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Ota et al.

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(54) **IMAGE FORMING APPARATUS HAVING SEPARATION GEAR TRAIN, FIXING GEAR TRAIN AND ADJUSTING GEAR TRAIN OPERATED BY A COMMON MOTOR**

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(22) Filed: **Jan. 23, 2024**

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Jan. 27, 2023 (JP) 2023-011106

(51) **Int. Cl.**

G03G 21/18 (2006.01)
G03G 15/00 (2006.01)
G03G 15/20 (2006.01)
G03G 21/16 (2006.01)

(52) **U.S. Cl.**

CPC ***G03G 21/1857*** (2013.01); ***G03G 15/2017*** (2013.01); ***G03G 15/2064*** (2013.01); ***G03G 15/6573*** (2013.01); *G03G 21/1647* (2013.01)

(58) **Field of Classification Search**

None
See application file for complete search history.

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(57) **ABSTRACT**

An image forming apparatus including a photosensitive drum, a development roller, a separation cam, a fixing device, an adjusting cam, a main motor, a separation gear train, a fixing gear train, and an adjusting gear train. The development roller is movable relative to the photosensitive drum between a contact position and a separate position. The adjusting cam switches a nip pressure of the fixing device between first and second pressures. The separation gear train transmits a driving force of the main motor to the separation cam. The fixing gear train transmits the driving force of the main motor received from the separation gear train to the fixing device. The adjusting gear train transmits the driving force of the main motor received from the separation gear train to the adjusting cam.

18 Claims, 24 Drawing Sheets

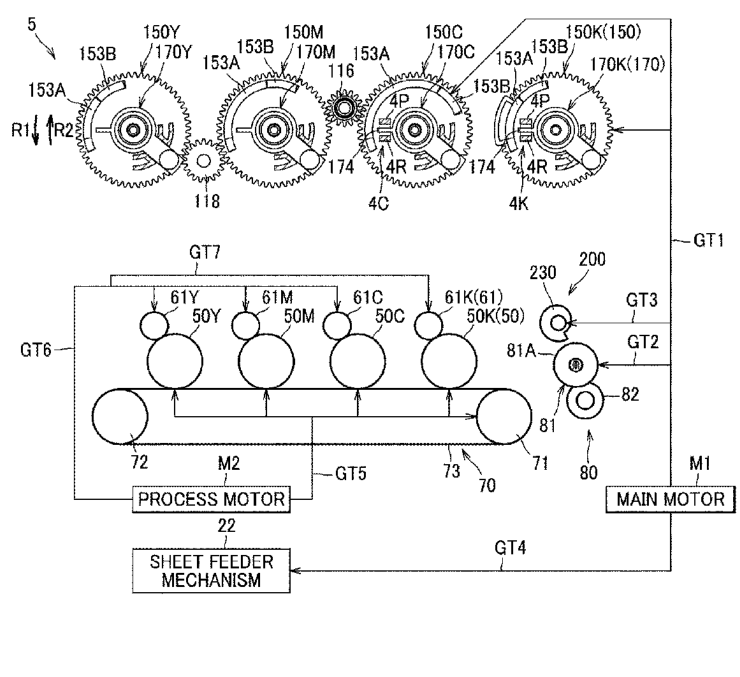


FIG.1

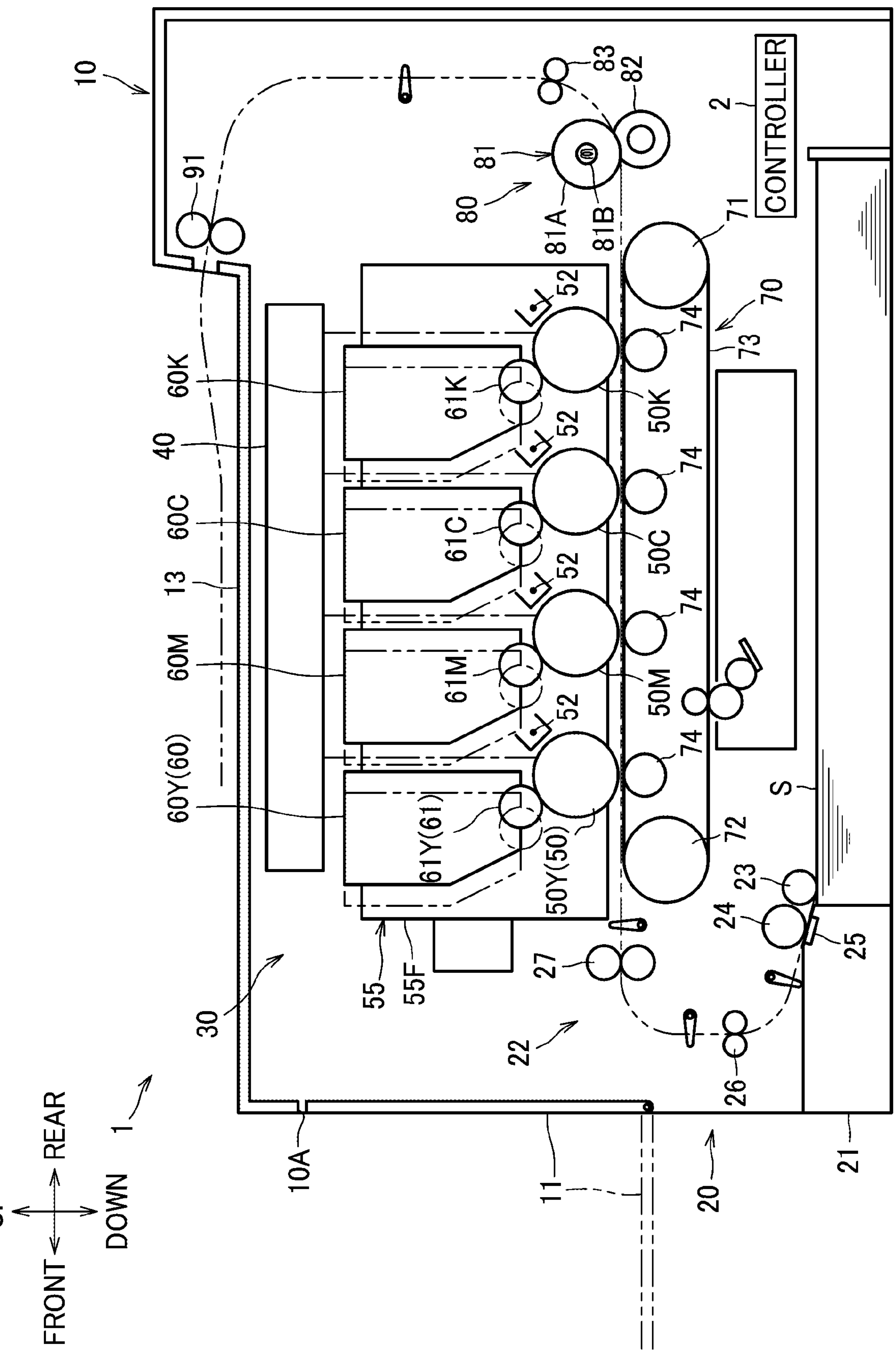

10
91
81
80
81A
81B
82
83
2
CONTROLLER
71
70
73
74
52
60K
61K
50K
40
60C
61C
50C
13
60M
61M
50M
60Y(60)
61Y(61)
50Y(50)
72
S
23
24
25
27
55
55F
30
22
26
1
10A
11
20
21
UP
DOWN
FRONT
REAR

FIG.2

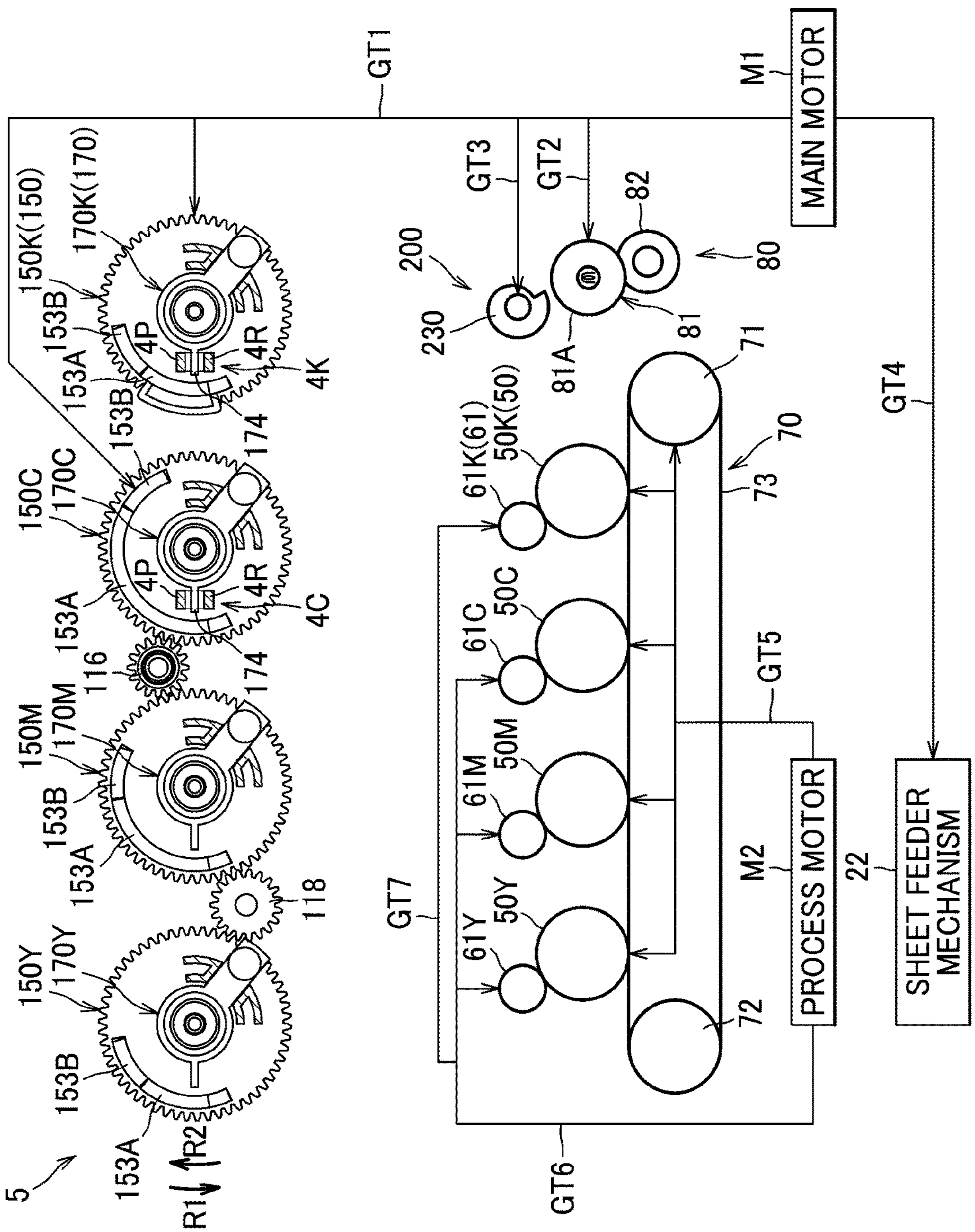

GT1
MAIN MOTOR
M1
GT2
GT3
GT4
GT5
GT6
GT7
200
230
80
81
81A
82
70
71
72
73
150K(150)
170K(170)
150C
170C
150M
170M
150Y
170Y
153A
153B
4P
4R
4K
4C
174
116
118
5
R1
R2
61K(61)
50K(50)
61C
50C
61M
50M
61Y
50Y
PROCESS MOTOR
M2
22
SHEET FEEDER MECHANISM

FIG.3

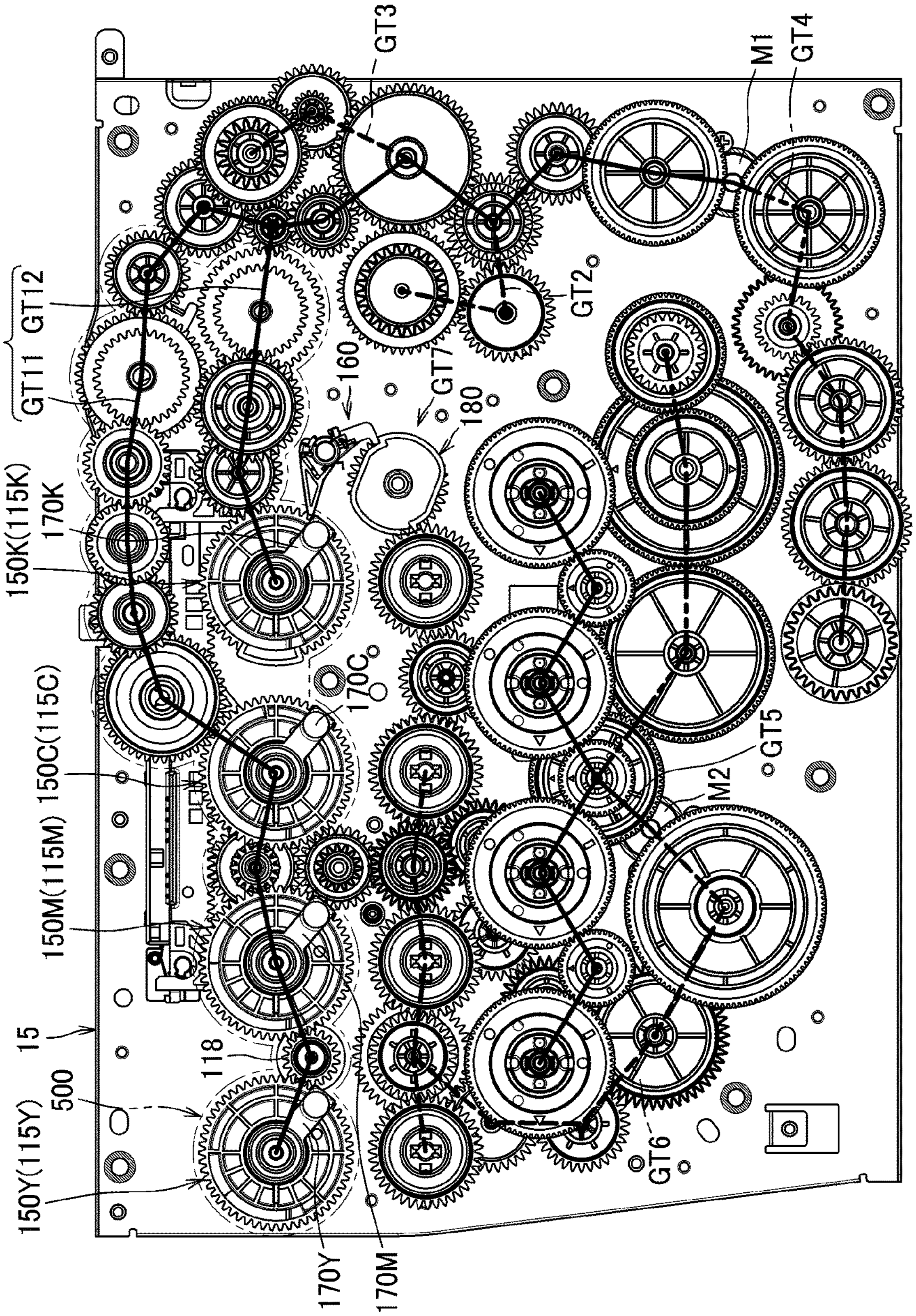
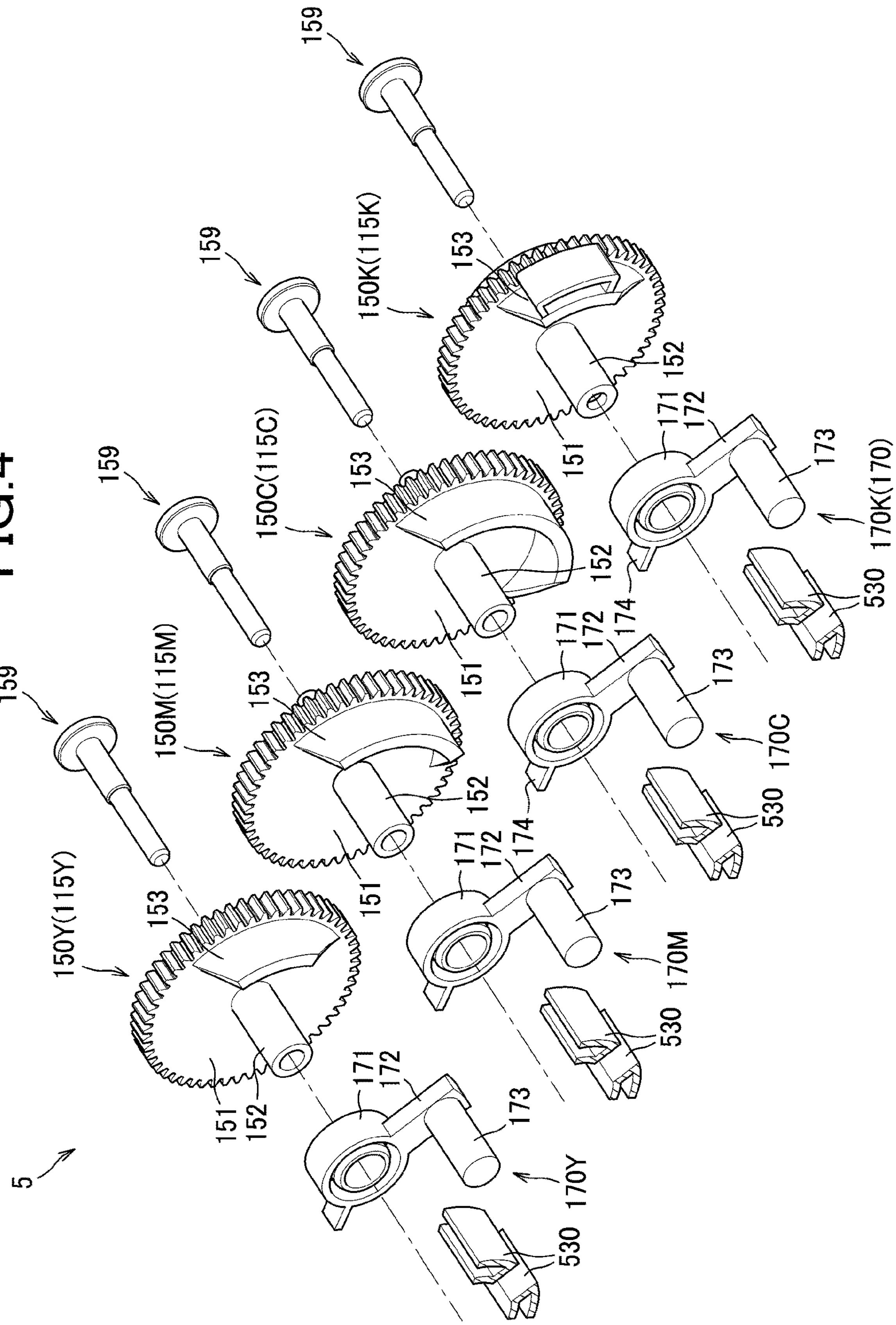

