash-device microcomputer 310 only needs to swivel the movable portion 300b in only one of the up and down directions and the right and left directions depending on the distance measurable range of the distance measuring unit 308. Therefore, the flash-device microcomputer 310 can determine the swiveling angle of the movable portion 300b in at least one of the up and down directions and the right and left directions at the time of measuring the subject distance according to the position of the determined distance measuring point. In step S3014, the flash-device microcomputer 310 transmits, to the camera microcomputer 101, information about the automatic bounce state, in this case, information indicating whether the flash device 300 is ready to perform the automatic bound operation.

In step S3015, the flash-device microcomputer 310 issues, according to the preliminary light emission command, a preliminary light emission instruction to the light emission control circuit 304.

In step S3016, the light emission control circuit 304 causes, according to the preliminary light emission instruction, the discharge tube 305 to perform preliminary light emission.

In step S3017, the distance measuring unit 308 receives, via the light receiving sensor, reflected light from the target object caused by the preliminary light emission, and calculates the subject distance based on the integrated value of the received reflected light.

In step S3018, the flash-device microcomputer 310 transmits, to the camera microcomputer 101, an "SC110 command: data XX" as subject distance information indicating the calculated subject distance. Then, the processing ends.

In the above-described way, the camera microcomputer 101 or the flash-device microcomputer 310 calculates the subject distance used to determine a radiation direction most appropriate for bounce light emission shooting.

In this calculation method, in a case where the SW1 switch is kept on without the SW2 switch turned on, if the distance measuring point determined in step S2009a illustrated in FIG. 13 has changed, the distance measuring point information to be transmitted in step S3005 changes, and, therefore, the flash-device microcomputer 310 changes the swiveling angle of the movable portion 300b to calculate the subject distance.

Next, the processing for calculating the distance to a ceiling (wall) in step S2706 in the bounce processing is described with reference to FIGS. 21A and 21B. The details of the setting commands as used herein are illustrated in FIGS. 26A and 26B. Moreover, in FIGS. 21A and 21B, processing performed by the camera body 100 is indicated with steps S3101 to S3106 and the corresponding processing performed by the flash device 300 is indicated with steps S3107 to S3113.

First, processing performed by the camera body 100 is described. In step S3101, the camera microcomputer 101 determines a distance measuring method for calculating the distance to a ceiling (wall) (ceiling distance). Then, the processing proceeds to step S3102.

In step S3102, the camera microcomputer 101 determines whether the distance measuring method is the preliminary light emission method. If the camera microcomputer 101 determines that the distance measuring method is other than the preliminary light emission method (NO in step S3102), the processing proceeds to step S3103. If the camera microcomputer 101 determines that the distance measuring method is the preliminary light emission method (YES in step S3102), the processing proceeds to step S3104.

In step S3103, since the distance measuring method is not the preliminary light emission method, the camera microcomputer 101 transmits, to the flash-device microcomputer 310, a "CS101 command: data XX" as ceiling distance information. Then, the processing proceeds to step S2707. In a case where information indicating that the distance measuring method is the flash-device distance measuring method is included in the automatic bounce data received by the camera microcomputer 101, step S3103 is omitted.

In step S3104, the camera microcomputer 101 transmits, to the flash-device microcomputer 310, a "CS131 command: data 00" as preliminary light emission permission. Then, the processing proceeds to step S3105.

In step S3105, the camera microcomputer 101 transmits a preliminary light emission command to the flash-device microcomputer 310. Then, the processing proceeds to step S3106.

In step S3106, the camera microcomputer 101 receives subject distance information (data) from the flash-device

microcomputer 310 and stores the received data into the built-in memory of the camera microcomputer 101. Then, the processing proceeds to step S2707.

Next, processing performed by the flash device 300 is described. In step S3107, after a communication interrupt occurs, the flash-device microcomputer 310 receives data transmitted from the camera microcomputer 101. Then, the processing proceeds to step S3108. In step S3108, the flash-device microcomputer 310 stores the received data into the built-in memory of the flash-device microcomputer 310. Then, the processing proceeds to step S3109.

When receiving the preliminary light emission permission, then in step S3109, the flash-device microcomputer 310 instructs and causes the bounce circuit 340 to swivel the movable portion 300b in such a way that the radiation direction becomes a direction toward the ceiling. Upon completion of swiveling of the movable portion 300b, in step S3110, the flash-device microcomputer 310 issues, according to the preliminary light emission command, a preliminary light emission instruction to the light emission control circuit 304.

In step S3111, the light emission control circuit 304 causes, according to the preliminary light emission instruction, the discharge tube 305 to perform preliminary light emission.

In step S3112, the distance measuring unit 308 receives, via the light receiving sensor, reflected light from the target object caused by the preliminary light emission, and calculates the ceiling distance based on the integrated value of the received reflected light.

In step S3113, the flash-device microcomputer 310 transmits, to the camera microcomputer 101, an "SC100 command: data XX" as ceiling distance information indicating the calculated ceiling distance. Then, the processing ends.

In the above-described way, the camera microcomputer 101 or the flash-device microcomputer 310 calculates the ceiling (wall) distance used to determine a radiation direction most appropriate for bounce light emission shooting. Next, the processing for determining a radiation direction in step S2707 in the bounce processing is described with reference to FIGS. 22A and 22B. The details of the setting commands as used herein are illustrated in FIGS. 26A and 26B. Moreover, in FIGS. 22A and 22B, processing performed by the camera body 100 is indicated with steps S3201 to S3206 and the corresponding processing performed by the flash device 300 is indicated with steps S3207 to S3212.

In step S3201, the camera microcomputer 101 determines whether to perform the determination of a radiation direction at the camera body 100. In a case where the determination of a radiation direction can be performed at both the camera body 100 and the flash device 300, any one of the camera body 100 and the flash device 300 may perform the determination of a radiation direction. However, the user may be allowed to operate the input unit 112 to set which of the camera body 100 and the flash device 300 performs the determination of a radiation direction.

Furthermore, in a case where only one of the camera body 100 and the flash device 300 can perform the determination of a radiation direction, which of the camera body 100 and the flash device 300 performs the determination of a radiation direction may be automatically set. If the camera microcomputer 101 determines to perform the determination of a radiation direction at the camera body 100 (YES in step S3201), the processing proceeds to step S3202. If the camera microcomputer 101 determines to perform the determination

of a radiation direction at the flash device **300** (NO in step **S3201**), the processing proceeds to step **S3205**.

In step **S3202**, the camera microcomputer **101** refers to the subject distance information indicating the subject distance calculated in step **S2705** and the ceiling distance information indicating the ceiling (wall) distance calculated in step **S2706**, which are used to determine a radiation direction.