GT3
M1
GT4
GT1
GT11
GT12
GT2
GT7
160
180
170K
150K(115K)
170C
150C(115C)
GT5
M2
150M(115M)
15
118
500
150Y(115Y)
GT6
170Y
170M

FIG.4


5
159
159
159
159
150Y(115Y)
150M(115M)
150C(115C)
150K(115K)
151
152
153
171
172
173
174
170Y
170M
170C
170K(170)
530

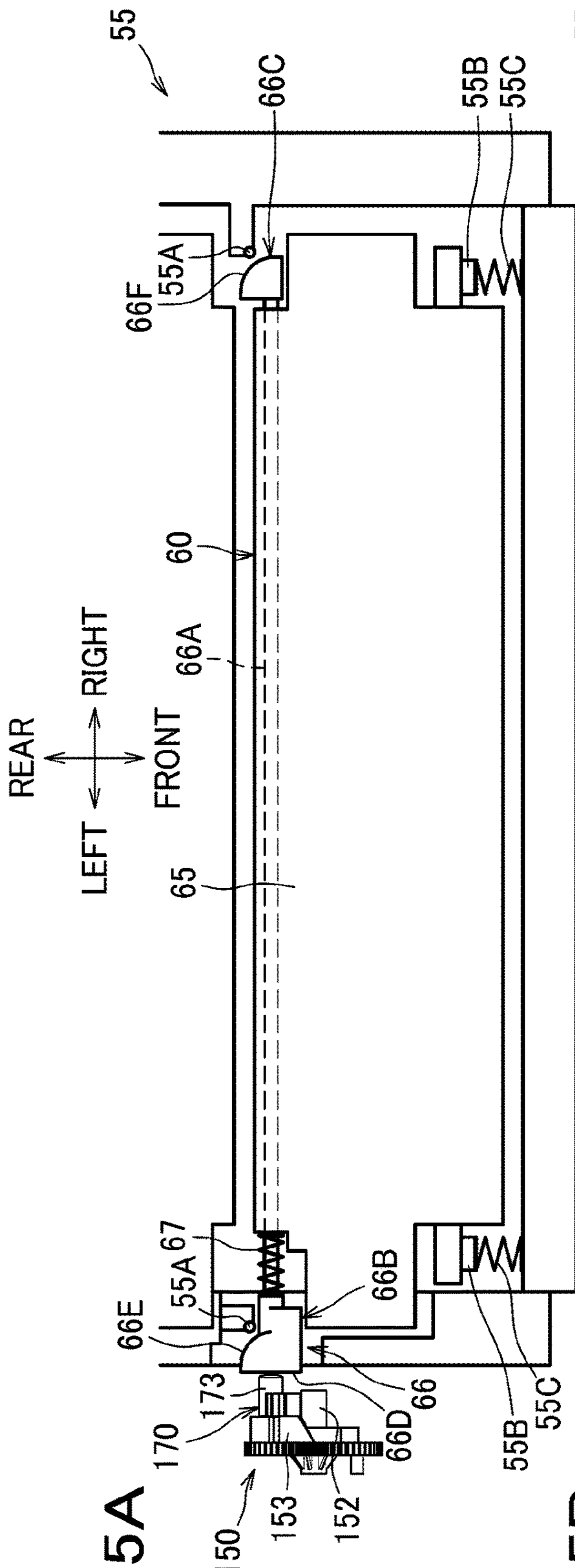

55
66C
55B
55C
55A
66F
60
66A
REAR
RIGHT
LEFT
FRONT
65
67
55A
66E
66B
173
170
66
66D
55B
55C
153
152
150

FIG.5A

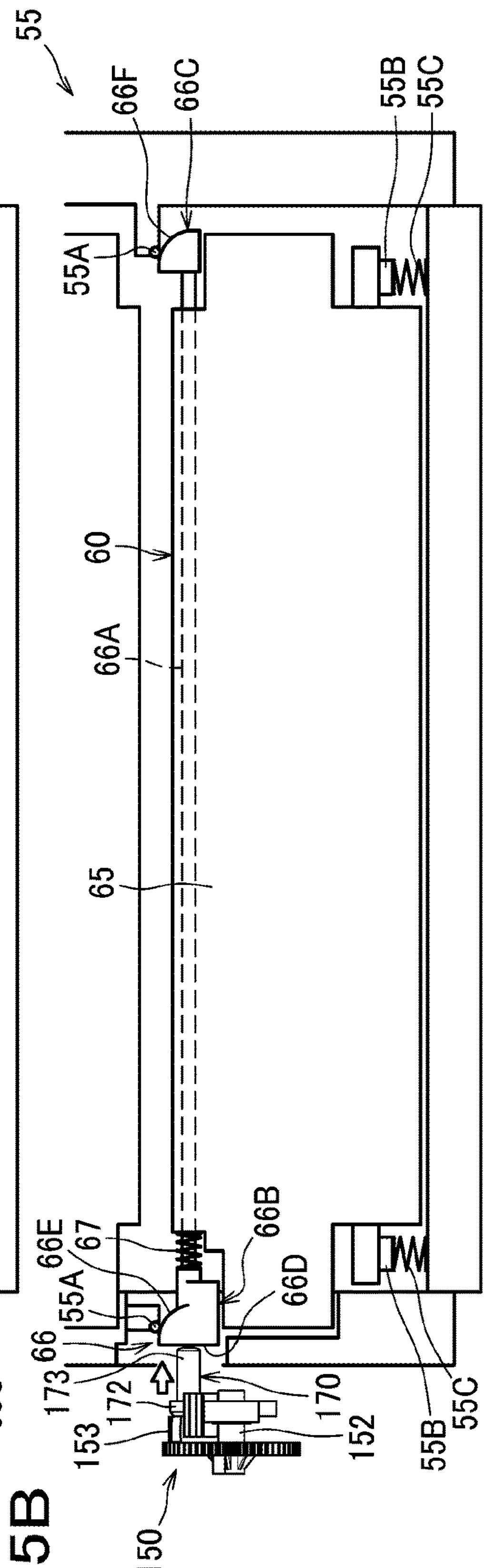

55
66F
66C
55B
55C
55A
60
66A
65
66B
66E
67
55A
66D
66
173
172
153
170
152
55B
55C
150

FIG.5B

FIG.6A

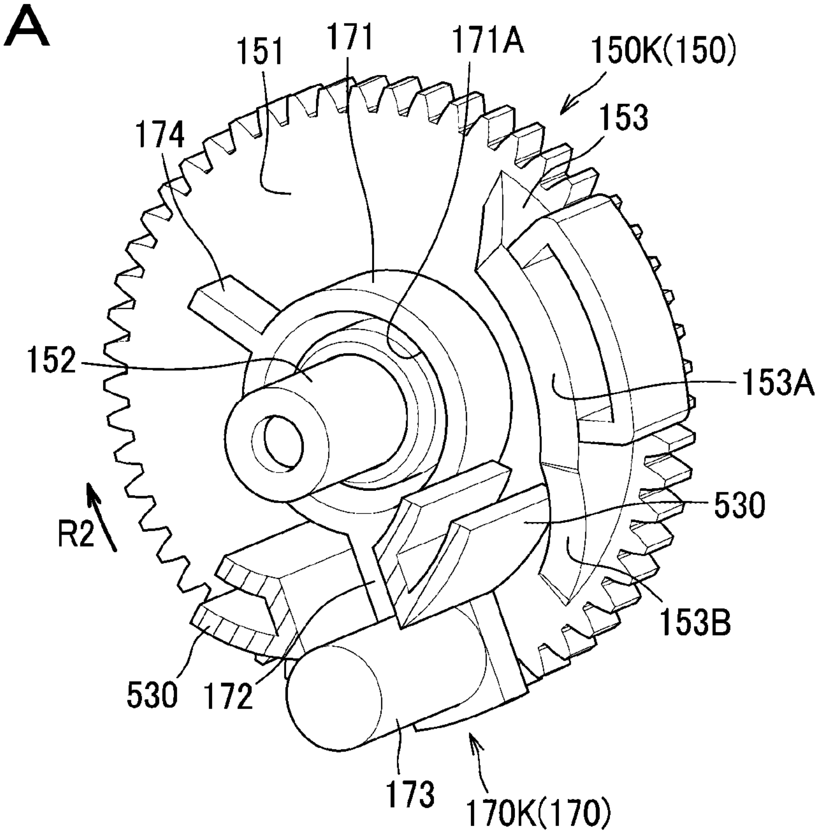

151
171
171A
150K(150)
153
174
152
153A
R2
530
153B
530
172
173
170K(170)

FIG.6B

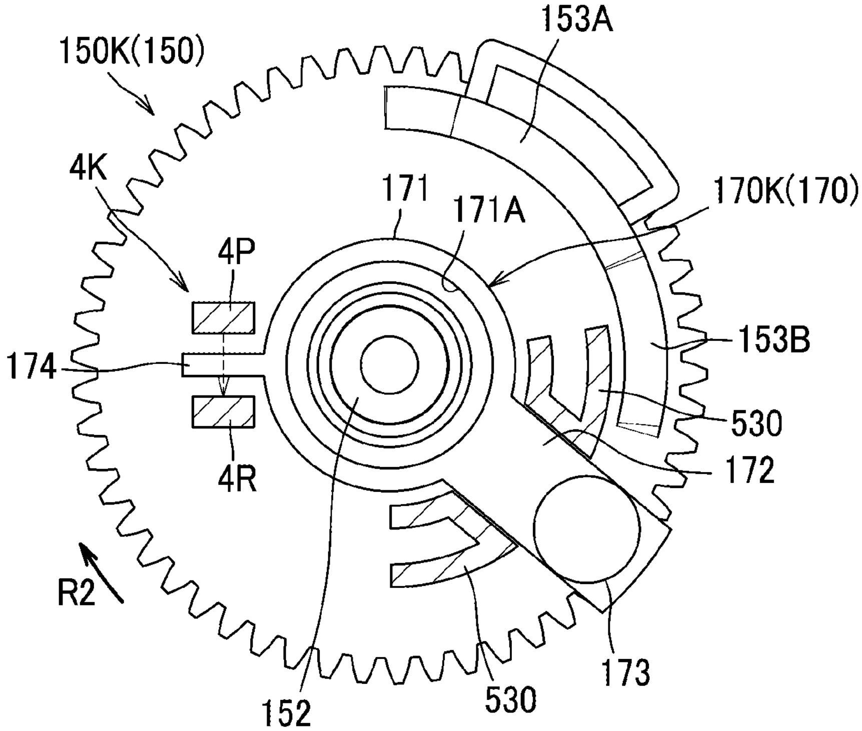

153A
150K(150)
4K
171
171A
170K(170)
4P
174
153B
530
4R
172
R2
173
152
530

FIG.7A

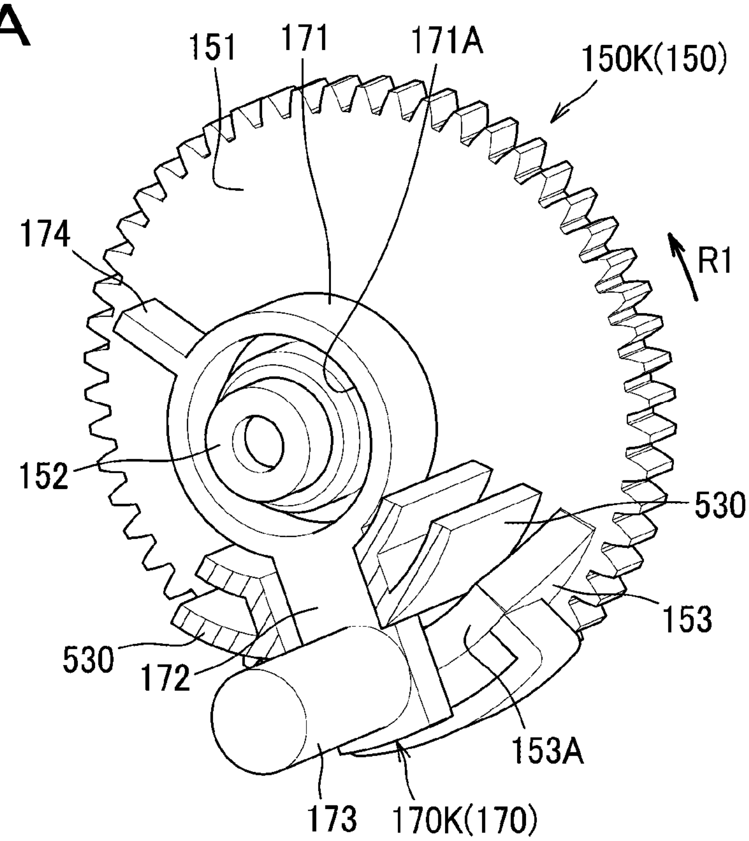
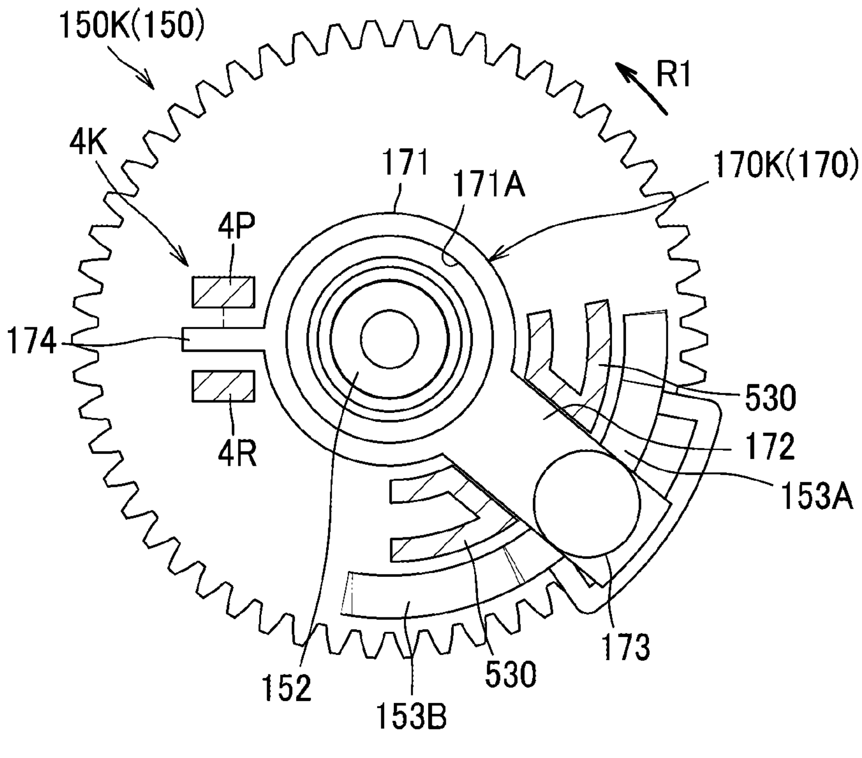

151
171
171A
150K(150)
174
R1
152
530
153
530
172
153A
173
170K(170)