In step **S3203**, the camera microcomputer **101** determines a radiation direction most appropriate for bounce light emission shooting based on the subject distance information and the ceiling distance information referred to in step **S3202**. More specifically, the camera microcomputer **101** calculates a swiveling angle of the movable portion **300b** in such a way as to attain the most appropriate radiation direction. The method for calculating the swiveling angle is not particularly limiting as long as it is a method of calculation performed based on the subject distance and the ceiling distance. Suppose that, in an example of a bounce light emission shooting scene illustrated in FIG. **27**, when the distance to a subject with the emission surface for flash light of the flash device **300** set as the point of origin is “d”, if flash light is reflected at a portion of the ceiling located at a distance of “d/2” toward the subject, the reflected light most appropriate for the subject can be obtained. In this case, when the distance to the ceiling is “h” and the angle of the most appropriate radiation direction relative to the horizontal direction is “ θ ”, a relationship of $\theta = \tan^{-1} (2 h/d)$ is obtained. Therefore, the camera microcomputer **101** can calculate the swiveling angle of the movable portion **300b** relative to the camera body **300a** in such a way that the angle of the radiation direction relative to the horizontal direction becomes “ θ ”. Furthermore, in order to cope with a case where the movable portion **300b** is not able to swivel up to the calculated swiveling angle, the camera microcomputer **101** may select a specified angle predetermined based on the calculated swiveling angle and may cause the movable portion **300b** to swivel to the selected specified angle. In this case, the camera microcomputer **101** is configured to select a specified angle larger than the calculated swiveling angle. In other words, the camera microcomputer **101** shifts the position of reflection of flash light to a position more distant from the position of the subject than a position of reflection corresponding to the calculated swiveling angle. The reason for this is to increase the reflected light from the ceiling radiated on the frontal surface of the subject compared with the case where a specified angle smaller than the calculated swiveling angle is selected, and to prevent flash light from being directly radiated on the subject.

Upon completion of the angle calculation, the camera microcomputer **101** stores angular information indicating the calculated angle into the built-in memory of the camera microcomputer **101**. Then, the processing proceeds to step **S3204**.

In step **S3204**, the camera microcomputer **101** transmits, to the flash-device microcomputer **310**, a “CS071 command: up and down data XX” and a “CS081 command: right and left data XX” as the angular information indicating the calculated angles. Then, the processing proceeds to step **S2708**. In the above-described way, the camera microcomputer **101** controls the radiation direction.

On the other hand, if the camera microcomputer **101** determines not to perform the determination of a radiation direction at the camera body **100** (NO in step **S3201**), then in step **S3205**, the camera microcomputer **101** transmits, to

the flash-device microcomputer **310**, a “CS171 command: 00” as an angle calculation instruction. Then, the processing proceeds to step **S3206**.

In step **S3206**, the camera microcomputer **101** receives angular information (data) from the flash-device microcomputer **310**, and stores the received data into the built-in memory of the camera microcomputer **101**. Then, the processing proceeds to step **S2708**.

Next, processing performed by the flash device **300** is described. In step **S3207**, after a communication interrupt occurs, the flash-device microcomputer **310** receives data transmitted from the camera microcomputer **101**. Then, the processing proceeds to step **S3208**. In step **S3208**, the flash-device microcomputer **310** stores the received data into the built-in memory of the flash-device microcomputer **310**. Then, the processing proceeds to step **S3209**.

In step **S3209**, the flash-device microcomputer **310** determines whether to perform the determination of a radiation direction at the flash device **300**. If the flash-device microcomputer **310** determines to perform the determination of a radiation direction at the flash device **300** (YES in step **S3209**), the processing proceeds to step **S3210**. If the flash-device microcomputer **310** determines not to perform the determination of a radiation direction at the flash device **300** (NO in step **S3209**), the processing ends.

In step **S3210**, the flash-device microcomputer **310** refers to the subject distance information indicating the subject distance calculated in step **S2705** and the ceiling distance information indicating the ceiling (wall) distance calculated in step **S2706**, which are used to determine a radiation direction.

In step **S3211**, the flash-device microcomputer **310** determines a radiation direction most appropriate for bounce light emission shooting based on the subject distance information and the ceiling distance information referred to in step **S3210**. The method for determining the radiation direction may be the same as that performed at the camera body **100**, and, therefore, the description thereof is omitted.

In step **S3212**, the flash-device microcomputer **310** transmits, to the camera microcomputer **101**, an “SC070 command: up and down data XX” and an “SC080 command: right and left data XX” as the angular information indicating the calculated angles. Then, the processing ends. In the above-described way, the flash-device microcomputer **310** controls the radiation direction.

Next, the processing for bounce drive control in step **S2708** in the bounce processing is described with reference to FIG. **23A** and FIG. **23B**, which is composed of FIGS. **23B1** and **23B2**. The details of the setting commands as used herein are illustrated in FIGS. **26A** and **26B**.

Moreover, in FIGS. **23A** and **23**, processing performed by the camera body **100** is indicated with steps **S3301** to **S3314** and the corresponding processing performed by the flash device **300** is indicated with steps **S3315** to **S3330**.

In step **S3301**, the camera microcomputer **101** determines whether to perform bounce drive control at the camera body **100**. If the camera microcomputer **101** determines to perform bounce drive control at the camera body **100** (YES in step **S3301**), the processing proceeds to step **S3302**. If the camera microcomputer **101** determines to perform bounce drive control at the flash device **300** (NO in step **S3301**), the processing proceeds to step **S3313**.

In step **S3302**, the camera microcomputer **101** refers to the angular information calculated in step **S2707**.

In step **S3303**, the camera microcomputer **101** transmits, to the flash-device microcomputer **310**, a “CS181 command: data 01” to inform the flash-device microcomputer **310** that

the camera microcomputer **101** performs bounce drive control. Then, the processing proceeds to step **S3304**.

In step **S3304**, the camera microcomputer **101** transmits, to the flash-device microcomputer **310**, a “CS011 command: 01” as automatic bounce setting. Then, the processing proceeds to step **S3305**.

In step **S3305**, the camera microcomputer **101** transmits, to the flash-device microcomputer **310**, a “CS021 command: data XX” as a drive condition for automatic bounce. Then, the processing proceeds to step **S3306**. The data in the CS021 command is set to “00 for both the right and left directions and the up and down directions”, “01 for only the right and left directions”, and “02 for only the up and down directions”.

In step **S3306**, the camera microcomputer **101** transmits, to the flash-device microcomputer **310**, a “CS031 command: data XX XX” as the driving range in the right and left directions. Then, the processing proceeds to step **S3307**. In step **S3307**, the camera microcomputer **101** transmits, to the flash-device microcomputer **310**, a “CS041 command: data XX XX” as the driving range in the up and down directions. Then, the processing proceeds to step **S3308**.

In step **S3308**, the camera microcomputer **101** transmits, to the flash-device microcomputer **310**, a “CS121 command: data XX XX XX” as orientation difference information. Then, the processing proceeds to step **S3309a**.

In step **S3309a**, the camera microcomputer **101** transmits, to the flash-device microcomputer **310**, a “CS161 command: data XX” as operation speed information indicating the speed at which to swivel the movable portion **300b** (the driving speed of a motor in the bounce drive circuit **340**). The data in the CS161 command is set to “00 for normal (reference speed)”, “01 for low speed (50% of reference speed)”, and “02 for high speed (150% of reference speed)”, but may be more finely set. Since the speed at which to swivel the movable portion **300b** is set variable in the above-mentioned way, operation sound of the motor for swiveling the movable portion **300b** can be set according to a shooting scene. The speed at which to swivel the movable portion **300b** can be changed by the user operation on the input unit **112**.

In step **S3310**, the camera microcomputer **101** transmits, to the flash-device microcomputer **310**, a “CS051 command: data 01” and a “CS071 command: data XX” as a driving instruction in the up and down directions. Then, the processing proceeds to step **S3311**. In step **S3311**, the camera microcomputer **101** transmits, to the flash-device microcomputer **310**, a “CS051 command: data 02” and a “CS081 command: data XX” as a driving instruction in the right and left directions. Then, the processing proceeds to step **S3312**.