FIG.7B


150K(150)
R1
4K
171
171A
170K(170)
4P
174
530
4R
172
153A
173
152
530
153B

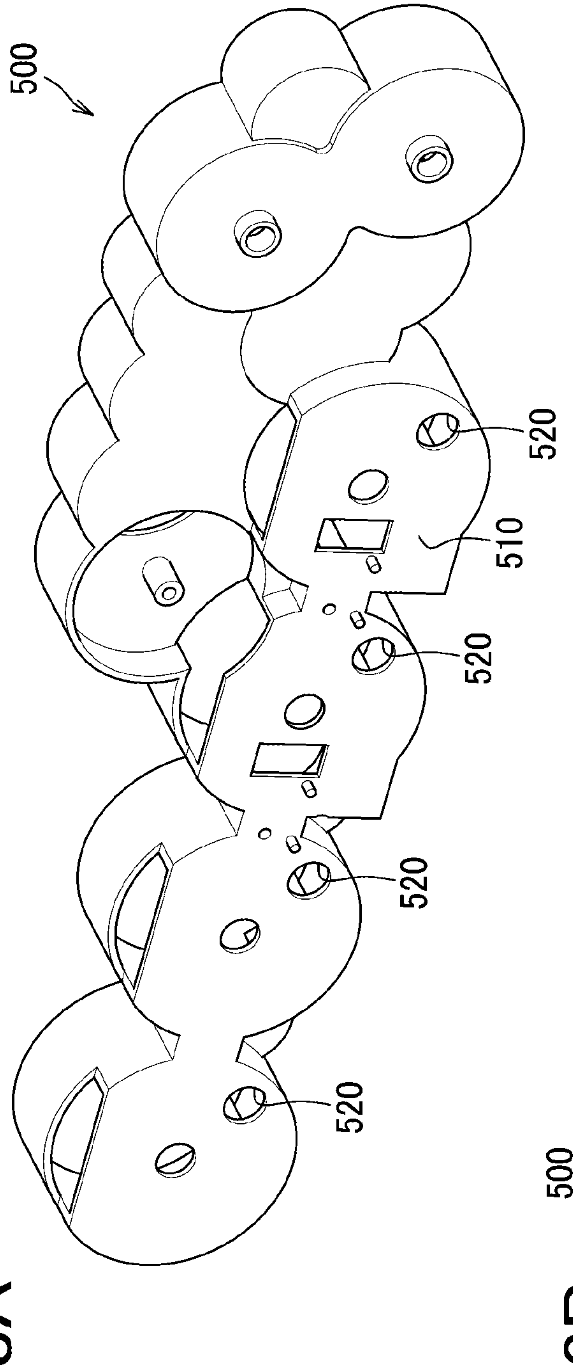

500
520
510
520
520
520

FIG.8A

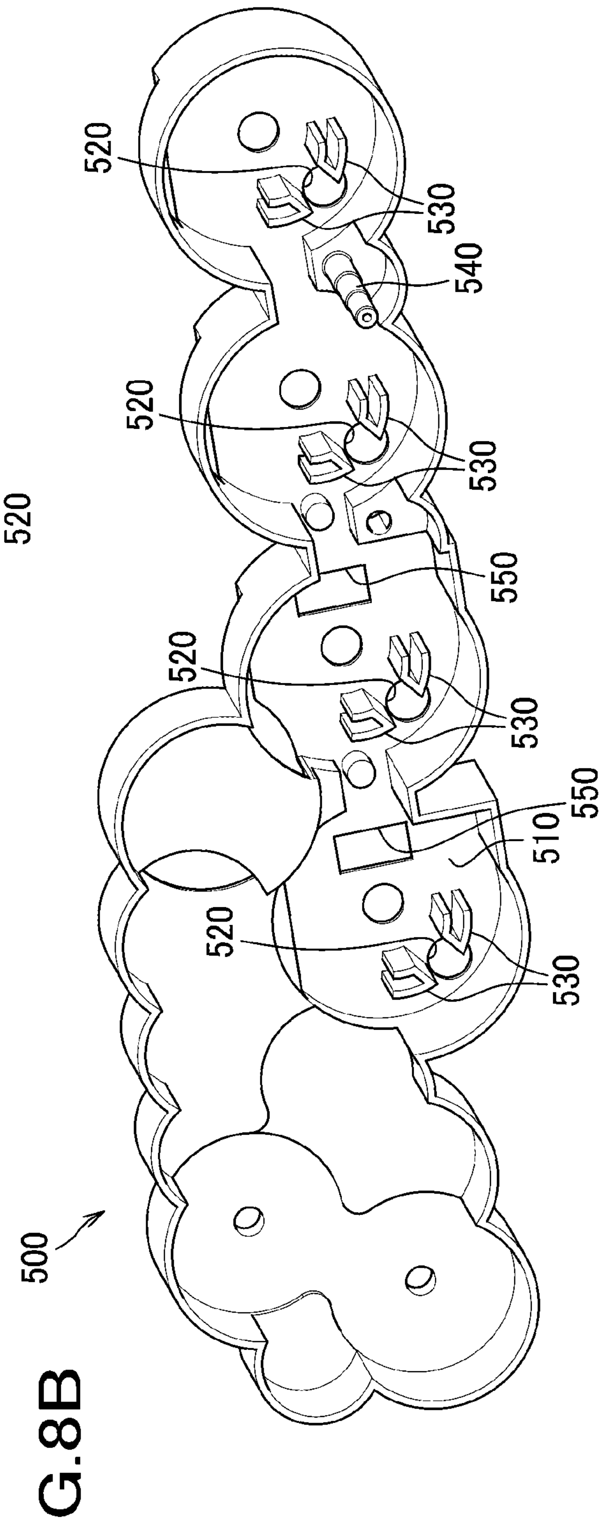

520
530
540
520
530
550
520
530
550
510
520
530
500

FIG.8B

FIG.9A

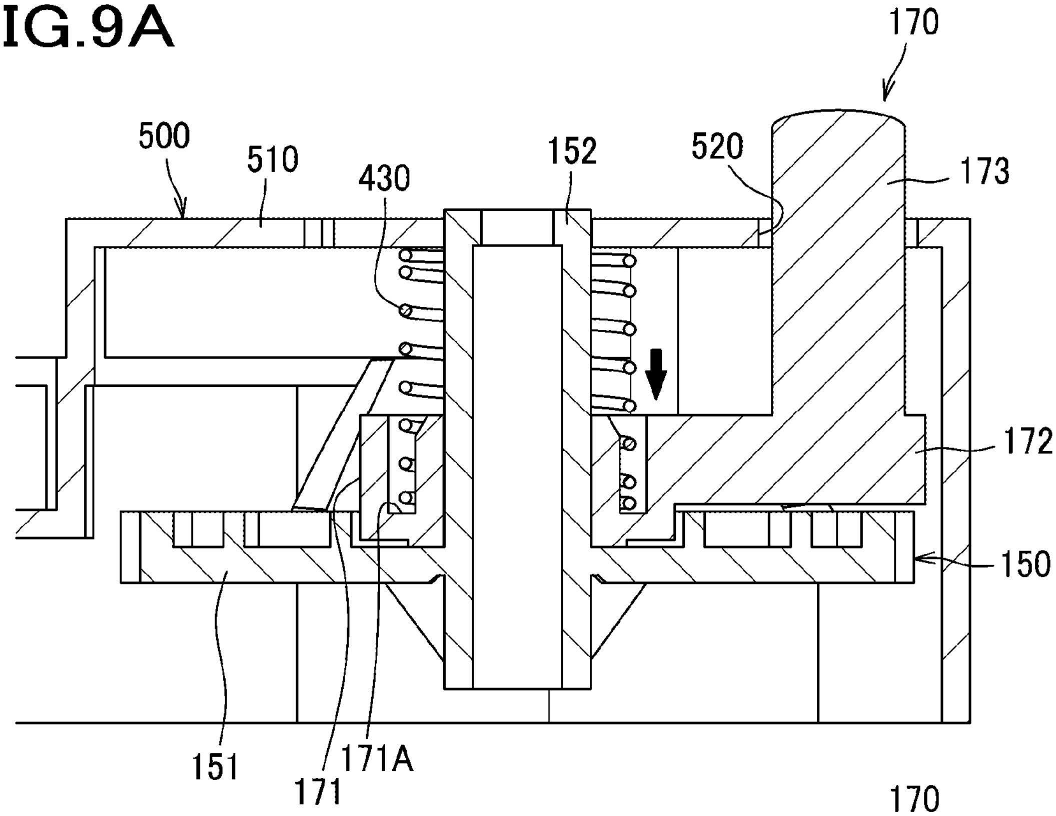

170
500
510
430
152
520
173
172
150
151
171
171A

FIG.9B

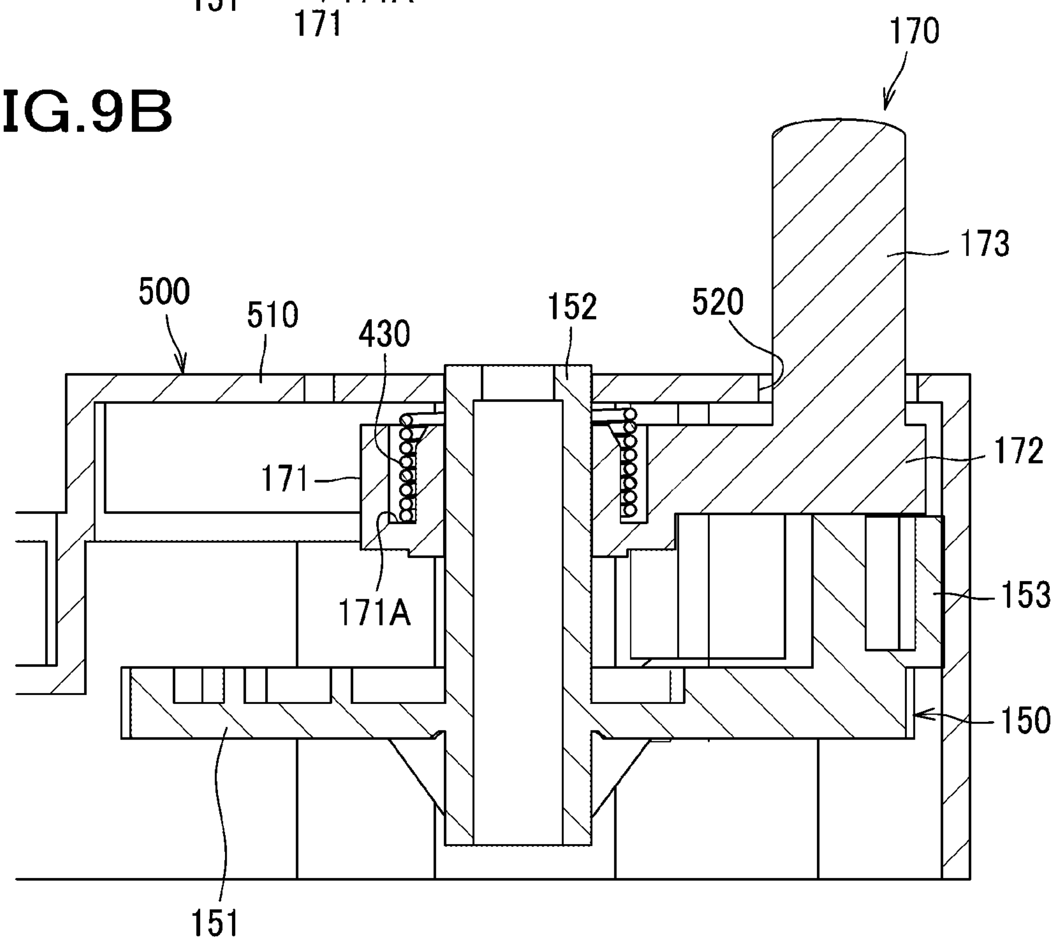
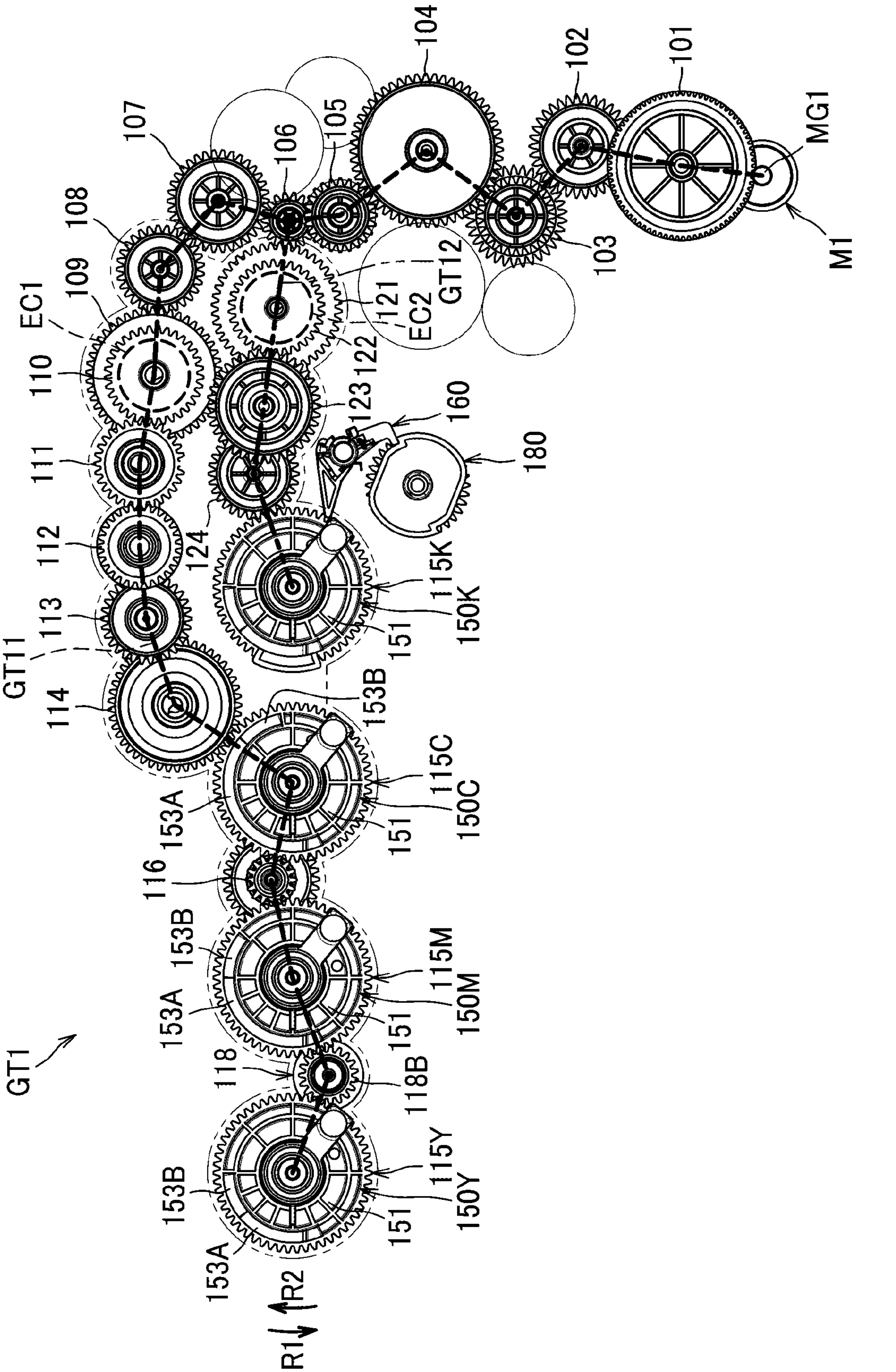

170
173
500
510
430
152
520
172
171
153
171A
150
151

FIG.10



101
102
103
104
105
106
107
108
109
110
111
112
113
114
115K
115C
115M
115Y
116
118
118B
121
122
123
124
150K
150C
150M
150Y
151
153A
153B
160
180
EC1
EC2
GT1
GT11
GT12
MG1
M1
R1
R2

FIG.11A

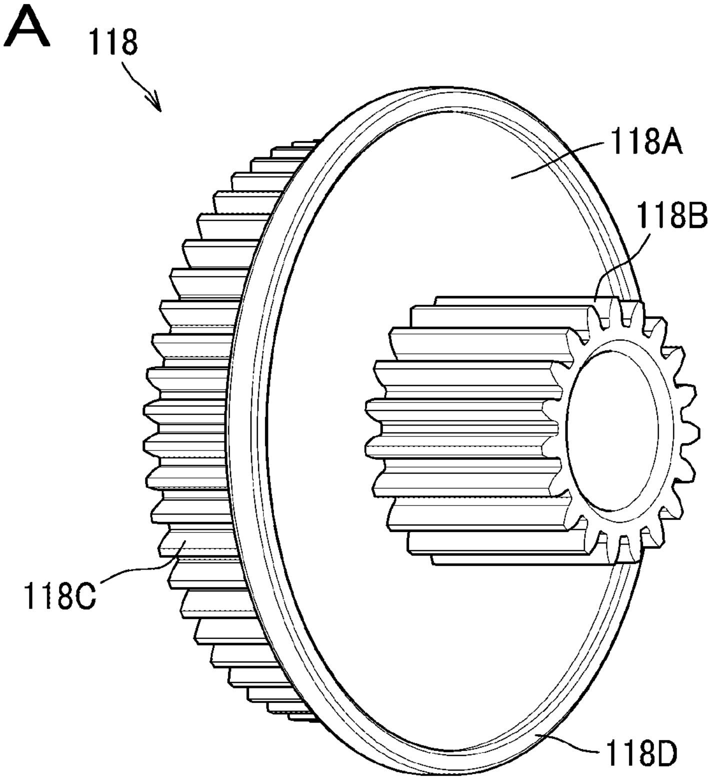


FIG.11B

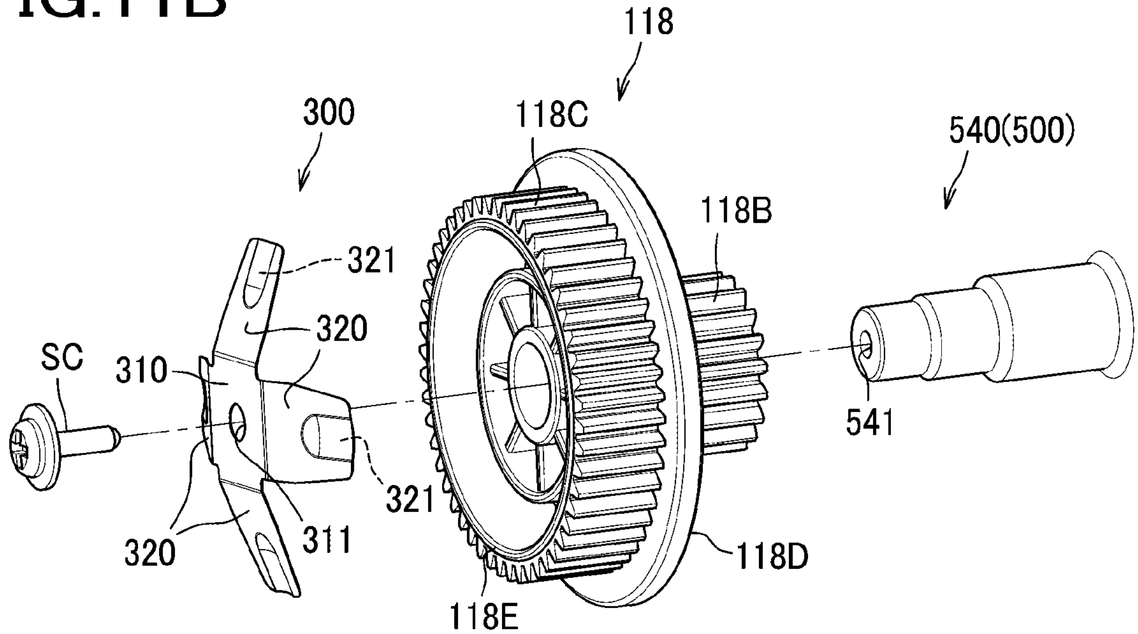


FIG.12

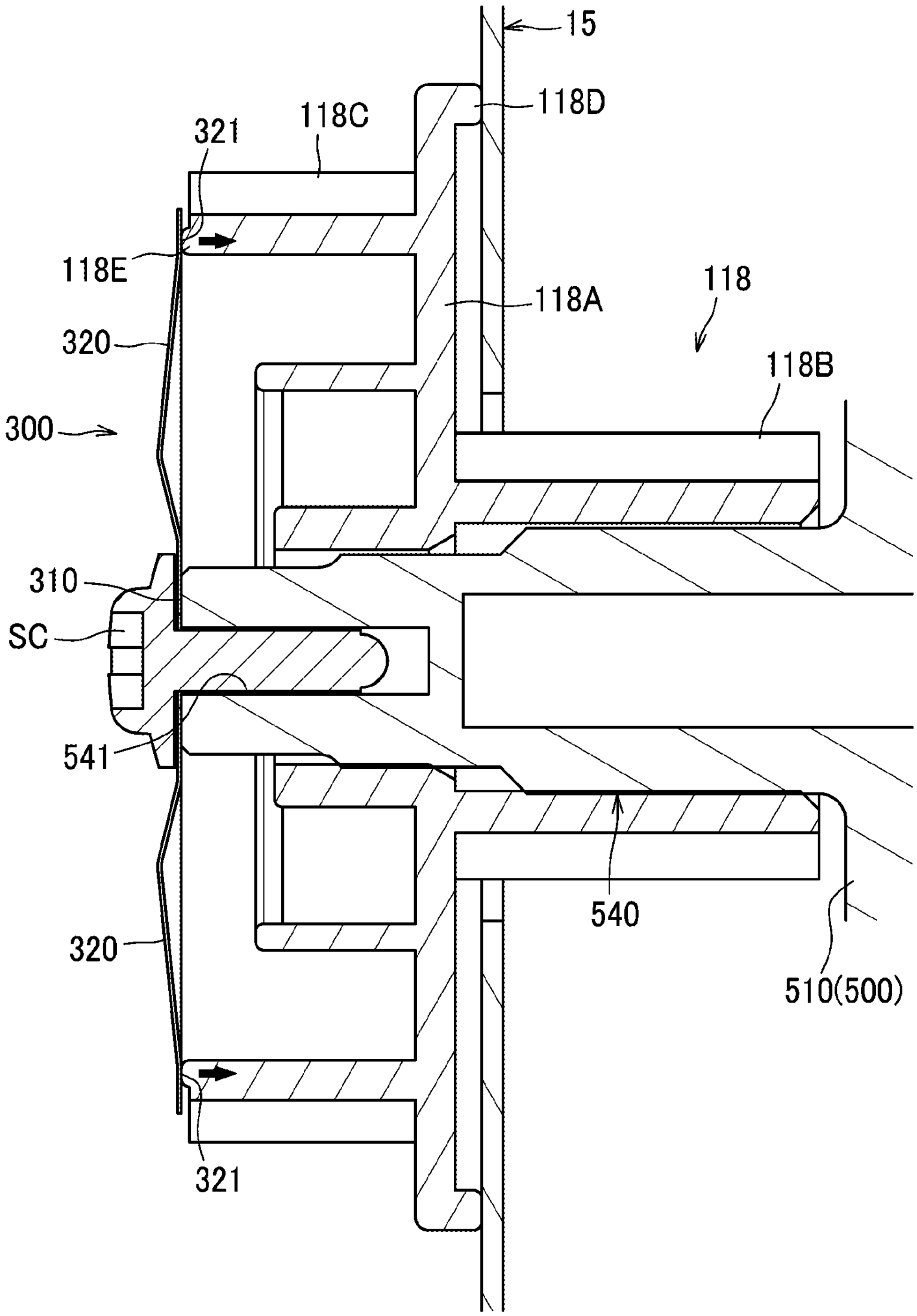

15
118D
118C
321
118E
118A
118
320
118B
300
310
SC
541
540
320
510(500)
321

FIG.13

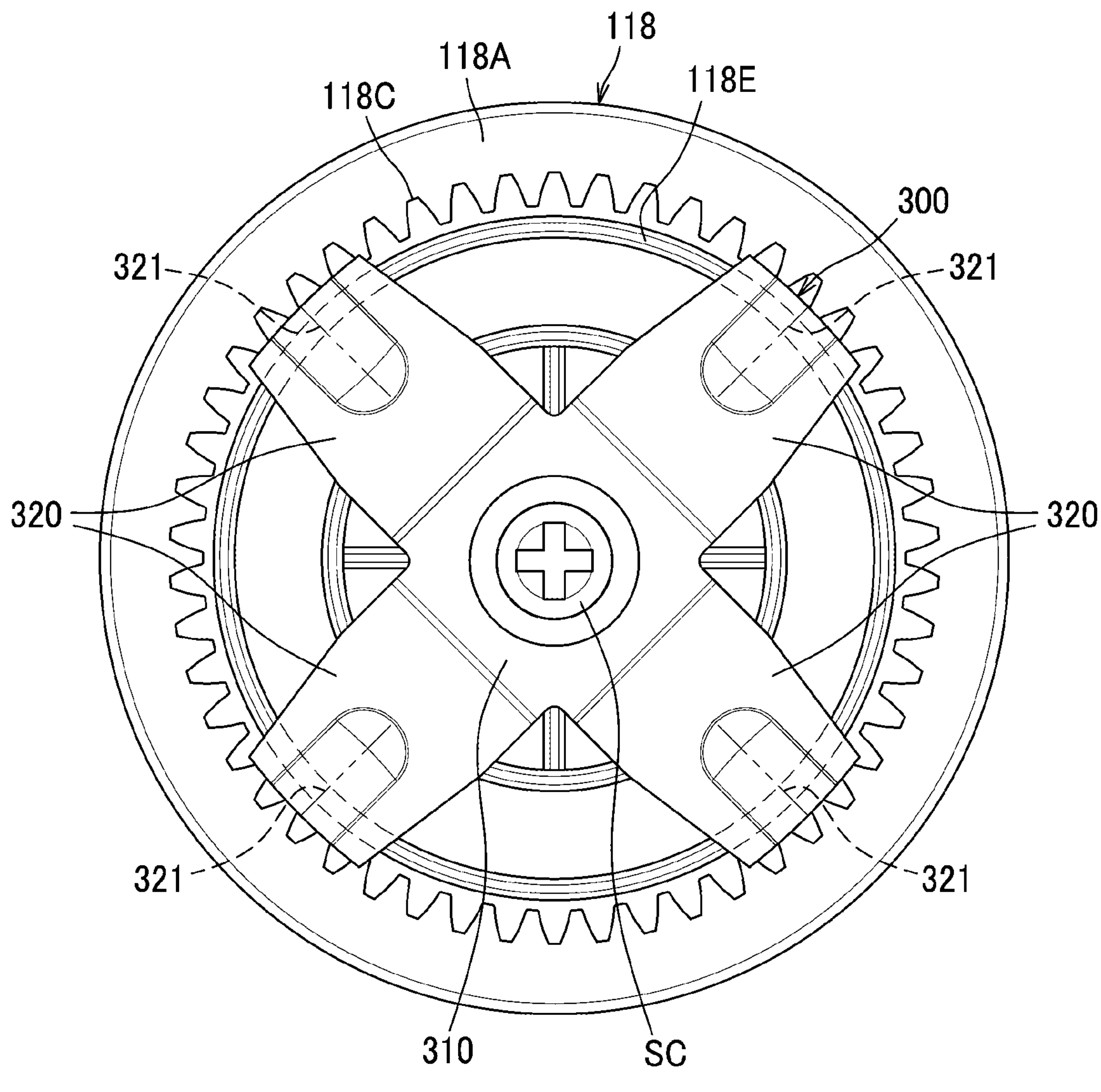


FIG.14

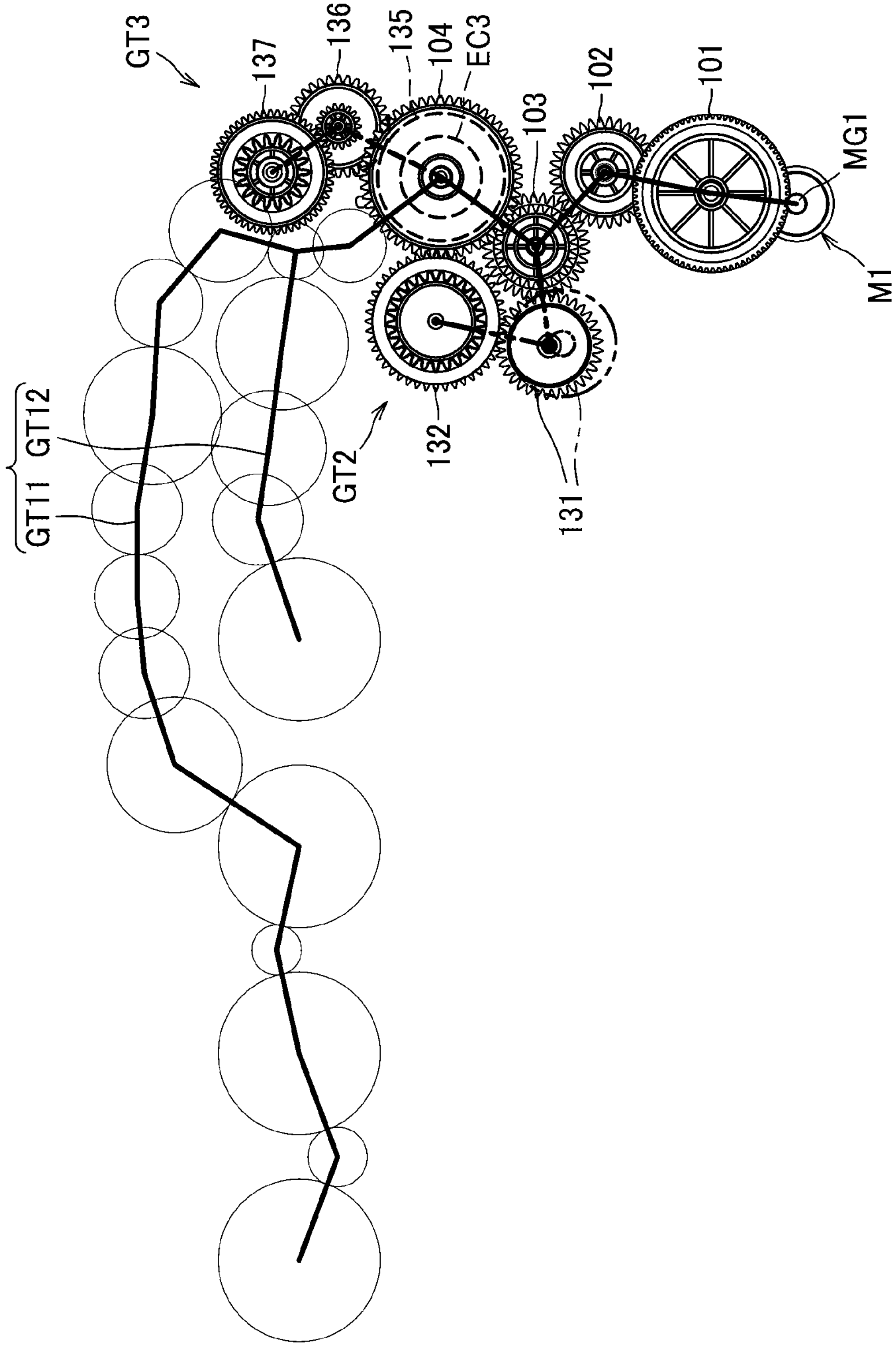

GT3
137
136
135
104
EC3
103
102
101
MG1
M1
GT1
GT11
GT12
GT2
132
131

FIG.15

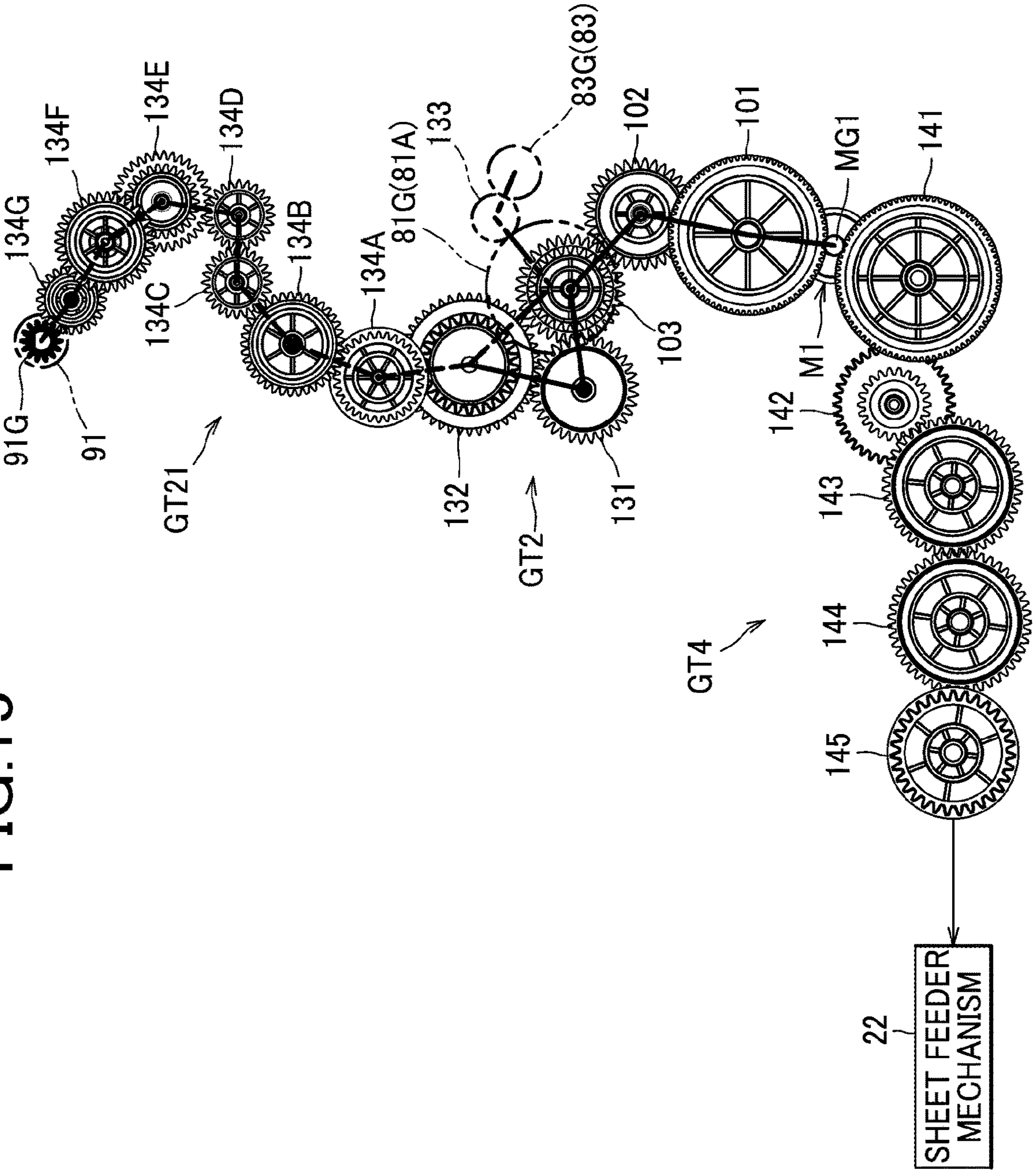

134G
134F
134E
134D
133
83G(83)
102
101
MG1
141
81G(81A)
134B
134A
134C
91G
91
GT21
103
M1
142
132
131
GT2
143
144
GT4
145
22
SHEET FEEDER
MECHANISM