Upon completion of the bounce driving, in step **S3312**, the camera microcomputer **101** transmits, to the flash-device microcomputer **310**, a “CS051 command: data 00” and a “CS011 command: data 00” as a stop instruction for the bounce driving. Then, the processing proceeds to step **S3314**.

If the camera microcomputer **101** determines to perform bounce drive control at the flash device **300** (NO in step **S3301**), then in step **S3313**, the camera microcomputer **101** transmits, to the flash-device microcomputer **310**, a “CS181 command: data 00” to inform the flash-device microcomputer **310** that the flash-device microcomputer **310** performs bounce drive control. Then, the processing proceeds to step **S3309b**.

In step **S3309b**, similar to step **S3309a**, the camera microcomputer **101** transmits, to the flash-device microcom-

puter **310**, a “CS161 command: data XX” as the operation speed information. Then, the processing proceeds to step **S3314**.

In step **S3314**, the camera microcomputer **101** receives current position information (data) from the flash-device microcomputer **310**, and stores the received data into the built-in memory of the camera microcomputer **101**. Then, the processing proceeds to step **S2709**.

Next, processing performed by the flash device **300** is described. In step **S3315**, after a communication interrupt occurs, the flash-device microcomputer **310** receives data transmitted from the camera microcomputer **101**. Then, the processing proceeds to step **S3316**. In step **S3316**, the flash-device microcomputer **310** stores the received data into the built-in memory of the flash-device microcomputer **310**. Then, the processing proceeds to step **S3317a**.

In step **S3317a**, the flash-device microcomputer **310** determines whether a driving error, such as the collision of the movable portion **300b** or the forcible manual pressing of the movable portion **300b**, has occurred during the bounce driving. If the flash-device microcomputer **310** determines that no driving error has occurred (NO in step **S3317a**), the processing proceeds to step **S3318**. If the flash-device microcomputer **310** determines that a driving error has occurred (YES in step **S3317a**), the processing proceeds to step **S3330**.

In step **S3318**, the flash-device microcomputer **310** transmits, to the camera microcomputer **101**, an “SC060 command: data 00” to inform the camera microcomputer **101** that no driving error has occurred. Then, the processing proceeds to step **S3319**.

In step **S3319**, the flash-device microcomputer **310** determines whether to perform bounce drive control at the camera body **100**. If the flash-device microcomputer **310** determines to perform bounce drive control at the flash device **300** (NO in step **S3319**), the processing proceeds to step **S3320**. If the flash-device microcomputer **310** determines to perform bounce drive control at the camera body **100** (YES in step **S3319**), the processing proceeds to step **S3327**.

In step **S3320**, the flash-device microcomputer **310** makes preparations to perform bounce driving according to instructions from the flash device **300**. Then, the processing proceeds to step **S3321a**.

In step **S3321a**, the flash-device microcomputer **310** refers to the angular information in the up and down directions calculated in step **S2707**. Then, the processing proceeds to step **S3322a**.

In step **S3322a**, the flash-device microcomputer **310** drives the motor of the bounce drive circuit **340d** to swivel the movable portion **300b** to the calculated angle in the up or down direction.

In step **S3323a**, the flash-device microcomputer **310** transmits, to the camera microcomputer **101**, an “SC050 command: data 01” to inform the camera microcomputer **101** that the movable portion **300b** is in the process of being driven in the up or down direction. Then, the processing proceeds to step **S3317b**.

In step **S3317b**, similar to step **S3317a**, the flash-device microcomputer **310** determines whether a driving error has occurred. If the flash-device microcomputer **310** determines that no driving error has occurred (NO in step **S3317b**), the processing proceeds to step **S3324a**. If the flash-device microcomputer **310** determines that a driving error has occurred (YES in step **S3317b**), the processing proceeds to step **S3330**.

In step S3324a, the flash-device microcomputer 310 refers to the angular information in the right and left directions calculated in step S2707. Then, the processing proceeds to step S3325a.

In step S3325a, the flash-device microcomputer 310 drives the motor of the bounce drive circuit 340b to swivel the movable portion 300b to the calculated angle in the right or left direction.

In step S3326a, the flash-device microcomputer 310 transmits, to the camera microcomputer 101, an "SC050 command: data 02" to inform the camera microcomputer 101 that the movable portion 300b is in the process of being driven in the right or left direction. Then, the processing proceeds to step S3317c.

In step S3317c, similar to step S3317a, the flash-device microcomputer 310 determines whether a driving error has occurred. If the flash-device microcomputer 310 determines that no driving error has occurred (NO in step S3317c), the processing proceeds to step S3328. If the flash-device microcomputer 310 determines that a driving error has occurred (YES in step S3317c), the processing proceeds to step S3330.

Upon completion of driving in the up or down direction and in the right or left direction, then in step S3328, the flash-device microcomputer 310 transmits, to the camera microcomputer 101, an "SC050 command: data 00" and an "SC010 command: data 00" as driving stop information. Then, the processing proceeds to step S3329.

In step S3329, the flash-device microcomputer 310 transmits, to the camera microcomputer 101, an "SC070 command: data XX" and an "SC080 command: data XX" as current position information indicating the swiveling angle of the movable portion 300b obtained after the bounce driving. Then, the processing ends.

On the other hand, if the flash-device microcomputer 310 determines to perform bounce drive control at the camera body 100 (YES in step S3319), then in step S3327, the flash-device microcomputer 310 makes preparations to perform bounce driving according to instructions from the camera body 100. Then, the processing proceeds to step S3321b.

Subsequently, in steps S3321b to S3317e, the flash-device microcomputer 310 performs processing similar to the processing performed in steps S3321a to S3317c.

In the above-described way, the flash-device microcomputer 310 automatically swivels the movable portion 300b in the up or down direction and in the right or left direction in such a way as to attain a radiation direction most appropriate for bounce light emission shooting.

Next, processing associated with the light emission of the flash device 300 including the bounce operation is described with reference to FIG. 24. When the flash-device microcomputer 310 of the flash device 300 is activated in response to the power switch included in the input unit 312 being turned on, the flash-device microcomputer 310 starts the flowchart illustrated in FIG. 24.

In step S3401, the flash-device microcomputer 310 performs initialization of its memories and ports. Furthermore, the flash-device microcomputer 310 reads the states of switches included in the input unit 312 and previously set pieces of input information, and performs setting of various light emission modes, such as the method of determining the amount of light emission and the timing of light emission.

In step S3402, the flash-device microcomputer 310 charges the main capacitor 302d by activating the booster circuit block 302.

In step S3403, the flash-device microcomputer 310 stores, into the built-in memory of the flash-device microcomputer 310, focal length information acquired from the camera microcomputer 101 via the communication line SC. Furthermore, in a case where focal length information has previously been stored in the memory, the flash-device microcomputer 310 updates the stored focal length information with new focal length information.

In step S3404, the flash-device microcomputer 310 displays, on the display unit 313, an image relating to the light emission mode set via the input unit 312 and an image relating to the acquired focal length information.

In step S3405, the flash-device microcomputer 310 causes the zoom drive circuit 330 to move the zoom optical system 307 in such a way that the radiation range of flash light reaches a range corresponding to the acquired focal length information.

In step S3406, the flash-device microcomputer 310 causes the bounce position detection circuits 340a and 340c to detect the swiveling angle of the movable portion 300b relative to the body portion 300a.

In step S3407, the flash-device microcomputer 310 determines whether a bounce operation execution instruction is issued. If the flash-device microcomputer 310 determines that the bounce operation execution instruction is issued (YES in step S3407), the processing proceeds to step S3408. In step S3408, the flash-device microcomputer 310 performs the above-described bounce driving. If the flash-device microcomputer 310 determines that the bounce operation execution instruction is not issued (NO in step S3407), the processing proceeds to step S3409.

In step S3409, the flash-device microcomputer 310 transmits, to the camera microcomputer 101, the current position information indicating the swiveling angle of the movable portion 300b relative to the body portion 300a obtained after the bounce driving, as described above.

In step S3410, the flash-device microcomputer 310 determines whether the charging voltage of the main capacitor 302d is equal to or higher than a predetermined value (charging completed). If the flash-device microcomputer 310 determines that the charging voltage is equal to or higher than the predetermined value (YES in step S3410), the processing proceeds to step S3411. If the flash-device microcomputer 310 determines that the charging voltage is lower than the predetermined value (NO in step S3410), the processing proceeds to step S3414.

In step S3411, the flash-device microcomputer 310 transmits a charging completion signal to the camera microcomputer 101. Then, the processing proceeds to step S3412.

In step S3412, the flash-device microcomputer 310 determines whether a light emission start signal has been received as a light emission command. If the flash-device microcomputer 310 determines that the light emission start signal has been received (YES in step S3412), the processing proceeds to step S3413. If the flash-device microcomputer 310 determines that the light emission start signal has not been received (NO in step S3412), the processing returns to step S3402.

In step S3413, in response to the received light emission start signal, the flash-device microcomputer 310 instructs the light emission control circuit 304 to perform light emission. The light emission control circuit 304 causes the discharge tube 305 to emit light according to the light emission instruction. After completion of the light emission, the processing returns to step S3402. Furthermore, in step S3413, with respect to a series of light emission, such as preliminary light emission for flash control or main light

emission, the processing does not return to step S3402 even after each light emission ends, so that the processing does not return to step S3402 until a series of light emission ends.

In a case where the charging voltage is lower than the predetermined value (NO in step S3410), then in step S3414, the flash-device microcomputer 310 transmits a charging incompleteness signal to the camera microcomputer 101. Then, the processing returns to step S3402.

In the above-described way, the flash-device microcomputer 310 performs processing associated with light emission of the flash device 300 including the bounce operation.

As described above, according to the present exemplary embodiment, the swiveling angle of the movable portion 300b at the time of measuring a subject distance in the frontal direction is determined according to the position of an area targeted for focus adjustment, which is determined as an area on which to focus. Accordingly, a radiation direction appropriate for bounce shooting can be accurately obtained regardless of the position of a subject within the shooting image plane.

Furthermore, while, in the above-described exemplary embodiment, a case where an area targeted for focus adjustment is determined as an area on which to focus has been described, a case may be assumed where an area targeted for focus adjustment cannot be determined due to a dark shooting scene or the like. In such a case, in step S3005, the camera microcomputer 101 can transmit, to the flash-device microcomputer 310, a "CS191 command: data FF FF" as distance measuring point information, and the flash-device microcomputer 310, having received such distance measuring point information, can set the swiveling angle of the movable portion 300b to 0 degrees both in the up and down directions and in the right and left directions.

Moreover, in the above-described exemplary embodiment, as an example of a measurement control method of controlling the distance measurable range, a configuration for moving the distance measurable range of the distance measuring unit 308 by swiveling the movable portion 300b has been described. However, the measurement control method may be other than the method used in above-described exemplary embodiment, and, for example, may be a configuration for moving the distance measurable range of the distance measuring unit 308 without swiveling the movable portion 300b. In such a case, similar to the above-described exemplary embodiment, the flash-device microcomputer 310 may determine the amount of movement of the distance measuring unit 308 causing the distance measurable range to be located in an appropriate position according to the position of the determined area targeted for focus adjustment. For example, in a case where the distance measuring unit 308 causes a light receiving sensor to receive light reflected from a target object irradiated by the discharge tube 305 and located in the radiation direction and detects the distance to the target object, the flash-device microcomputer 310 may determine the direction of the light receiving surface of the light receiving sensor.

In addition, the distance measurable range does not need to be moved in such a manner that a position corresponding to the position of the determined area targeted for focus adjustment becomes the center of the distance measurable range, but the flash-device microcomputer 310 may move the distance measurable range only in such a manner that the position corresponding to the position of the determined area targeted for focus adjustment is included in the distance measurable range.

Furthermore, the distance measuring unit 308 may have a plurality of distance measurable ranges, and the flash-device

microcomputer 310 may select at which of the distance measurable ranges to perform the distance measurement according to the position of the determined area targeted for focus adjustment.

Moreover, in a case where the distance measuring unit 308 is capable of changing the size of the distance measurable range, the flash-device microcomputer 310 may determine the size of the distance measurable range in such a manner that the position corresponding to the position of the determined area targeted for focus adjustment is included in the distance measurable range, according to the position of the determined area targeted for focus adjustment.

Japanese Patent Application Laid-Open No. 2009-163179 discusses a technique to acquire the distances to a subject and a reflection surface, on which a photographic lens is focused, based on the lens positions of the photographic lens taken when the photographic lens is focused on the subject and on the reflection surface, and to obtain the most appropriate bounce angle based on the acquired distances.

However, depending on some setting of a mode for focusing the photographic lens on the subject (focus adjustment mode), the method for obtaining a bounce angle discussed in Japanese Patent Application Laid-Open No. 2009-163179 may not obtain the most appropriate bounce angle.

Therefore, according to a fourth exemplary embodiment of the present invention, an imaging system is configured to perform light emission shooting according to the focus adjustment mode in a manner described below.

The imaging system according to the fourth exemplary embodiment is almost similar to that illustrated in FIGS. 1 and 2, and, therefore, the description of the same portions as those illustrated in FIGS. 1 and 2 is not repeated. Data communications performed via the terminal group 130 in the present exemplary embodiment are almost the same as those in the third exemplary embodiment, and various pieces of information are transmitted from the camera microcomputer 101 to the flash-device microcomputer 310 according to command lists illustrated in FIG. 34A, which is composed of FIGS. 34A1 and 34A2, and FIG. 34B, which is composed of FIGS. 34B1, 34B2, and 34B3, which are described below. In the present exemplary embodiment, the user can operate a setting button or the like contained in the input unit 112 to perform various settings of the flash device 300 attached to the camera body 100, the setting of the focus adjustment mode, which is described below, and the setting of control modes in the AF mode.

Next, various processing operations performed by the camera body 100 relating to automatic bounce light emission shooting are described with reference to FIG. 32. The various processing operations performed by the camera body 100 relating to automatic bounce light emission shooting according to the present exemplary embodiment are almost similar to the various processing operations performed by the camera body 100 relating to automatic bounce light emission shooting according to the third exemplary embodiment.

In step S2006 illustrated in FIG. 32, the camera microcomputer 101 performs processing according to the flowchart of FIG. 15. The details of the setting commands used when the various processing operation are performed in the present exemplary embodiment are illustrated in FIGS. 34A and 34B.

The processing for calculating the distance to a subject in step S2705 in the bounce processing (step S2012 illustrated in FIG. 32) according to the present exemplary embodiment is described with reference to FIGS. 33A and 33B. In FIGS.

33A and 33B, processing performed by the camera body 100 is indicated with steps S5001 to S5007 and the corresponding processing performed by the flash device 300 is indicated with steps S5008 to S5014.