FIG.16A

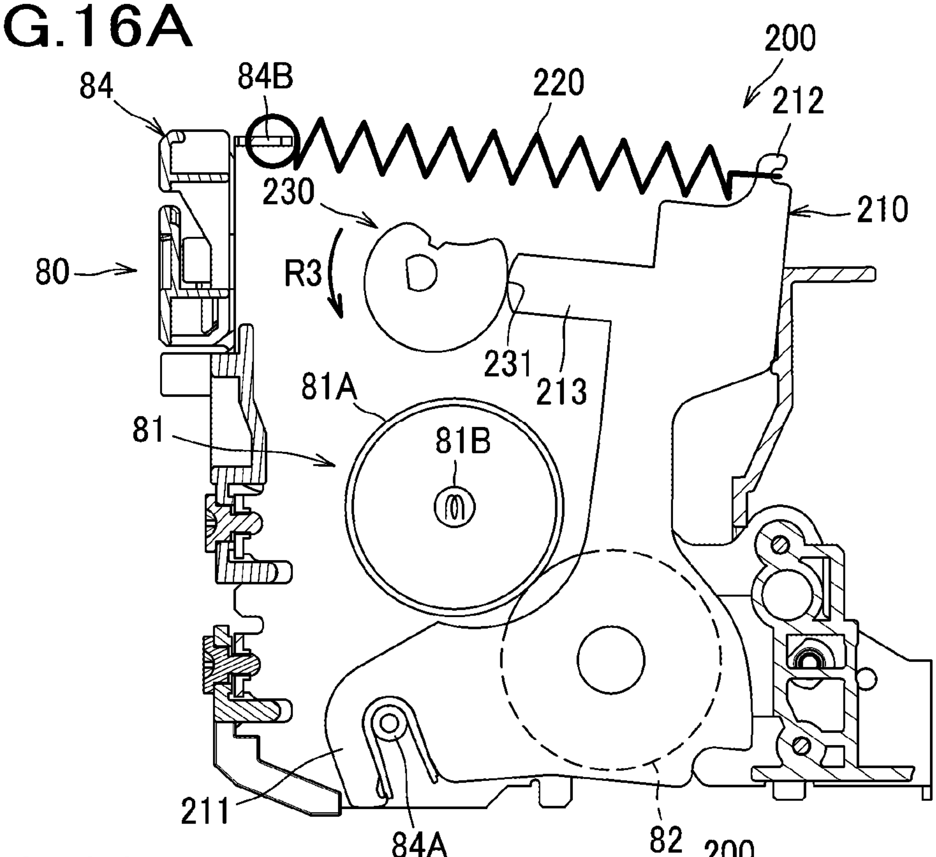


FIG.16B

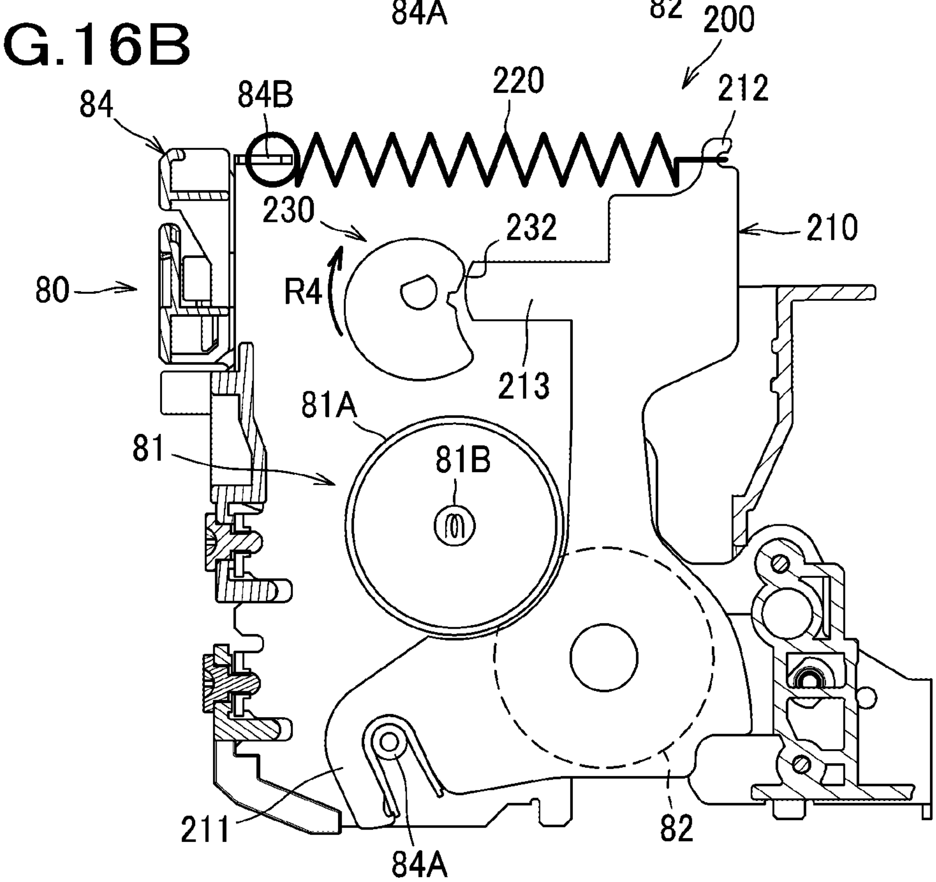


FIG.17

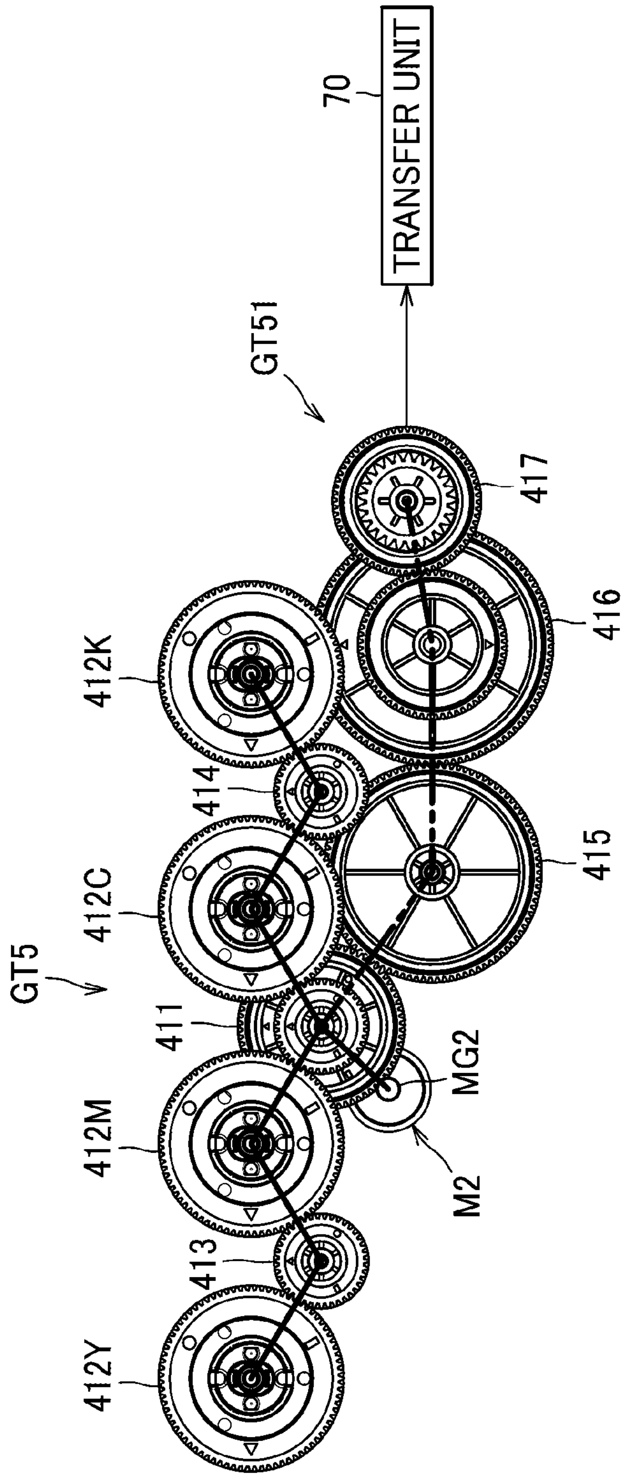

70
TRANSFER UNIT
GT51
417
416
412K
414
415
412C
GT5
411
MG2
412M
M2
413
412Y

FIG.18

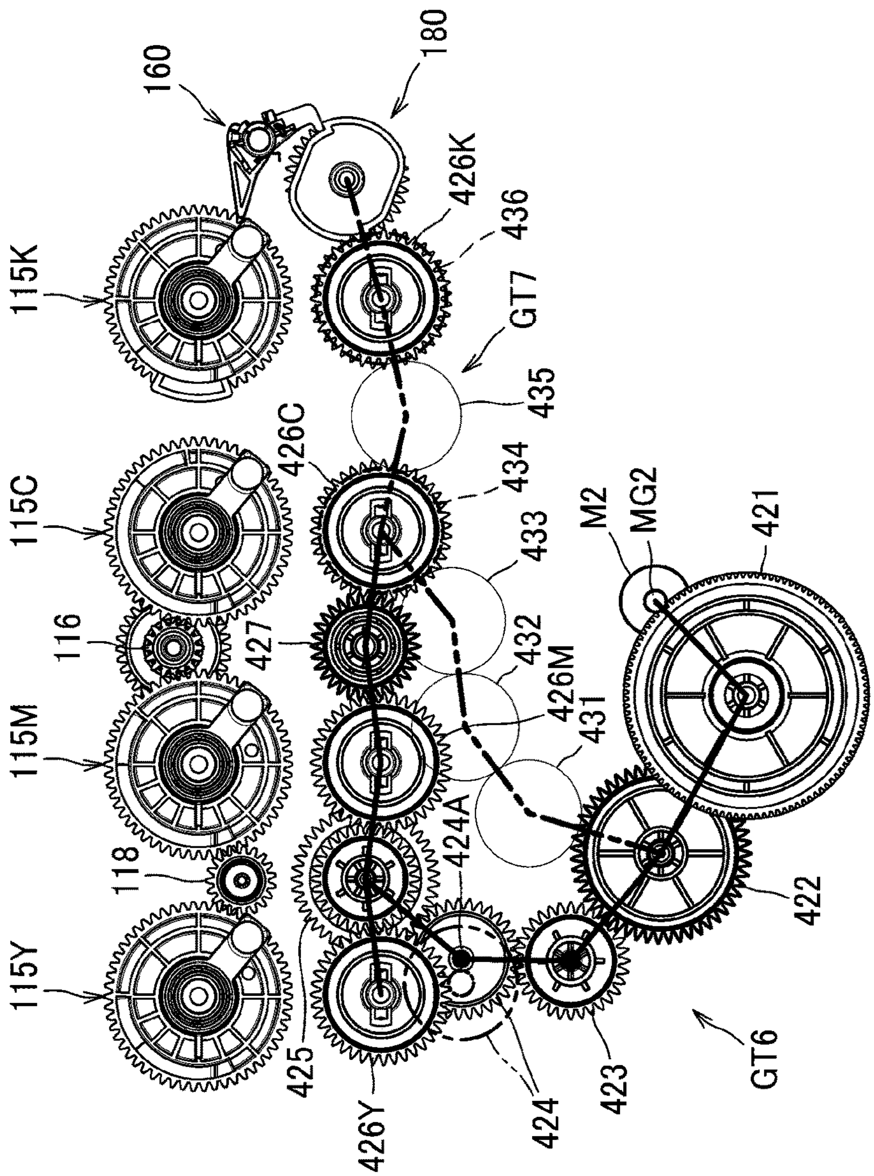

160
180
426K
436
115K
GT7
435
426C
434
115C
433
M2
MG2
421
116
427
432
426M
115M
431
118
424A
422
115Y
425
424
423
GT6
426Y

FIG.19

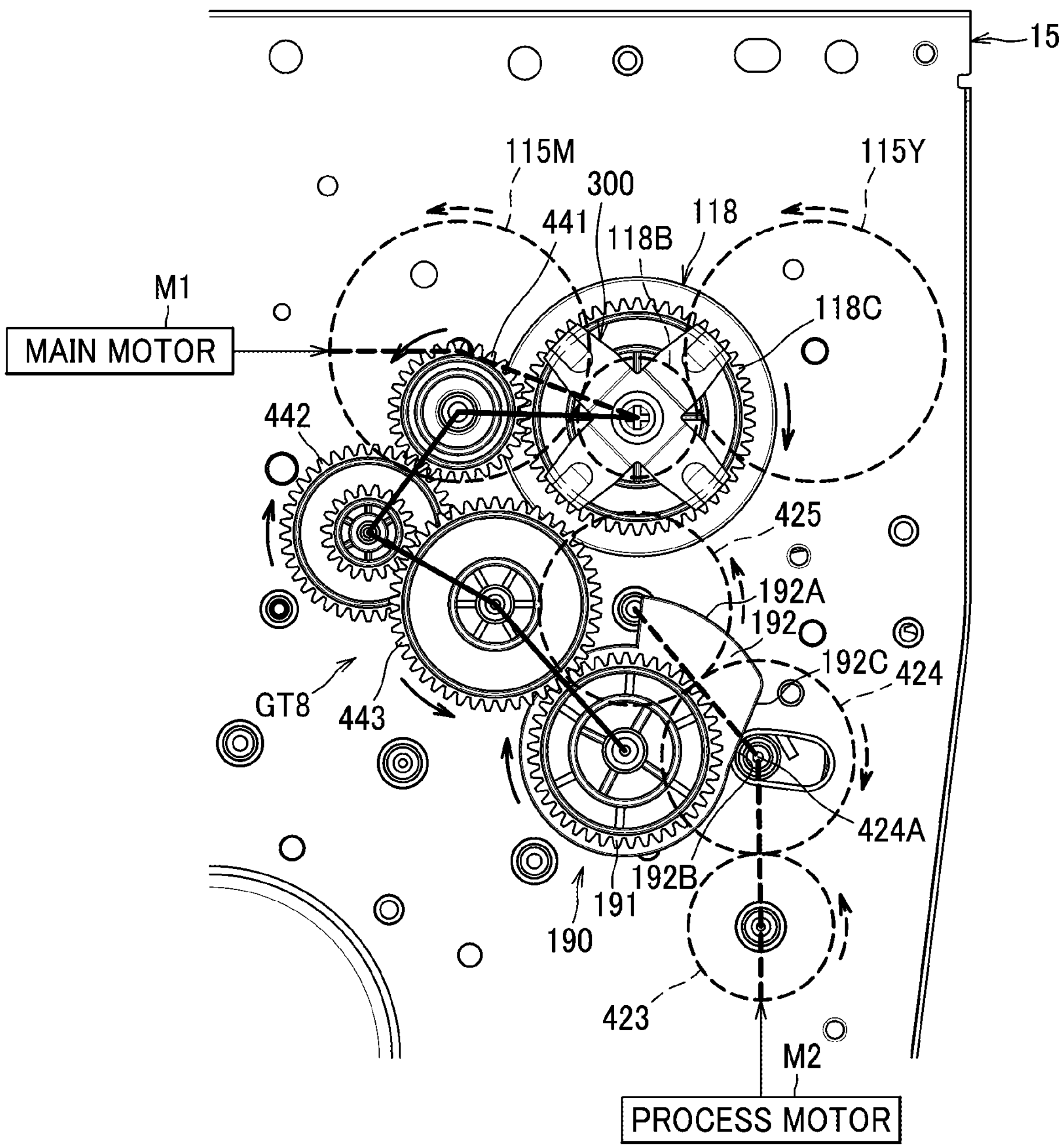
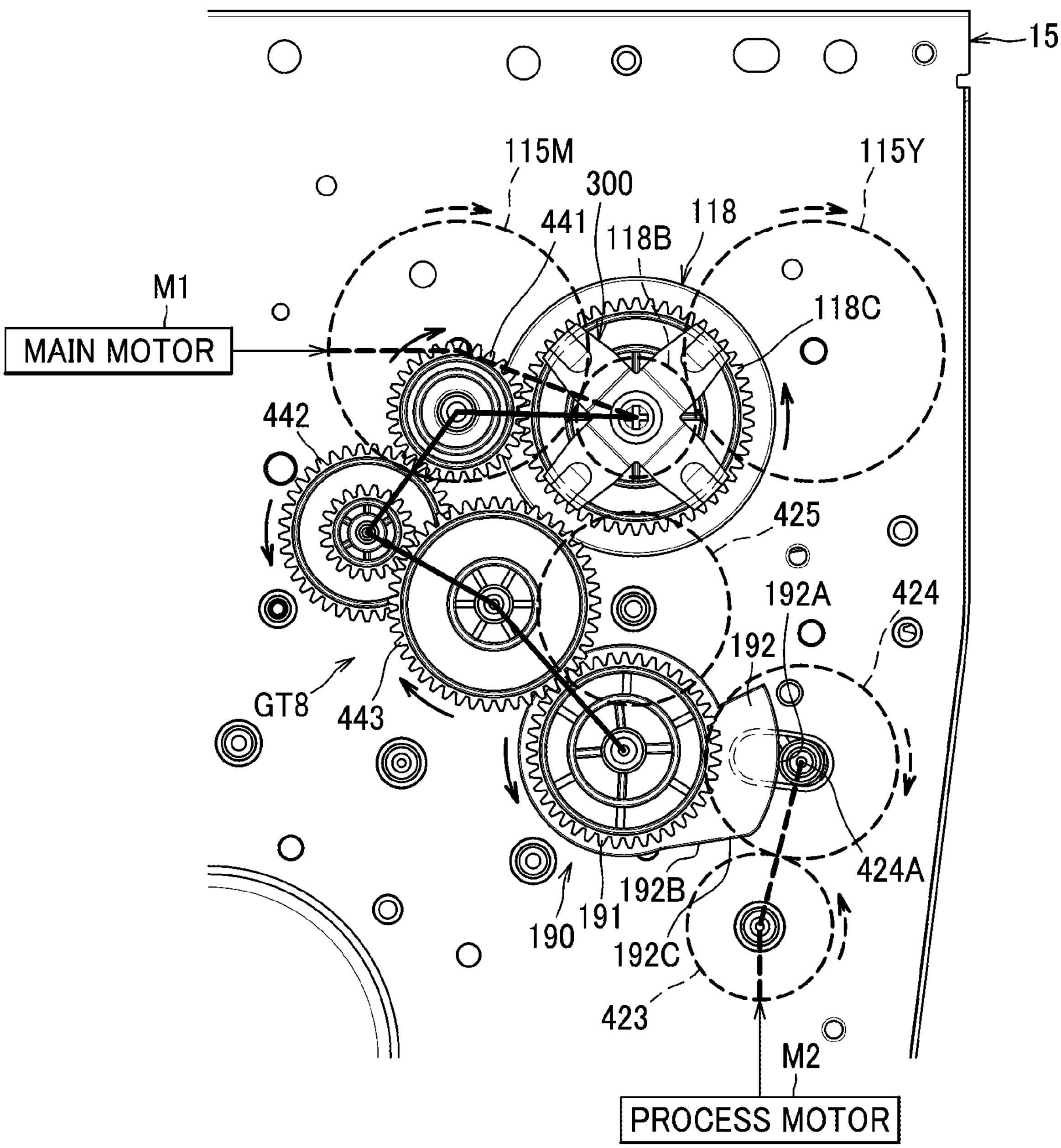

15
115M
300
115Y
441
118
118B
M1
118C
MAIN MOTOR
442
425
192A
192
192C
424
GT8
443
424A
192B
191
190
423
M2
PROCESS MOTOR

FIG.20



15
115M
300
118
115Y
441
118B
118C
M1
MAIN MOTOR
442
425
192A
424
192
GT8
443
424A
192B
191
190
192C
423
M2
PROCESS MOTOR