First, processing performed by the camera body 100 is described. In step S5001, the camera microcomputer 101 determines a distance measuring method for calculating the distance to a subject (subject distance). Then, the processing proceeds to step S5002.

In step S5002, the camera microcomputer 101 determines whether the distance measuring method is the preliminary light emission method. If the camera microcomputer 101 determines that the distance measuring method is other than the preliminary light emission method (NO in step S5002), the processing proceeds to step S5003. If the camera microcomputer 101 determines that the distance measuring method is the preliminary light emission method (YES in step S5002), the processing proceeds to step S5005.

In step S5003, the camera microcomputer 101 determines one of control modes in the AF mode. The control modes in the AF mode (hereinafter referred to as "AF detailed modes") are modes for setting how to perform automatic focus adjustment. For example, the AF detailed modes include single mode and servo mode. The single mode is a mode to perform focus adjustment (focusing) only once when the release switch is half pressed, and the servo mode is a mode to repeatedly perform focus adjustment during the time the release switch is kept half pressed. If the camera microcomputer 101 determines that the AF detailed mode is the single mode (NO in step S5003), the processing proceeds to step S5004. If the camera microcomputer 101 determines that the AF detailed mode is the servo mode (YES in step S5003), the processing proceeds to step S2016 illustrated in FIG. 32, so that the camera microcomputer 101 does not perform the subsequent bounce processing.

In step S5004, since the distance measuring method is not the preliminary light emission method, the camera microcomputer 101 transmits, to the flash-device microcomputer 310, a "CS111 command: data XX" as subject distance information. Then, the processing proceeds to step S2706. The subject distance information to be transmitted in step S5004 is calculated by the camera microcomputer 101 based on the lens information, such as the position of the lens group 202 taken when the subject is in focus, detected by the encoder 204, and the focal length. Furthermore, in step S5004, the camera microcomputer 101 transmits, to the flash-device microcomputer 310, a "CS201 command: 00 (single mode)" as AF mode information. In a case where information indicating that the distance measuring method is the flash-device distance measuring method is included in the automatic bounce data received by the camera microcomputer 101, step S5004 is omitted.

In step S5005, the camera microcomputer 101 transmits, to the flash-device microcomputer 310, a "CS131 command: data 00" as preliminary light emission permission. Then, the processing proceeds to step S5006.

In step S5006, the camera microcomputer 101 transmits a preliminary light emission command to the flash-device microcomputer 310. Then, the processing proceeds to step S5007.

In step S5007, the camera microcomputer 101 receives subject distance information (data) from the flash-device microcomputer 310 and stores the received data into the built-in memory of the camera microcomputer 101. Then, the processing proceeds to step S2706.

Next, processing performed by the flash device 300 is described. In step S5008, after a communication interrupt

occurs, the flash-device microcomputer 310 receives data transmitted from the camera microcomputer 101. Then, the processing proceeds to step S5009. In step S5009, the flash-device microcomputer 310 stores the received data into the built-in memory of the flash-device microcomputer 310. Then, the processing proceeds to step S5010.

After receiving the preliminary light emission permission, then in step S5010, the flash-device microcomputer 310 instructs and causes the bounce circuit 340 to swivel the movable portion 300b in such a way that the radiation direction is oriented in the direction of the subject.

Upon completion of swiveling of the movable portion 300b, in step S5011, the flash-device microcomputer 310 issues, according to the preliminary light emission command, a preliminary light emission instruction to the light emission control circuit 304.

In step S5012, the light emission control circuit 304 causes, according to the preliminary light emission instruction, the discharge tube 305 to perform preliminary light emission.

In step S5013, the distance measuring unit 308 receives, via the light receiving sensor, reflected light from the target object caused by the preliminary light emission, and calculates the subject distance based on the integrated value of the received reflected light (reflected light information).

In step S5014, the flash-device microcomputer 310 transmits, to the camera microcomputer 101, an "SC110 command: data XX" as subject distance information indicating the calculated subject distance. Then, the processing ends.

In the above-described way, the camera microcomputer 101 or the flash-device microcomputer 310 calculates the subject distance used to determine a radiation direction most appropriate for bounce light emission shooting.

As described above, according to the present exemplary embodiment, the radiation direction most appropriate for bounce light emission shooting can be automatically determined and a communication of information between the imaging apparatus and the illumination device for performing bounce light emission shooting can be appropriately performed. Furthermore, it is determined whether to automatically determine the radiation direction most appropriate for bounce light emission shooting, according to the focus adjustment mode. If the set focus adjustment mode is the servo mode, the radiation direction is not automatically determined. It is supposed that the servo mode, in which focus adjustment is repeatedly performed during the time the release switch is kept half pressed, is set to shoot a moving subject. Therefore, it is considered that, in a case where the servo mode is set, the subject distance information calculated based on the lens information, such as the position of the lens group 202 taken when the subject is in focus and the focal length, does not accurately correspond to the current subject distance. Accordingly, in a case where the set focus adjustment mode is the servo mode, the radiation direction is not automatically determined, so that an erroneous radiation direction can be prevented from being determined.

Furthermore, the method for preventing an erroneous radiation direction from being determined may be other than not automatically determining the radiation direction. For example, in a case where the set focus adjustment mode is the servo mode, there may be adopted a method of automatically setting the radiation direction to a predetermined radiation direction, such as the frontal direction, to drive the movable portion 300b. Although this method, in which the radiation direction is set to a predetermined radiation direction, does not enable intended bounce light emission shooting, bounce light emission shooting with flash light radiated

in an erroneous radiation direction can be prevented. Furthermore, in the case of the method of automatically setting the radiation direction to a predetermined radiation direction, such as the frontal direction, to drive the movable portion **300b**, if the radiation direction taken before shooting is other than the frontal direction, it is necessary to drive the movable portion **300b** in such a way that the radiation direction is oriented in the frontal direction. Therefore, in the case of the method of automatically setting the radiation direction to a predetermined radiation direction, such as the frontal direction, to drive the movable portion **300b**, the camera microcomputer **101** drives the movable portion **300b** between the end of step **S5003** illustrated in FIG. **33A** and at least the start of processing in step **S2024** illustrated in FIG. **14**.

Next, a fifth exemplary embodiment of the present invention is described. An imaging system according to the present exemplary embodiment is similar to that in the fourth exemplary embodiment, but differs from that in the fourth exemplary embodiment only in the subject distance calculation processing.

The subject distance calculation processing according to the present exemplary embodiment is described with reference to FIGS. **35A** and **35B**. In FIGS. **35A** and **35B**, processing performed by the camera body **100** is indicated with steps **S5001** to **S5007** and **S5015** and the corresponding processing performed by the flash device **300** is indicated with steps **S5008** to **S5014**. Furthermore, steps assigned with the respective same step numbers between FIGS. **33A** and **33B** and FIGS. **35A** and **35B** are provided to perform the respective same processing operations. Therefore, the detailed description of processing operations that have already been described with reference to FIGS. **33A** and **33B** is omitted.

In step **S5003** illustrated in FIG. **35A**, the camera microcomputer **101** determines an AF detailed mode. If the camera microcomputer **101** determines that the AF detailed mode is the single mode (NO in step **S5003**), the processing proceeds to step **S5004**. If the camera microcomputer **101** determines that the AF detailed mode is the servo mode (YES in step **S5003**), the processing proceeds to step **S5015**. In step **S5015**, the camera microcomputer **101** transmits, to the flash-device microcomputer **310**, a "CS201 command: 00 (servo mode)" as AF mode information. Then, the processing proceeds to step **S5005**.