FIG.21A

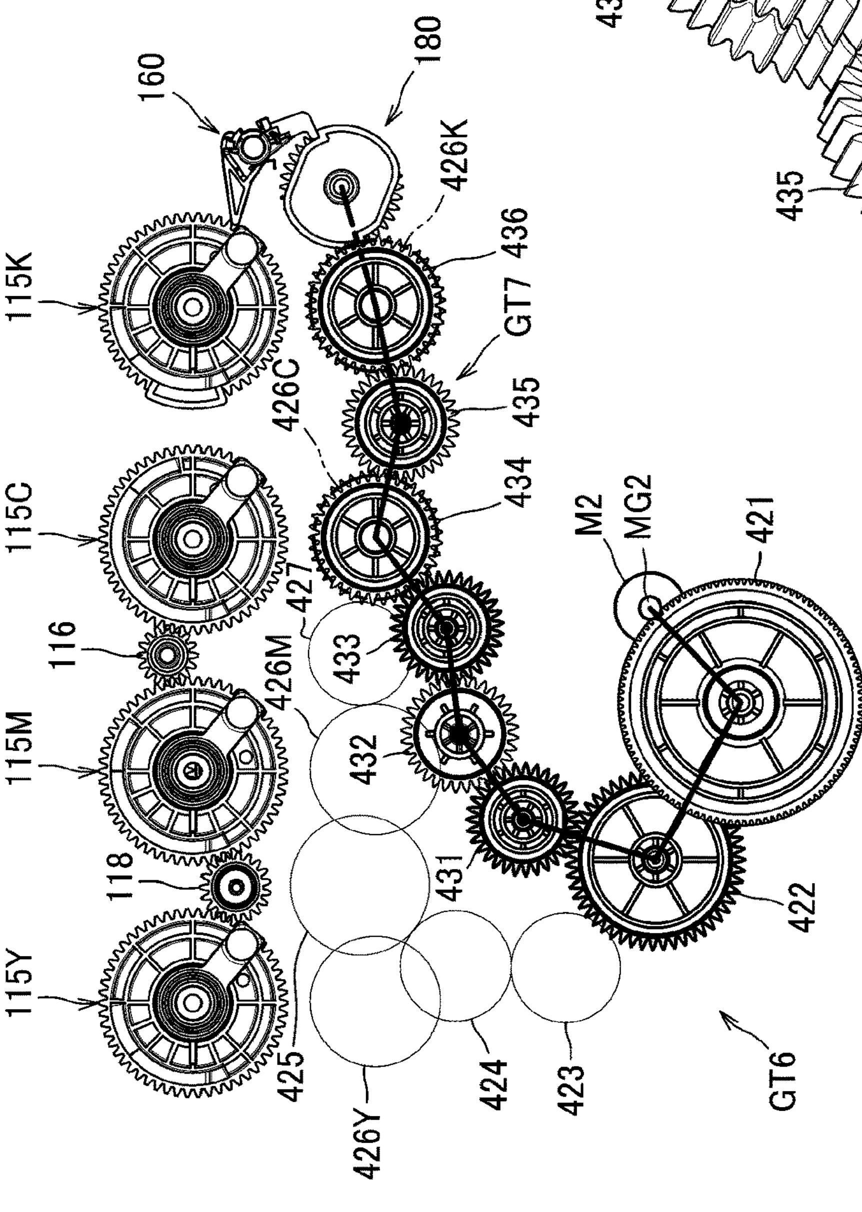


FIG.21B

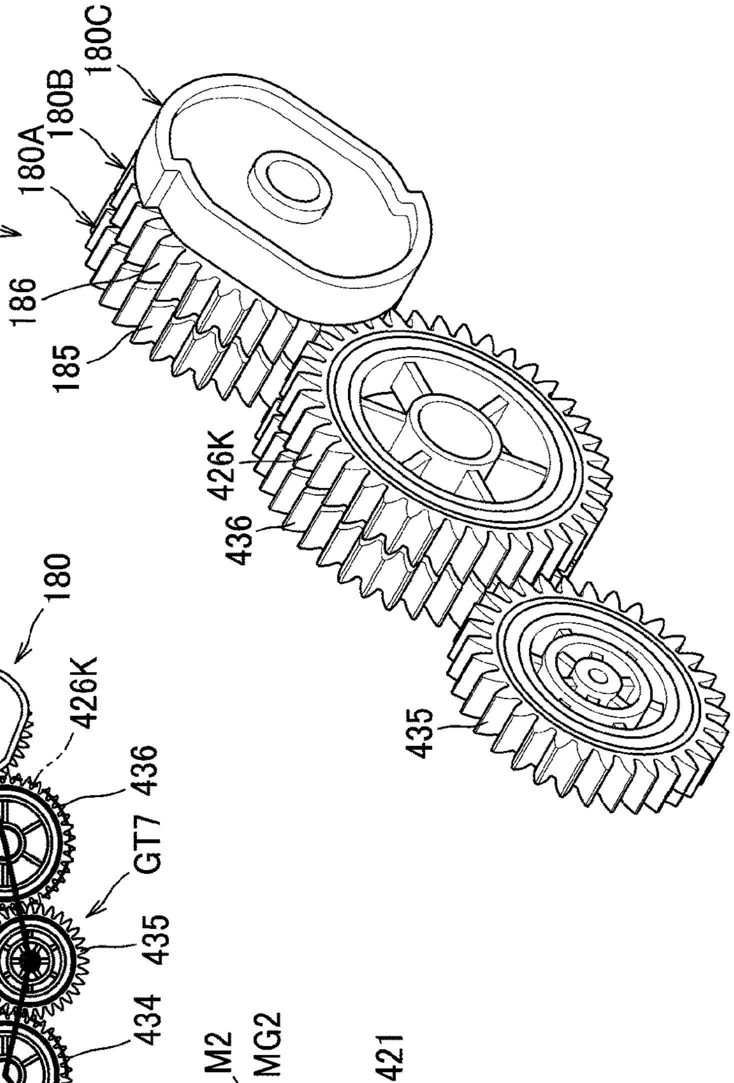


FIG.22

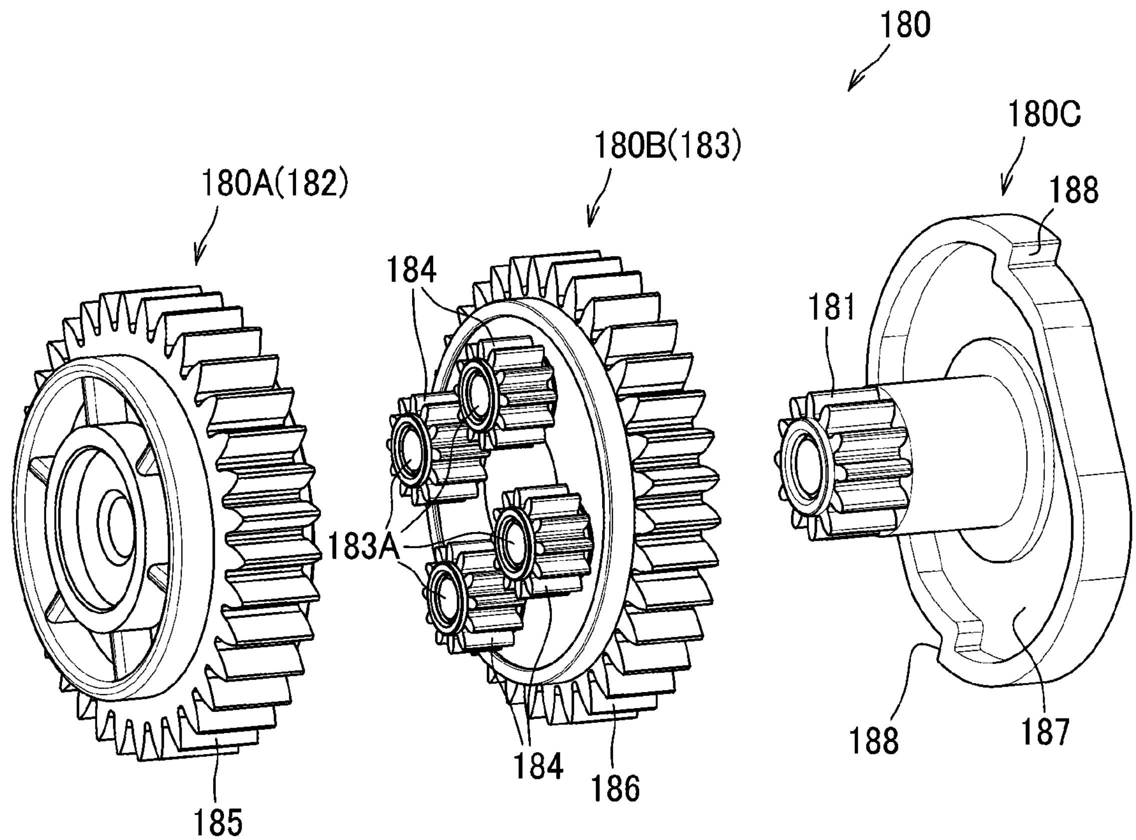


FIG.23A

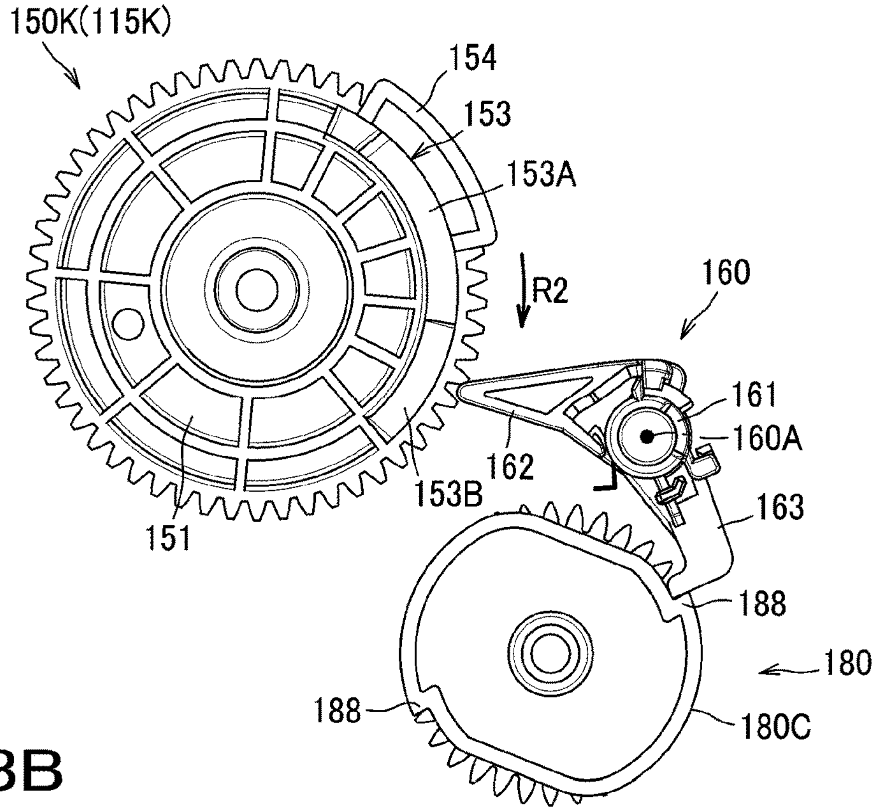


FIG.23B

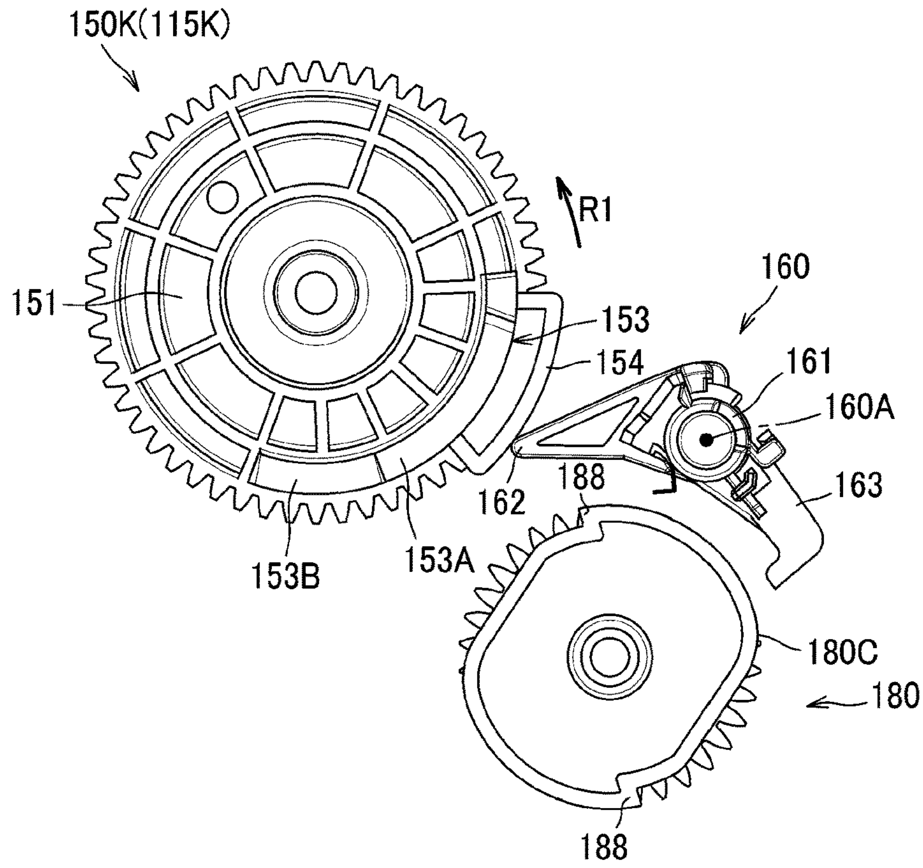


FIG.24

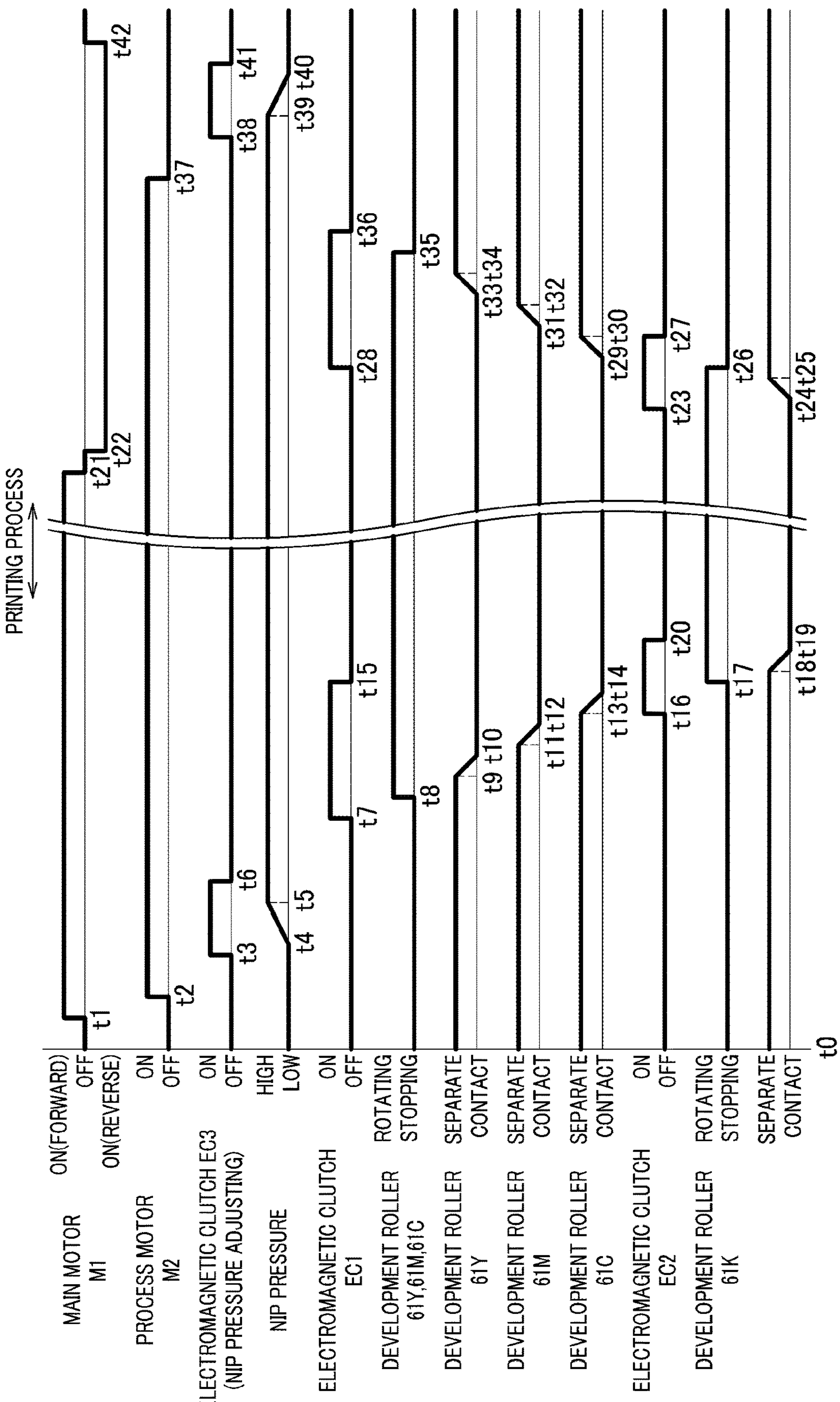

PRINTING PROCESS
MAIN MOTOR M1
ON(FORWARD)
OFF
ON(REVERSE)
PROCESS MOTOR M2
ON
OFF
ELECTROMAGNETIC CLUTCH EC3 (NIP PRESSURE ADJUSTING)
ON
OFF
NIP PRESSURE
HIGH
LOW
ELECTROMAGNETIC CLUTCH EC1
ON
OFF
DEVELOPMENT ROLLER 61Y,61M,61C
ROTATING
STOPPING
DEVELOPMENT ROLLER 61Y
SEPARATE
CONTACT
DEVELOPMENT ROLLER 61M
SEPARATE
CONTACT
DEVELOPMENT ROLLER 61C
SEPARATE
CONTACT
ELECTROMAGNETIC CLUTCH EC2
ON
OFF
DEVELOPMENT ROLLER 61K
ROTATING
STOPPING
SEPARATE
CONTACT
t0
t1
t2
t3
t4
t5
t6
t7
t8
t9 t10
t11t12
t13t14
t15
t16
t17
t18t19
t20
t21
t22
t23
t24t25
t26
t27
t28
t29t30
t31t32
t33t34
t35
t36
t37
t38
t39 t40
t41
t42

IMAGE FORMING APPARATUS HAVING SEPARATION GEAR TRAIN, FIXING GEAR TRAIN AND ADJUSTING GEAR TRAIN OPERATED BY A COMMON MOTOR

REFERENCE TO RELATED APPLICATIONS

This application claims priority from Japanese Patent Application Nos. 2023-011103, 2023-011104, 2023-011105, and 2023-011106 filed on Jan. 27, 2023. The entire contents of the priority applications are incorporated herein by reference.

BACKGROUND ART

An image forming apparatus including a first cam configured to cause a development roller to be located selectively in contact with and apart from a photosensitive drum, and a second cam configured to switch a nip pressure of a heating roller and a pressure roller of a fixing device is known in the art.

An image forming apparatus including a first photosensitive drum, a second photosensitive drum located upstream of the first photosensitive drum in a sheet conveyance direction, a first development roller configured to supply toner to the first photosensitive drum, a second development roller configured to supply toner to the second photosensitive drum, and a separation mechanism is also known in the art. The separation mechanism is configured to cause the first development roller to move between a contact position in which the first development roller is in contact with the first photosensitive drum and a separate position in which the first development roller is separate from the first photosensitive drum, and to cause the second development roller to move between a contact position in which the second development roller is in contact with the second photosensitive drum and a separate position in which the second development roller is separate from the second photosensitive drum. In this image forming apparatus, the second development roller moves from the contact position to the separate position when the first development roller is located in the contact position.

An image forming apparatus including development rollers for multiple colors, a development roller for black, a process motor, and a gear train configured to transmit a driving force of the process motor to the development rollers for multiple colors is also known in the art. In this image forming apparatus, the gear train is located upstream of the development rollers for multiple colors, and a moving gear configured to swing to a transmit position in which the driving force is transmitted and to a disconnect position in which the transmission of the driving force is disconnected is provided.

An image forming apparatus including a cam rotatable about an axis parallel to a rotation axis of the development roller configured to thereby cause the development roller to move between a contact position in which the development roller is in contact with the photosensitive drum and a separate position in which the development roller is separate from the photosensitive drum, and a cam follower slidable in a direction parallel to the rotation axis, is known in the art. In this image forming apparatus, the cam follower slides according to the rotation of the cam, pushes a development cartridge including the development roller to move the development roller from the contact position to the separate position, and separates from the development cartridge, thereby causing the development roller to move from the separate position to the contact position.

SUMMARY

In an image forming apparatus, reducing the number of motors is desirable.

Thus, the development roller, a fixing device, and a fixing device, being operated by one motor is desirable.

Also, when a toner image is being transferred from a first photosensitive drum to a sheet under a state in which a first development roller is located in the contact position, a position of a sheet may be shifted undesirably due to an undesirable shift of the position of a second photosensitive drum by a second development roller moving from a contact position to a separate position. Also, the position of the first photosensitive drum may be shifted undesirably when an impact that occurs by the second development roller moving from the contact position to the separate position is transmitted to the first photosensitive drum. Therein, the relative positions of the sheet and the first photosensitive drum are shifted undesirably, and the image quality is degraded.

Thus, the second development roller not moving from the contact position to the separate position while the first development roller is located in the contact position is desirable.

Also an image forming apparatus may include a member for moving the moving gear to control the position of the moving gear. The design of the shape of such a member for moving the moving gear may desirably have a high degree of freedom is desirable.

Thus, increasing the degree of freedom of the design of the shape of the member for moving the moving gear is desirable.

Also, if a backlash of a gear for transmitting a driving force to a cam is large, the cam follower may slide suddenly when the development roller starts moving from the separate position to the contact position.

Thus, restraining a sudden slide of a cam follower is desirable.

In one aspect, an image forming apparatus comprises a first photosensitive drum, a first development roller, a first separation cam, a fixing device, an adjusting cam, a main motor, a separation gear train, a fixing gear train, and an adjusting gear train.

The first development roller is movable relative to the first photosensitive drum between a contact position in which the first development roller is in contact with the first photosensitive drum and a separate position in which the first development roller is separate from the first photosensitive drum.

The first separation cam is configured to move the first development roller between the contact position and the separate position when receiving a driving force.

The fixing device comprises a heating portion and a pressure portion. The fixing device is configured to convey a sheet nipped between the heating portion and the pressure portion upon receipt of a driving force.

The adjusting cam is configured to switch a nip pressure to be produced by the heating portion and the pressure portion between a first nip pressure and a second nip pressure higher than the first nip pressure when receiving of a driving force.

The separation gear train is configured to transmit a driving force of the main motor to the first separation cam.

The fixing gear train is configured to transmit the driving force of the main motor received from the separation gear train to the fixing device.

The adjusting gear train is configured to transmit the driving force of the main motor received from the separation gear train to the adjusting cam.

With this image forming apparatus comprising the separation gear train, the fixing gear train, and the adjusting gear train, the development roller, the fixing device, and the adjusting cam can be operated by one motor.

The fixing gear train may comprise an output gear and a moving gear.

The output gear outputs the driving force to the fixing device.

The moving gear is capable of being moved, when receiving a driving force from the main motor, between a transmit position in which the moving gear is engaged with the output gear and a disconnect position in which the moving gear is disengaged from the output gear.

By the use of the moving gear for switching the transmission and disconnection of the driving force of the main motor to the fixing device, the cost can be reduced.

The main motor may be a motor rotatable in forward and reverse directions, and the image forming apparatus may be configured such that the moving gear is located in the transmit position when the main motor rotates in the forward direction, and is located in the disconnect position when the main motor rotates in the reverse direction.

By locating the moving gear in the transmit position when the main motor rotates in the forward direction, the fixing device is made able to convey a sheet. By locating the moving gear in the disconnect position when the main motor rotates in the reverse direction, the driving force of the main motor can be stopped from being transmitted to the fixing gear.

The image forming apparatus may be configured to further comprise an electromagnetic clutch switchable to a transmit state in which the driving force of the main motor is transmitted from the separation gear train to the adjusting gear train, and a disconnect state in which the driving force of the main motor is not transmitted from the separation gear train to the adjusting gear train.

The adjusting gear train may include a clutch connecting gear configured to rotate when the electromagnetic clutch is in the transmit state. The clutch connecting gear rotates about an axis that is coaxial with an axis of a gear included in the separation gear train.

With the clutch connecting gear rotating about the axis that is coaxial with the axis of the gear included in the separation gear train, the gear train can be arranged more compactly.

The first separation cam may be configured to move the first development roller between the contact position and the separate position when receiving a driving force.

The image forming apparatus may be configured to comprise a first development cartridge and a first cam follower.

The first development cartridge includes the first development roller, the first development cartridge being movable relative to the first photosensitive drum between a first position in which the first development roller is located in the contact position, and a second position in which the first development roller is located in the separate position.

The first cam follower is slidable according to rotation of the first separation cam, in a direction parallel to a rotation axis of the first separation cam between a push position in which the first cam follower pushes and causes the first development cartridge to be located in the second position and a no-push position in which the first development cartridge is located in the first position.

The image forming apparatus may be configured such that the main motor is rotatable in forward and reverse direction, and the first separation cam is configured to move the first development roller from the separate position to the contact position when the main motor rotates in the forward direction, and move the first development roller from the contact position to the separate position when the main motor rotates in the reverse direction.

With the separation cam used by switching the rotation direction, the shape of the separation cam can be designed more freely. The separation cam can also be made smaller in size, and the image forming apparatus can be made smaller in size.

The moving gear may be configured to be located in the transmit position when the main motor rotates in the forward direction and located in the disconnect position when the main motor rotates in the reverse direction.

By locating the moving gear in the transmit position when the main motor rotates in the forward direction, the sheet can be conveyed by the fixing device. Also, by locating the moving gear in the disconnect position when the main motor rotates in the reverse direction, the driving force of the main motor can be stopped from being transmitted to the fixing device.

The image forming apparatus may be configured such that the heating portion includes a heating roller, and the pressure portion is a pressure roller configured to nip a sheet between the heating roller and the pressure roller. The fixing gear train may be configured to transmit the driving force of the main motor received from the separation gear train to the heating roller.

The image forming apparatus may be configured to comprise a sheet feeder mechanism configured to feed a sheet to the first photosensitive drum upon receipt of a driving force, a sheet feeder gear train configured to transmit the driving force of the main motor to the sheet feeder mechanism, and a motor gear provided on an output shaft of the main motor. The motor gear is engaged with a gear included in the separation gear train and a gear included in the sheet feeder gear train.

With the motor gear being engaged with both the gear included in the separation gear train and the gear included in the sheet feeder gear train, the driving force of the main motor can be directly transmitted to both the separation gear train and the sheet feeder gear train.

The image forming apparatus may further comprise a process motor configured to drive the first photosensitive drum and the first development roller.

The image forming apparatus may further comprise an ejection roller configured to eject a sheet conveyed out from between the heating portion and the pressing portion upon receipt of the driving force of the main motor from the fixing gear train.

With the ejection roller configured to receive the driving force of the main motor from the fixing gear train, the ejection roller can be driven by the main motor.

The image forming apparatus may further comprise a second photosensitive drum, a second development roller, and a second separation cam.

The second development roller is movable relative to the second photosensitive drum between a contact position in which the second development roller is in contact with the second photosensitive drum and a separate position in which the second development roller is separate from the second photosensitive drum.

The second separation cam is configured to move the second development roller between the contact position and the separate position when receiving a driving force.

The first separation cam is configured to receive a driving force to rotate and move the first development roller between the contact position and the separate position, and the second separation cam is configured to receive a driving force to rotate and move the second development roller between the contact position and the separate position. The separation gear train may include a first separation gear train configured to transmit the driving force of the main motor to the first separation cam, and a second separation gear train configured to transmit the driving force of the main motor received from the first separation gear train to the second separation cam.

In another aspect, an image forming apparatus is disclosed herein which comprises a first photosensitive drum, a first development roller, a first separation cam, a fixing device, an adjusting cam, a main motor, a separation gear train, a fixing gear train, and an adjusting gear train.

The first development roller is movable relative to the first photosensitive drum between a contact position in which the first development roller is in contact with the first photosensitive drum and a separate position in which the first development roller is separate from the first photosensitive drum.

The first separation cam is configured to move the first development roller between the contact position and the separate position when receiving a driving force.

The fixing device comprises a heating roller and a pressure roller. The fixing device may be configured to convey a sheet nipped between the heating roller and the pressure roller when receiving a driving force.

The adjusting cam is configured to switch a nip pressure to be produced by the heating roller and the pressure roller between a first nip pressure and a second nip pressure higher than the first nip pressure when receiving a driving force.

The separation gear train is configured to transmit a driving force of the main motor to the first separation cam.

The fixing gear train is configured to transmit the driving force of the main motor received from the separation gear train to the fixing device.

The adjusting gear train is configured to transmit the driving force of the main motor received from the separation gear train to the adjusting cam.

With this image forming apparatus comprising the separation gear train, the fixing gear train, and the adjusting gear train, contact and separation of the development roller, drive of the fixing device, and the switching of the adjusting cam can be operated by one motor.

The image forming apparatus may further comprise a second photosensitive drum, a second development roller, a separation mechanism, and a controller.

The second photosensitive drum is located downstream of the first photosensitive drum in a direction of conveyance of a sheet.

The second development roller is movable relative to the second photosensitive drum between a contact position in which the second development roller is in contact with the second photosensitive drum and a separate position in which the second development roller is separate from the second photosensitive drum.

The separation mechanism includes a first separation cam configured to rotate and thereby cause the first development roller to move between the contact position and the separate position, and a second separation cam configured to rotate and thereby cause the second development roller to move between the contact position and the separate position.

In this instance, the controller may be configured to exercise control over the separation mechanism such that while the first development roller is located in the contact position, the second development roller located in the separate position is moved from the separate position to the contact position, and thereafter moved from the contact position to the separate position.

Because the first development roller located in the separate position is moved from the separate position to the contact position and thereafter the moved from the contact position to the separate position, while the second development roller is located in the contact position, the second development roller does not move from the contact position to the separate position while the first development roller is located in the contact position.

The controller may be configured to exercise control over the separation mechanism such that the first development roller is moved from the separate position to the contact position and thereafter the second development roller is moved from the separate position to the contact position. The controller may be also configured to exercise control over the separation mechanism such that the second development roller is moved from the contact position to the separate position, and thereafter the first development roller is moved from the contact position to the separate position.

The main motor may be a motor that drives the separation mechanism and is configured to rotate in forward and reverse directions.

In this instance, when the main motor rotates in the forward direction, the controller exercises control over the separation mechanism such that the first development roller is moved from the separate position to the contact position, and thereafter the second development roller is moved from the separate position to the contact position, and when the main motor rotates in the reverse direction, the controller exercises control over the separation mechanism such that the second development roller is moved from the contact position to the separate position, and thereafter the first development roller is moved from the contact position to the separate position.

Because the rotation direction of the separation cam of the separation mechanism is switchable depending on the direction (forward or reverse) of the main motor, the shape of the separation cam can be designed more freely. The separation cam can also be made smaller in size. Therefore, the image forming apparatus can be made smaller in size.

The image forming apparatus may be configured to further comprise a first development cartridge and a second development cartridge, and the separation mechanism may comprise a first cam follower and a second cam follower.

The first development cartridge includes the first development roller, and is movable relative to the first photosensitive drum between a first position in which the first development roller is located in the contact position and a second position in which the first development roller is located in the separate position.

The second development cartridge includes the second development roller, and is movable relative to the second photosensitive drum between a first position in which the second development roller is located in the contact position and a second position in which the second development roller is located in the separate position.

The first cam follower is configured to slide, according as the first separation cam rotates, in a direction parallel to a rotation axis of the first separation cam, between a push position in which the first cam follower presses and causes the first development cartridge to be located in the second position and a no-push position in which the first development cartridge is located in the first position.

The second cam follower is configured to slide, according as the second separation cam rotates in a direction parallel to a rotation axis of the second separation cam, between a push position in which the second cam follower presses and causes the second development cartridge to be located in the second position and a no-push position in which the second development cartridge is located in the first position.

In yet another aspect, an image forming apparatus disclosed herein comprises a first photosensitive drum, a second photosensitive drum, a first development roller, a second development roller, a separation mechanism, and a controller.

The second photosensitive drum is located upstream of the first photosensitive drum in a sheet conveyance direction.

The first development roller is movable relative to the first photosensitive drum between a contact position in which the first development roller is in contact with the first photosensitive drum and a separate position in which the first development roller is separate from the first photosensitive drum.

The second development roller is movable relative to the second photosensitive drum between a contact position in which the second development roller is in contact with the second photosensitive drum and a separate position in which the second development roller is separate from the second photosensitive drum.

The separation mechanism includes a first separation cam configured to rotate and thereby cause the first development roller to move between the contact position and the separate position, and a second separation cam configured to rotate and thereby cause the second development roller to move between the contact position and the separate position.

The controller is configured to exercise control over the separation mechanism such that while the second development roller is located in the contact position, the first development roller located in the separate position is moved from the separate position to the contact position, and thereafter moved from the contact position to the separate position.

Because the first development roller located in the separate position is moved from the separate position to the contact position and thereafter the moved from the contact position to the separate position, while the second development roller is located in the contact position, the second development roller does not move from the contact position to the separate position while the first development roller is located in the contact position.

The controller may be configured to exercise control over the separation mechanism such that the second development roller is moved from the separate position to the contact position and thereafter the first development roller is moved from the separate position to the contact position. The controller may be also configured to exercise control over the separation mechanism such that the first development roller is moved from the contact position to the separate position, and thereafter the second development roller is moved from the contact position to the separate position

The image forming apparatus may further comprise a main motor that drives the separation mechanism. The main motor is configured to rotate in forward and reverse directions.

In this instance, the controller may be configured to exercise control over the separation mechanism such that when the main motor rotates in the forward direction, the first development roller is moved from the separate position to the contact position, and thereafter the second development roller is moved from the separate position to the contact position, and when the main motor rotates in the reverse direction, the second development roller is moved from the contact position to the separate position, and thereafter the first development roller is moved from the contact position to the separate position.

Because the rotation direction of the separation cam of the separation mechanism is switchable depending on the direction (forward or reverse) of the main motor, the shape of the separation cam can be designed more freely. The separation cam can also be made smaller in size. Therefore, the image forming apparatus can be made smaller in size.

The image forming apparatus may be configured to further comprise a first development cartridge and a second development cartridge, and the separation mechanism may further comprise a first cam follower and a second cam follower.

The first development cartridge includes the first development roller, and is movable relative to the first photosensitive drum between a first position in which the first development roller is located in the contact position and a second position in which the first development roller is located in the separate position.

The second development cartridge includes the second development roller, and is movable relative to the second photosensitive drum between a first position in which the second development roller is located in the contact position and a second position in which the second development roller is located in the separate position.

The first cam follower is configured to slide, according as the first separation cam is rotated, in a direction parallel to a rotation axis of the first separation cam, between to be located in the second position and a no-push position in which the first development cartridge is located in the first position.

The second cam follower is configured to slide, according as the second separation cam is rotated in a direction parallel to a rotation axis of the second separation cam, between a push position in which the second cam follower pushes and causes the second development cartridge to be located in the second position and a no-push position in which the second development cartridge is located in the first position.

The first separation cam may include a first cam portion protruding in a direction parallel to a rotation axis of the first separation cam and the second separation cam may include a second cam portion protruding in a direction parallel to a rotation axis of the second separation cam.

The first cam portion has a first retaining surface configured to retain the first cam follower in the push position, and a first guide surface configured to guide the first cam follower between the push position and the no-push position, the first guide surface being inclined with respect to a plane perpendicular to a rotation axis of the first separation cam.

The second cam portion has a second retaining surface configured to retain the second cam follower in the push position, and a second guide surface configured to guide the second cam follower between the push position and the no-push position, the second guide surface being inclined with respect to a plane perpendicular to a rotation axis of the second separation cam.

The controller is configured to execute a printing process in a first printing mode in which an image is formed on a sheet using both the first development roller and the second development roller, and a second printing mode in which image is formed on a sheet using only the first development roller. The controller in the first printing mode is configured to exercise control over the separation mechanism such that the second development roller is moved from the separate position to the contact position, and thereafter the first development roller is moved from the separate position to the contact position. The controller may also be configured to exercise control over the separation mechanism such that the first development roller is moved from the contact position to the separate position, and thereafter the second development roller is moved from the contact position to the separate position.

When executing a printing process in the first printing mode, the time for which the first development roller (i.e., the development roller more frequently used because the first development roller is used in both the first printing mode and the second printing mode) is in contact with the first photosensitive drum can be made shorter in that the first development roller contacts the first photosensitive drum after the second development roller contacts the second photosensitive drum and the first development roller separates from the first photosensitive drum before the second development roller separates from the second photosensitive drum. Thus, the toner used in the first development roller and the first development roller can be made long-lasting.

The image forming apparatus may be configured to further comprise a main motor, a first electromagnetic clutch, and a second electromagnetic clutch.

The controller is configured to exercise control over the first electromagnetic clutch to switch to a transmit state in which a driving force from the main motor is transmitted to the first separation cam and to a disconnect state in which the driving force from the main motor is not transmitted to the first separation cam.

The controller is configured to exercise control over the second electromagnetic clutch to switch to a transmit state in which the driving force from the main motor is transmitted to the second separation cam and to a disconnect state in which the driving force from the main motor is not transmitted to the second separation cam.

The first electromagnetic clutch regulates the motion of the first separation cam and the second electromagnetic clutch regulates the motion of the second separation cam, such that the contact and separation of each development roller can be controlled more precisely.

The image forming apparatus may be configured to further comprise a main motor and a third electromagnetic clutch.

The controller is configured to exercise control over the third electromagnetic clutch to switch to a transmit state in which a driving force of the main motor is transmitted to the first separation cam and the second separation cam, and a disconnect state in which the driving force of the main motor is not transmitted to the first separation cam and the second separation cam.

The third electromagnetic clutch regulates the motion of the first separation cam and the second separation cam, the cost can be reduced.

The image forming apparatus may further comprise a fixing device for fixing a toner image transferred to a sheet, and a fixing gear train configured to transmit a driving force of the main motor to the fixing device.

The fixing gear train may comprise an output gear and a moving gear.

The output gear outputs the driving force to the fixing device.

The moving gear is a gear capable of being moved, when receiving a driving force, relative to the output gear between a transmit position in which the moving gear is engaged with the output gear and a disconnect position in which the moving gear is disengaged from the output gear.

The moving gear is located in the transmit position when the main motor rotates in the forward direction, and located in the disconnect position when the main motor rotates in the reverse direction.

With this configuration in which the moving gear is located in the disconnect position when the main motor rotates in the reverse direction, the driving force of the main motor is not transmitted to the fixing device.

The image forming apparatus may further comprise a fixing gear, an adjusting cam, and a fourth electromagnetic clutch.

The fixing device may comprise a heating portion and a pressure portion. The fixing device may be configured to convey a sheet nipped between the heating portion and the pressure portion when receiving a driving force.

The adjusting cam may be configured to switch a nip pressure to be produced by the heating portion and the pressure portion between a first nip pressure and a second nip pressure higher than the first nip pressure.

The fourth electromagnetic clutch is configured to switch to a transmit state in which a driving force from the main motor is transmitted to the adjusting cam, and a disconnect state in which the driving force from the main motor can be interrupted so as not to be transmitted to the adjusting cam.

With this configuration in which the fourth electromagnetic clutch is in the disconnect state when the main motor rotates in the reverse direction, the driving force of the main motor is not transmitted to the adjusting cam.

The image forming apparatus may be further configured to comprise a third photosensitive drum, a fourth photosensitive drum, a third development roller, and a fourth development roller. The separation mechanism may be configured to further include a third separation cam and a fourth separation cam.

The third photosensitive drum is located upstream of the second photosensitive drum in the direction of conveyance of a sheet.

The fourth photosensitive drum is located upstream of the third photosensitive drum in the direction of conveyance of a sheet.

The third development roller is movable relative to the third photosensitive drum between a contact position in which the third development roller is in contact with the third photosensitive drum and a separate position in which the third development roller is separate from the third photosensitive drum.

The fourth development roller is movable relative to the fourth photosensitive drum between a contact position in which the fourth development roller is in contact with the fourth photosensitive drum and a separate position in which the fourth development roller is separate from the fourth photosensitive drum.

The third separation cam is configured to rotate and thereby cause the third development roller to move between the contact position and the separate position.

The fourth separation cam is configured to rotate and thereby cause the fourth development roller to move between the contact position and the separate position.

In this instance, the controller is configured to exercise control over the separation mechanism such that the fourth, third, second and first development rollers each located in the corresponding separate position are moved to the corresponding contact position one after another in this order. The controller is also configured to exercise control over the separation mechanism such that the first, second, third and fourth development rollers each located in the corresponding contact position are moved from to the separate position one after another in this order.

The image forming apparatus may be configured to comprise a housing having an opening and a drawer.