On the other hand, in the flash device **300**, after receiving the "CS201 command: 00 (servo mode)", the flash-device microcomputer **310** changes the distance measuring method to the preliminary light emission method even if the preliminary light emission method is not selected by the user.

As described above, according to the present exemplary embodiment, in a case where the set focus adjustment mode is the servo mode, the subject distance to be used to automatically determine the radiation direction is calculated based on the preliminary light emission method.

As described in the fourth exemplary embodiment, it is considered that, in a case where the servo mode is set, the subject distance information calculated based on the lens information, such as the position of the lens group **202** taken when the subject is in focus and the focal length, does not accurately correspond to the current subject distance. Accordingly, in a case where the servo mode is set, the subject distance is calculated based on the preliminary light emission method, so that an erroneous radiation direction can be prevented from being determined.

Next, a sixth exemplary embodiment of the present invention is described. An imaging system according to the

present exemplary embodiment is similar to that in the fourth exemplary embodiment, but differs from that in the fourth exemplary embodiment only in the subject distance calculation processing.

The subject distance calculation processing according to the present exemplary embodiment is described with reference to FIGS. **36A** and **36B**. In FIGS. **36A** and **36B**, processing performed by the camera body **100** is indicated with steps **S5001** to **S5007** and **S5016** and the corresponding processing performed by the flash device **300** is indicated with steps **S5008** to **S5014**. Furthermore, steps assigned with the respective same step numbers between FIGS. **33A** and **33B** and FIGS. **36A** and **36B** are provided to perform the respective same processing operations. Therefore, the detailed description of processing operations that have already been described with reference to FIGS. **33A** and **33B** is omitted.

In step **S5003** illustrated in FIG. **36A**, the camera microcomputer **101** determines an AF detailed mode. If the camera microcomputer **101** determines that the AF detailed mode is the single mode (NO in step **S5003**), the processing proceeds to step **S5004**. If the camera microcomputer **101** determines that the AF detailed mode is the servo mode (YES in step **S5003**), the processing proceeds to step **S5016**.

In step **S5016**, the camera microcomputer **101** determines a movement speed of the subject. If the camera microcomputer **101** determines that the movement speed of the subject is equal to or higher than a predetermined value (predetermined speed) (NO in step **S5016**), the processing proceeds to step **S2016** illustrated in FIG. **32**. If the camera microcomputer **101** determines that the movement speed of the subject is lower than the predetermined value (YES in step **S5016**), the processing proceeds to step **S5004**. As described above, according to the present exemplary embodiment, in a case where the set focus adjustment mode is the servo mode, it is determined whether to automatically determine the radiation direction, according to the movement speed of the subject.

It is considered that, in a case where the movement speed of the subject is lower than the predetermined value, even if the servo mode is set, the subject distance information calculated based on the lens information, such as the position of the lens group **202** taken when the subject is in focus and the focal length, accurately corresponds to the current subject distance. On the other hand, in a case where the movement speed of the subject is equal to or higher than the predetermined value, the subject distance information calculated based on the lens information, such as the position of the lens group **202** taken when the subject is in focus and the focal length, does not accurately correspond to the current subject distance. Accordingly, in a case where the set focus adjustment mode is the servo mode, it is determined whether to automatically determine the radiation direction, according to the movement speed of the subject, so that an erroneous radiation direction can be prevented from being determined. Furthermore, the method for obtaining the movement speed of the subject may be a known method. For example, the movement speed of the subject may be obtained based on a result of focus detection that is repeatedly performed, or, if the light metering sensor included in the light metering circuit **106** is an image sensor, may be obtained based on changes of an image signal that is sequentially output from the light metering sensor, which is an image sensor.

Furthermore, in all of the above-described exemplary embodiments, a part of the processing which the camera microcomputer **101** performs may be processed by the

flash-device microcomputer **310**, and a part of the processing which the flash-device microcomputer **310** performs may be processed by the camera microcomputer **101**.

Moreover, in all of the above-described exemplary embodiments, besides a configuration in which the illumination device is detachably attachable to the imaging apparatus, the present invention can be applied to a configuration in which the illumination device is incorporated in the imaging apparatus as long as the radiation direction of the illumination device is able to be changed.

Additionally, the flowcharts described in all of the above-described exemplary embodiments are merely examples. Various processing operations may be performed in the order different from that in the flowcharts described above unless an adverse effect occurs.

Furthermore, the commands, command numbers, and data items described in all of the above-described exemplary embodiments are merely examples, and, therefore, may be set in any way as long as similar functions are attained.

Embodiment(s) of the present invention can also be realized by a computer of a system or apparatus that reads out and executes computer executable instructions (e.g., one or more programs) recorded on a storage medium (which may also be referred to more fully as a 'non-transitory computer-readable storage medium') to perform the functions of one or more of the above-described embodiment(s) and/or that includes one or more circuits (e.g., application specific integrated circuit (ASIC)) for performing the functions of one or more of the above-described embodiment(s), and by a method performed by the computer of the system or apparatus by, for example, reading out and executing the computer executable instructions from the storage medium to perform the functions of one or more of the above-described embodiment(s) and/or controlling the one or more circuits to perform the functions of one or more of the above-described embodiment(s). The computer may comprise one or more processors (e.g., central processing unit (CPU), micro processing unit (MPU)) and may include a network of separate computers or separate processors to read out and execute the computer executable instructions. The computer executable instructions may be provided to the computer, for example, from a network or the storage medium. The storage medium may include, for example, one or more of a hard disk, a random access memory (RAM), a read-only memory (ROM), a storage of distributed computing systems, an optical disk (such as a compact disc (CD), digital versatile disc (DVD), or Blu-ray Disc (BD)TM), a flash memory device, a memory card, and the like.

While the present invention has been described with reference to exemplary embodiments, it is to be understood that the invention is not limited to the disclosed exemplary embodiments. The scope of the following claims is to be accorded the broadest interpretation so as to encompass all such modifications and equivalent structures and functions.

This application claims the benefit of Japanese Patent Applications No. 2014-184404 filed Sep. 10, 2014, No. 2014-184405 filed Sep. 10, 2014, and No. 2014-184406 filed Sep. 10, 2014, which are hereby incorporated by reference herein in their entirety.

What is claimed is:

1. An imaging system, which includes an illumination device capable of automatically driving a movable portion including a light emission unit to change a radiation direction of the light emission unit and an imaging apparatus, the imaging system comprising:

a processor; and

a memory containing instructions that, when executed by the processor, cause the processor to perform operations comprising:

an acquisition operation to acquire information classifying a lens unit attached to the imaging apparatus; and

a control operation to determine whether to perform automatically driving the movable portion or not, based on the information classifying the lens unit, wherein, if a focal length of the lens unit attached to the imaging apparatus is shorter than a first threshold value, the control operation does not allow the movable portion to be automatically driven.

2. The imaging system according to claim **1**, wherein, if the focal length of the lens unit attached to the imaging apparatus is equal to or longer than a second threshold value greater than the first threshold value, the control operation does not allow the movable portion to be automatically driven.

3. An imaging system, which includes an illumination device capable of automatically driving a movable portion including a light emission unit to change a radiation direction of the light emission unit and an imaging apparatus, the imaging system comprising:

a processor; and

a memory containing instructions that, when executed by the processor, cause the processor to perform operations comprising:

an acquisition operation to acquire information classifying a lens unit attached to the imaging apparatus; and

a control operation to determine whether to perform automatically driving the movable portion or not, based on the information classifying the lens unit, wherein, if the lens unit attached to the imaging apparatus is not able to be classified, the control operation does not allow the movable portion to be automatically driven.

4. An imaging system, which includes an illumination device capable of automatically driving a movable portion including a light emission unit to change a radiation direction of the light emission unit and an imaging apparatus, the imaging system comprising:

a processor; and

a memory containing instructions that, when executed by the processor, cause the processor to perform operations comprising:

an acquisition operation to acquire information classifying a lens unit attached to the imaging apparatus; and

a control operation to determine whether to perform automatically driving the movable portion or not, based on the information classifying the lens unit, wherein, if the lens unit attached to the imaging apparatus is a lens unit used for special shooting, the control operation does not allow the movable portion to be automatically driven.

5. An imaging system, which includes an illumination device capable of automatically driving a movable portion including a light emission unit to change a radiation direction of the light emission unit and an imaging apparatus, the imaging system comprising:

a processor; and

a memory containing instructions that, when executed by the processor, cause the processor to perform operations comprising:

an acquisition operation to acquire information classifying a lens unit attached to the imaging apparatus; a calculation operation to calculate the radiation direction of the light emission unit; and

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a determination operation to determine whether to cause the calculation operation to calculate the radiation direction of the light emission unit or not, based on the information classifying the lens unit,

wherein, if a focal length of the lens unit attached to the imaging apparatus is shorter than a first threshold value, the determination operation determines not to cause the calculation operation to calculate the radiation direction of the light emission unit.

6. The imaging system according to claim 5, wherein, if the focal length of the lens unit attached to the imaging apparatus is equal to or longer than a second threshold value greater than the first threshold value, the determination operation determines not to cause the calculation operation to calculate the radiation direction of the light emission unit.

7. An imaging system, which includes an illumination device capable of automatically driving a movable portion including a light emission unit to change a radiation direction of the light emission unit and an imaging apparatus, the imaging system comprising:

a processor; and

a memory containing instructions that, when executed by the processor, cause the processor to perform operations comprising:

an acquisition operation to acquire information classifying a lens unit attached to the imaging apparatus; a calculation operation to calculate the radiation direction of the light emission unit; and

a determination operation to determine whether to cause the calculation operation to calculate the radiation direction of the light emission unit or not, based on the information classifying the lens unit,

wherein, if the lens unit attached to the imaging apparatus is not able to be classified, the determination operation determines not to cause the calculation operation to calculate the radiation direction of the light emission unit.

8. An imaging system, which includes an illumination device capable of automatically driving a movable portion including a light emission unit to change a radiation direction of the light emission unit and an imaging apparatus, the imaging system comprising:

a processor; and

a memory containing instructions that, when executed by the processor, cause the processor to perform operations comprising:

an acquisition operation to acquire information classifying a lens unit attached to the imaging apparatus; a calculation operation to calculate the radiation direction of the light emission unit; and

a determination operation to determine whether to cause the calculation operation to calculate the radiation direction of the light emission unit or not, based on the information classifying the lens unit,

wherein, if the lens unit attached to the imaging apparatus is a lens unit used for special shooting, the determination operation determines not to cause the calculation operation to calculate the radiation direction of the light emission unit.

9. An illumination device comprising:

a body portion that is detachably attached to an imaging apparatus;

a movable portion that is able to be rotated relative to the body portion;

a light emission unit mounted on the movable portion;

a drive unit configured to rotate the movable portion;

a processor; and

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a memory containing instructions that, when executed by the processor, cause the processor to perform operations comprising:

an acquisition operation configured to acquire information classifying a lens unit attached to the imaging apparatus attached to the body portion; and

a control operation configured to determine whether to perform automatically driving the movable portion or not, based on the information classifying the lens unit,

wherein, if a focal length of the lens unit attached to the imaging apparatus is shorter than a first threshold value, the control operation does not allow the movable portion to be automatically driven.

10. An illumination device comprising:

a body portion that is detachably attached to an imaging apparatus;

a movable portion that is able to be rotated relative to the body portion;

a light emission unit mounted on the movable portion;

a drive unit configured to rotate the movable portion;

a processor; and

a memory containing instructions that, when executed by the processor, cause the processor to perform operations comprising:

a calculation operation configured to calculate a radiation direction of the light emission unit;

an acquisition operation configured to acquire information classifying a lens unit attached to the imaging apparatus attached to the body portion; and

a determination operation configured to determine whether to cause the calculation operation to calculate the radiation direction of the light emission unit or not, based on the information classifying the lens unit,

wherein, if a focal length of the lens unit attached to the imaging apparatus is shorter than a first threshold value, the determination operation determines not to cause the calculation operation to calculate the radiation direction of the light emission unit.

11. A control method for an illumination device including a body portion that is detachably attached to an imaging apparatus, a movable portion that is able to be rotated relative to the body portion, a light emission unit mounted on the movable portion, and a drive unit configured to rotate the movable portion, the control method comprising:

acquiring information classifying a lens unit attached to the imaging apparatus attached to the body portion; and

determining not to allow the movable portion to be automatically driven, if a focal length of the lens unit attached to the imaging apparatus is shorter than a first threshold value.

12. A control method for an illumination device including a body portion that is detachably attached to an imaging apparatus, a movable portion that is able to be rotated relative to the body portion, a light emission unit mounted on the movable portion, a drive unit configured to rotate the movable portion, and a calculation unit configured to calculate a radiation direction of the light emission unit, the control method comprising:

acquiring information classifying a lens unit attached to the imaging apparatus attached to the body portion; and

determining not to cause the calculation unit to calculate the radiation direction of the light emission unit, if a focal length of the lens unit attached to the imaging apparatus is shorter than a first threshold value.

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13. An imaging apparatus which is detachably attached to an illumination device capable of automatically driving a movable portion including a light emission unit to change a radiation direction of the light emission unit, the imaging apparatus comprising:

a processor; and
a memory containing instructions that, when executed by the processor, cause the processor to perform operations comprising:

an acquisition operation to acquire information classifying a lens unit attached to the imaging apparatus; and

a control operation to determine whether to perform automatically driving the movable portion or not, based on the information classifying the lens unit acquired by the acquisition unit,

wherein, if a focal length of the lens unit attached to the imaging apparatus is shorter than a first threshold value, the control operation does not allow the movable portion to be automatically driven.

14. An imaging apparatus which is detachably attached to an illumination device capable of automatically driving a movable portion including a light emission unit to change a radiation direction of the light emission unit, the imaging apparatus comprising:

a processor; and
a memory containing instructions that, when executed by the processor, cause the processor to perform operations comprising:

an acquisition operation to acquire information classifying a lens unit attached to the imaging apparatus;
a calculation operation to calculate the radiation direction of the light emission unit; and

a determination operation to determine whether to cause the calculation unit to calculate the radiation direction of the light emission unit or not, based on the information classifying the lens unit acquired by the acquisition unit,

wherein, if a focal length of the lens unit attached to the imaging apparatus is shorter than a first threshold value, the determination operation determines not to cause the calculation operation to calculate the radiation direction of the light emission unit.

15. An illumination device comprising:

a body portion that is detachably attached to an imaging apparatus;

a movable portion that is able to be rotated relative to the body portion;

a light emission unit mounted on the movable portion;
a drive unit configured to rotate the movable portion;
a processor; and

a memory containing instructions that, when executed by the processor, cause the processor to perform operations comprising:

an acquisition operation configured to acquire information classifying a lens unit attached to the imaging apparatus attached to the body portion; and

a control operation configured to determine whether to perform automatically driving the movable portion or not, based on the information classifying the lens unit,

wherein, if the lens unit attached to the imaging apparatus is not able to be classified, the control operation does not allow the movable portion to be automatically driven.

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16. An illumination device comprising:

a body portion that is detachably attached to an imaging apparatus;

a movable portion that is able to be rotated relative to the body portion;

a light emission unit mounted on the movable portion;
a drive unit configured to rotate the movable portion;
a processor; and

a memory containing instructions that, when executed by the processor, cause the processor to perform operations comprising:

an acquisition operation configured to acquire information classifying a lens unit attached to the imaging apparatus attached to the body portion; and

a control operation configured to determine whether to perform automatically driving the movable portion or not, based on the information classifying the lens unit,

wherein, if the lens unit attached to the imaging apparatus is a lens unit used for special shooting, the control operation does not allow the movable portion to be automatically driven.

17. An illumination device comprising:

a body portion that is detachably attached to an imaging apparatus;

a movable portion that is able to be rotated relative to the body portion;

a light emission unit mounted on the movable portion;
a drive unit configured to rotate the movable portion;
a processor; and

a memory containing instructions that, when executed by the processor, cause the processor to perform operations comprising:

a calculation operation configured to calculate a radiation direction of the light emission unit;

an acquisition operation configured to acquire information classifying a lens unit attached to the imaging apparatus attached to the body portion; and

a determination operation configured to determine whether to cause the calculation operation to calculate the radiation direction of the light emission unit or not, based on the information classifying the lens unit,

wherein, if the lens unit attached to the imaging apparatus is not able to be classified, the determination operation determines not to cause the calculation operation to calculate the radiation direction of the light emission unit.

18. An illumination device comprising:

a body portion that is detachably attached to an imaging apparatus;

a movable portion that is able to be rotated relative to the body portion;

a light emission unit mounted on the movable portion;
a drive unit configured to rotate the movable portion;
a processor; and

a memory containing instructions that, when executed by the processor, cause the processor to perform operations comprising:

a calculation operation configured to calculate a radiation direction of the light emission unit;

an acquisition operation configured to acquire information classifying a lens unit attached to the imaging apparatus attached to the body portion; and

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a determination operation configured to determine whether to cause the calculation operation to calculate the radiation direction of the light emission unit or not, based on the information classifying the lens unit,

wherein, if the lens unit attached to the imaging apparatus is a lens unit used for special shooting, the determination operation determines not to cause the calculation operation to calculate the radiation direction of the light emission unit.

19. A control method for an illumination device including a body portion that is detachably attached to an imaging apparatus, a movable portion that is able to be rotated relative to the body portion, a light emission unit mounted on the movable portion, and a drive unit configured to rotate the movable portion, the control method comprising:

acquiring information classifying a lens unit attached to the imaging apparatus attached to the body portion; and determining not to allow the movable portion to be automatically driven, if the lens unit attached to the imaging apparatus is not able to be classified.

20. A control method for an illumination device including a body portion that is detachably attached to an imaging apparatus, a movable portion that is able to be rotated relative to the body portion, a light emission unit mounted on the movable portion, and a drive unit configured to rotate the movable portion, the control method comprising:

acquiring information classifying a lens unit attached to the imaging apparatus attached to the body portion; and determining not to allow the movable portion to be automatically driven, if the lens unit attached to the imaging apparatus is a lens unit used for special shooting.

21. A control method for an illumination device including a body portion that is detachably attached to an imaging apparatus, a movable portion that is able to be rotated relative to the body portion, a light emission unit mounted on the movable portion, a drive unit configured to rotate the movable portion, and a calculation unit configured to calculate a radiation direction of the light emission unit, the control method comprising:

acquiring information classifying a lens unit attached to the imaging apparatus attached to the body portion; and determining not to cause the calculation unit to calculate the radiation direction of the light emission unit, if the lens unit attached to the imaging apparatus is not able to be classified.

22. A control method for an illumination device including a body portion that is detachably attached to an imaging apparatus, a movable portion that is able to be rotated relative to the body portion, a light emission unit mounted on the movable portion, a drive unit configured to rotate the movable portion, and a calculation unit configured to calculate a radiation direction of the light emission unit, the control method comprising:

acquiring information classifying a lens unit attached to the imaging apparatus attached to the body portion; and determining not to cause the calculation unit to calculate the radiation direction of the light emission unit, if the lens unit attached to the imaging apparatus is a lens unit used for special shooting.

23. An imaging apparatus which is detachably attached to an illumination device capable of automatically driving a movable portion including a light emission unit to change a radiation direction of the light emission unit, the imaging apparatus comprising:

a processor; and
a memory containing instructions that, when executed by the processor, cause the processor to perform operations comprising:

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an acquisition operation to acquire information classifying a lens unit attached to the imaging apparatus; and

a control operation to determine whether to perform automatically driving the movable portion or not, based on the information classifying the lens unit acquired by the acquisition unit,

wherein, if the lens unit attached to the imaging apparatus is not able to be classified, the control operation does not allow the movable portion to be automatically driven.

24. An imaging apparatus which is detachably attached to an illumination device capable of automatically driving a movable portion including a light emission unit to change a radiation direction of the light emission unit, the imaging apparatus comprising:

a processor; and
a memory containing instructions that, when executed by the processor, cause the processor to perform operations comprising:

an acquisition operation to acquire information classifying a lens unit attached to the imaging apparatus; and

a control operation to determine whether to perform automatically driving the movable portion or not, based on the information classifying the lens unit acquired by the acquisition unit,

wherein, if the lens unit attached to the imaging apparatus is a lens unit used for special shooting, the control operation does not allow the movable portion to be automatically driven.

25. An imaging apparatus which is detachably attached to an illumination device capable of automatically driving a movable portion including a light emission unit to change a radiation direction of the light emission unit, the imaging apparatus comprising:

a processor; and
a memory containing instructions that, when executed by the processor, cause the processor to perform operations comprising:

an acquisition operation to acquire information classifying a lens unit attached to the imaging apparatus; a calculation operation to calculate the radiation direction of the light emission unit; and

a determination operation to determine whether to cause the calculation unit to calculate the radiation direction of the light emission unit or not, based on the information classifying the lens unit acquired by the acquisition unit,

wherein, if the lens unit attached to the imaging apparatus is not able to be classified, the determination operation determines not to cause the calculation operation to calculate the radiation direction of the light emission unit.

26. An imaging apparatus which is detachably attached to an illumination device capable of automatically driving a movable portion including a light emission unit to change a radiation direction of the light emission unit, the imaging apparatus comprising:

a processor; and
a memory containing instructions that, when executed by the processor, cause the processor to perform operations comprising:

an acquisition operation to acquire information classifying a lens unit attached to the imaging apparatus; a calculation operation to calculate the radiation direction of the light emission unit; and

a determination operation to determine whether to
cause the calculation unit to calculate the radiation
direction of the light emission unit or not, based on
the information classifying the lens unit acquired by
the acquisition unit, 5
wherein, if the lens unit attached to the imaging apparatus
is a lens unit used for special shooting, the determina-
tion operation determines not to cause the calculation
operation to calculate the radiation direction of the light
emission unit. 10

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