The drawer is movable through the opening of the housing between an inside position in which the drawer is installed in the housing and an outside position in which at least a part of the drawer is exposed. The drawer includes a frame by which the first development cartridge and the second development cartridge in a manner that permits each of the cartridges to be installed therein and removed therefrom.

The frame may be configured to support the first photosensitive drum and the second photosensitive drum in a manner that renders each of the photosensitive drums rotatable.

In yet another aspect, an image forming apparatus comprises a first photosensitive drum, a first development roller, a process motor, a first development roller gear train, a first separation cam, and a main motor.

The first development roller is movable relative to the first photosensitive drum between a contact position in which the first development roller is in contact with the first photosensitive drum and a separate position in which the first development roller is separate from the first photosensitive drum.

The process motor drives the first photosensitive drum and the first development roller.

The first development roller gear train transmits the driving force of the process motor to the first development roller.

The first separation cam is configured to rotate and thereby cause the first development roller to move between the contact position and the separate position.

The main motor is a motor that drives the first separation cam and is rotatable in forward and reverse directions.

The first development roller gear train includes a first output gear and a moving gear.

The first output gear outputs a driving force to the first development roller.

The moving gear is a gear capable of being moved, when receiving a driving force from the process motor, between a first transmit position in which the moving gear is engaged with the first output gear and a first disconnect position in which the moving gear is disengaged from the first output gear.

The image forming apparatus may further comprise a switching cam configured to rotate when receiving the driving force, between a first phase in which the moving gear is located in the first disconnect position, and a second phase in which the moving gear is located in the first transmit position.

When the main motor rotates in the forward direction, the switching cam rotates from the first phase to the second phase to move the moving gear from the first disconnect position to the first transmit position. When the main motor rotates in the reverse direction, the switching cam rotates, from the second phase to the first phase to move the moving gear from the first transmit position to the first disconnect position.

With this configuration in which the switching cam as a member for moving the moving cam moves the moving gear to the transmit position when the main motor rotates in the forward direction, and moves the moving gear to the disconnect position when the main motor rotates in the reverse direction, the shape of the switching cam can be designed more freely. The switching cam can also be made smaller in size.

The image forming apparatus may further comprise a separation gear train configured to transmit a driving force of the main motor to the first separation cam. The separation gear train may be configured to include a first cam gear having the first separation cam.

In this instance, the switching cam may be configured to receive the driving force of the main motor from the first cam gear.

With the switching cam configured to receive the driving force from the first cam gear, The gear train can be made more compact.

The separation gear train may include an idle gear configured to engage with the first cam gear, and the switching cam gear may receive the driving force of the main motor from the first cam gear via the idle gear.

The image forming apparatus may further comprise a metal sheet by which the idle gear is rotatably supported. The idle gear may include a first gear portion configured to engage with the first cam gear and a second gear portion configured to output a driving force to the switching cam.

In this instance, the first cam gear and the first gear portion is located on a first side of the metal sheet as defined by a side surface thereof facing in a direction parallel to a rotation axis of the idle gear, and the second gear portion and the switching cam are located on a second side, opposite to the first side, of the metal sheet.

With the first cam gear located on one side (first side) of the metal sheet, and the switching cam located on the other side (second side opposite to the first side) of the metal sheet, the shape and position of the switching cam can be designed more freely. The gear train can also be made more compact.

When moving the moving gear from the first disconnect position to the first transmit position, the switching cam causes the moving gear to be located in the first transmit position at a time before the first development roller is located in the contact position. When moving the moving gear from the first transmit position to the first disconnect position, the switching cam causes the moving gear to be located in the first disconnect position at a time after a time in which the first development roller is located in the separate position.

With this configuration in which the moving gear is located in the first transmit position at a time before the first development roller is located in the contact position, the first development roller can be caused to start rotating before the first development roller contacts the first photosensitive drum. Also, because the first moving gear is located in the first disconnect position at a time after the first development roller is located in the separate position, the first development roller can be caused to stop rotating after the first development roller separates from the first photosensitive drum.

The image forming apparatus may be configured to further comprise a second photosensitive drum, a second development roller, and a second separation cam.

The second photosensitive drum receives a driving force from the process motor.

The second development roller is movable relative to the second photosensitive drum between a contact position in which the second development roller is in contact with the second photosensitive drum and a separate position in which the second development roller is separate from the second photosensitive drum.

The second separation cam is configured to rotate and thereby cause the second development roller to move between the contact position and the separate position.

The image forming apparatus may be configured to further comprise a second development roller gear train and a switching lever. The second development roller gear train is configured to transmit a driving force of the process motor to the second development roller.

The second development roller gear train is a planetary gear train comprising an input element configured to receive a driving force of the process motor, an output element configured to output the driving force to the second development roller, and a transmission element configured to allow the driving force to be transmitted from the input element to the output element when rotation of the transmission element is restrained, and not allow the driving force to be transmitted from the input element to the output element when rotation of the transmission element is not restrained.

The switching lever is movable relative to the planetary gear train between a second transmit position and a second disconnect position, according to rotation of the second separation cam.

The switching lever in the second transmit position restrains the rotation of the transmit element. The switching lever in the second disconnect position does not restrain the rotation of the transmit element.

The second separation cam includes a protrusion contactable with the switching lever, the protrusion being configured to cause the switching lever to move between the second transmit state and the second disconnect state according to rotation of the second separation cam.

To cause the switching lever to move from the second disconnect position to the second transmit position, the protrusion is configured to cause the switching lever to be located in the second transmit position at a time before the second development roller is located in the contact position. To cause the switching lever to move from the second transmit position to the second disconnect position, the protrusion is configured to cause the switching lever to be located in the second disconnect position at a time after the second development roller is located in the separate position.

Because the switching lever is located in the transmit position at a time before the second development roller is located in the contact position, the second development roller can be caused to start rotating before the second development roller contacts the second photosensitive drum. Because the switching lever is located in the disconnect position at a time after the second development roller is located in the separate position, the second development roller can be cause to stop rotating after the second development roller separates from the second photosensitive drum.

The image forming apparatus may further comprise a third photosensitive drum, a third development roller, and a third separation cam, and the separation gear train may be configured to include a second cam gear having a third separation cam.

The third development roller is movable relative to the third photosensitive drum between a contact position in which the third development roller is in contact with the third photosensitive drum and a separate position in which the third development roller is separate from the third photosensitive drum.

The third separation cam is configured to rotate and thereby cause the third development roller to move between the contact position and the separate position.

In this instance, the first cam gear may be configured to receive the driving force of the main motor from the second cam gear.

The image forming apparatus may further comprise a fourth photosensitive drum, a fourth development roller, and a fourth separation cam, and the separation gear train may be configured to include a third cam gear having the fourth separation cam.

The fourth development roller is movable relative to the fourth photosensitive drum between a contact position in which the fourth development roller is in contact with the fourth photosensitive drum and a separate position in which the fourth development roller is separate from the fourth photosensitive drum.

The fourth separation cam may be configured to rotate and thereby cause the fourth development roller to move between the contact position and the separate position.

The third cam gear may engage with the idle gear.

The second development roller drive train may be configured to include a first gear and a second gear.

The first gear is configured to receive a driving force from the process motor, and engages with a gear provided on the input element.

The second gear is configured to output a driving force to the second development roller, and engages with a gear provided on the output element.

The first gear and the second gear rotate about a common axis.

Because the first gear rotates about one and the same axis as that about which the second gear rotates, the second development roller gear train can be made compact as viewed from a direction parallel to the rotation axis of the first gear and the second gear.

In yet another aspect, an image forming apparatus comprises a first photosensitive drum, a first development cartridge, a first cam gear having a first separation cam, a first cam follower, an idle gear, and a rotation resistance member.

The first development cartridge includes the first development roller, and is movable relative to the first photosensitive drum between a first position in which the first development roller is in contact with the first photosensitive drum and a second position in which the first development roller is separate from the first photosensitive drum.

The first separation cam may be configured to rotate and thereby cause the first development cartridge to move between a first position and a second position.

The first cam follower is slidable, according as the first separation cam is rotated, in a direction parallel to a rotation axis of the first separation cam, between a push position in which the first cam follower pushes and causes the first development cartridge to be located in the second position and a no-push position in which the first development cartridge is located in the first position.

The idle gear engages with the first cam gear.

The rotation resistance member applies rotation resistance to the idle gear.

With the rotation resistance member provided to apply rotation resistance to the idle gear that engages with the first cam gear, the free rotation of the first cam gear can be restrained. Therefore, the sudden sliding of the first cam follower caused by the free rotation of the first cam gear can be restrained.

The rotation resistance member may be configured to press the idle gear in a direction parallel to the rotation axis of the idle gear to apply rotation resistance to the idle gear.

Because the rotation resistance member is configured to push the idle gear in a direction parallel to the rotation axis of the idle gear, the rotation resistance member can be made compact on the idle gear as viewed from the direction parallel to the rotation axis of the idle gear.

For example, the rotation resistance member is a spring.

The rotation resistance member may be a leaf spring.

With the rotation resistance member being a leaf spring, the rotation resistance member can be arranged more compactly.

The image forming apparatus may be configured to comprise a metal sheet by which the idle gear is rotatably supported.

In this instance, the idle gear may be configured to include a first rib having an annular shape and protruding in a direction parallel to the rotation axis of the idle gear toward the metal sheet. The first rib is kept in contact with the metal sheet by the pushing force of the rotation resistance member.

With the idle gear kept in contact with the metal sheet by the pushing force of the rotation resistance member, a necessary amount of rotation resistance can be applied to the idle gear without restraining the rotation of the idle gear too much.

The first rib may be located at end portion of the idle gear in a plane perpendicular to the rotation axis.

With the first rib located at an end portion of the idle gear in a plane perpendicular to the rotation axis, the contact area of the first rib and the metal sheet can be increased. Therefore, a necessary amount of rotation resistance can be applied sufficiently to the idle gear by the contact of the first rib and the metal sheet.

The idle gear may include a gear portion configured to engage with the first cam gear. The first cam gear and the gear portion are located on a first side of the metal sheet as defined by a side surface thereof facing in a direction parallel to the rotation axis of the idle gear, and the first rib and the rotation resistance member are located on a second side, opposite to the first side, of the metal sheet.

In this instance, the rotation resistance member pushes the idle gear in a direction parallel to the rotation axis of the idle gear, which is a direction opposite to the direction in which the side surface of the metal sheet faces.

Because the first cam gear and the rotation resistance member are located on opposite sides of the metal sheet as defined by the opposite side surfaces facing in the direction parallel to the rotation axis of the idle gear, the shape and position of the rotation resistance member can be designed more freely.

The idle gear may be configured to include an annular second rib protruding in a direction away from the metal sheet on the second side of the metal sheet.

In this instance, the rotation resistance member pushes the second rib in a direction parallel to the rotation axis of the idle gear, which is a direction opposite to the direction in which the side surface of the metal sheet faces, and the inner diameter of the second rib is larger than a pitch diameter of the gear portion.

With the rotation resistance member pushing a second rib having a diameter larger than a pitch diameter of the gear potion, a necessary amount of rotation resistance can be applied to the idle gear with a smaller load. Also, since the diameter of the gear portion can be made smaller, the gear train can be made compact, and the members can be arranged compactly. Therefore, the image forming apparatus can be made smaller in size.

The image forming apparatus may further comprise a second photosensitive drum, a second development cartridge, a second cam gear having a second separation cam, and a second cam follower.

The second development cartridge includes the second development roller, and is movable relative to the second photosensitive drum between a first position in which the second development roller is in contact with the second photosensitive drum and a second position in which the second development roller is separate from the second photosensitive drum.

The second separation cam is configured to rotate and thereby cause the second development cartridge to move between a first position and a second position.

The second cam follower is configured to slide, according as the second separation cam is rotated, in a direction parallel to the rotation axis of the second cam gear, between a push position in which the second cam follower pushes and causes the second development cartridge to be located in the second position and a no-push position in which the second development cartridge is located in the first position.

In this instance, the idle gear can be configured to engage with both the first cam gear and the second cam gear.

Since the idle gear, to which rotation resistance is applied, engages with both the first cam gear and the second cam gear, the free rotation of the first cam gear and the second cam gear can be restrained. Therefore, the sudden sliding of the first cam follower and the second cam follower caused by the free rotation of the first cam gear and the second cam gear can be restrained.

The image forming apparatus may further comprise a stopper configured to restrain the rotation of the cam follower about the rotation axis of the first cam gear.

With this stopper, the rotation of the first cam follower can be restricted. Therefore, the sudden sliding of the first cam follower caused by the rotation of the first cam follower can be restrained.

The first cam follower may be configured to include a slide shaft, an arm, and a pin.

The slide shaft is slidable in directions parallel to the rotation axis of the first cam gear.

The arm extends from the slide shaft in a direction perpendicular to the rotation axis of the first cam gear.

The pin extends from the arm in a direction parallel to the rotation axis of the first cam gear. The pin is configured to push the first development cartridge.

In this instance, the stopper may be configured to hold the arm.

The image forming apparatus may be configured to comprise a spring configured to bias the first cam follower toward the no-push position.

With this configuration in which the first cam follower is biased toward no-push position, the free rotation of the first cam gear can be restrained by the rotation resistance member, and therefore the sudden sliding of the first cam follower caused by the free rotation of the first cam gear can be effectively restrained.

The first separation cam may be configured to include a cam portion protruding in a direction of a rotation axis of the first cam gear.

The cam portion may be configured to include a retaining surface and a guide surface.

The retaining surface retains the first cam follower in the push position.

The guide surface guides the first cam follower from the push position to the no-push position, and is inclined with respect to a plane perpendicular to the rotation axis of the first cam gear.

BRIEF DESCRIPTION OF DRAWINGS

FIG. **1** is a diagram of an image forming apparatus.

FIG. **2** is a schematic diagram showing a system for transmitting a driving force in the image forming apparatus.

FIG. **3** is a diagram showing a gear train and a metal sheet of the image forming apparatus.

FIG. **4** is a diagram showing separation cams, cam followers, shafts, and stoppers.

FIG. **5**A is a diagram for explaining an arrangement for moving a development cartridge, showing a state in which the development cartridge is located in a contact position.

FIG. **5**B is a diagram for explaining the arrangement for moving the development cartridge, showing a state in which the development cartridge is located in a separate position.

FIG. **6**A is a perspective view showing a separation cam and a cam follower located in a no-push position.

FIG. **6**B is a side view showing the separation cam and the cam follower located in the no-push position.

FIG. **7**A is a perspective view of the separation cam and the cam follower located in a push position.

FIG. **7**B is a side view of the separation cam and the cam follower located in the push position.

FIG. **8**A is a perspective view of a gear cover.

FIG. **8**B is another perspective view of the gear cover.

FIG. **9**A is a sectional view showing the separation cam, the cam follower, the gear cover, and a spring, as taken when the cam follower is located in the no-push position.

FIG. **9**B is a sectional view showing the separation cam, the cam follower, the gear cover, and the spring, as taken when the cam follower is located in the push position.

FIG. **10** is a diagram showing a separation gear train.

FIG. **11**A is a perspective view of an idle gear of a first separation gear train.

FIG. **11**B is a perspective view of the idle gear, a shaft of the gear cover, and a rotation resistance member.

FIG. **12** is a sectional view of the idle gear, the shaft of the gear cover, the rotation resistance member, and a metal sheet.

FIG. **13** is a diagram showing the idle gear and the rotation resistance member.

FIG. **14** is a diagram showing a fixing gear train and an adjusting gear train.

FIG. **15** is a diagram showing the fixing gear train, a first ejection roller gear, an ejection gear train, a second ejection roller gear, and a sheet feeder gear train.

FIG. **16**A is a diagram of an adjusting mechanism in which the nip pressure is adjusted to a first nip pressure.

FIG. **16**B is a diagram of the adjusting mechanism in which the nip pressure is adjusted to a second nip pressure.

FIG. **17** is a diagram showing a drum gear train.

FIG. **18** is a diagram showing a first development roller gear train.

FIG. **19** is a diagram showing the idle gear, a switching gear train, and a switching cam in a first phase.

FIG. **20** is a diagram showing the idle gear, the switching gear train, and the switching cam in a second phase.

FIG. **21**A is a diagram showing a second development roller gear train.

FIG. **21**B is a diagram showing the second development roller gear train.

FIG. **22** is an exploded perspective view of a planetary gear train.

FIG. **23**A is a diagram showing a separation cam for black, a switching lever, and the planetary gear train as illustrated when the switching lever is located in a second transmit position.

FIG. **23**B is a diagram showing the separation cam for black, the switching lever, and the planetary gear train as illustrated when the switching lever is located in a second disconnect state.

FIG. **24** is a time chart for explaining an example of an operation of a controller.

DESCRIPTION

As shown in FIG. **1**, an image forming apparatus **1** is a color printer, comprising a housing **10**, a front cover **11**, a sheet feeder unit **20**, an image forming unit **30**, a second ejection roller **91** as an example of an ejection roller, and a controller **2**. In the following description, directions will be referred to as directions shown in FIG. **1**. That is, the left-hand side of FIG. **1** is referred to as “front,” the right-hand side of FIG. **1** as “rear,” the front side of the drawing sheet of FIG. **1** as “right,” and the back side of the drawing sheet of FIG. **1** as “left.” Similarly, upward direction (upper side) of FIG. **1** is referred to as “upward (upper),” and the downward direction (lower side) of FIG. **1** is referred to as “downward (lower).”

The housing **10** has an opening **10**A at a front side thereof. The front cover **11** is configured to openably close the opening **10**A. Specifically, the front cover **11** is configured to rotate between a closed position indicated by a solid line and an open position indicated by a chain double-dashed line, relative to the housing **10**. The closing position is a position in which the opening **10**A is closed and the open position is a position in which the opening **10**A is open.

The sheet feeder unit **20** comprises a sheet tray **21** and a sheet feeder mechanism **22**. Sheets S are held in the sheet tray **21**. The sheet feeder mechanism **22** is a mechanism that receives a driving force and thereby feeds a sheet S toward photosensitive drums **50** (**50**Y, **50**M, **50**C, **50**K), which will be described below, of the image forming unit **30**. The sheet feeder mechanism **22** comprises a pickup roller **23**, a separation roller **24**, a separation pad **25**, a conveyor roller **26**, and a registration roller **27**.

Sheet S in the sheet tray S**21** are picked up by the pickup roller **23**. Next, one sheet S is separated from the others by the separation roller **24** and the separation pad **25** of the sheet feeder mechanism **22**. Then, the sheet S is fed by the conveyor roller **26** and the registration roller **27** of the sheet feeder mechanism **22** to the image forming unit **30**.

The image forming unit **30** comprises an exposure unit **40**, four photosensitive drums **50**, four development cartridges **60**, a transfer unit **70**, and a fixing device **80**.

The exposure unit **40** comprises, for example, a light source, deflectors, lenses, and mirrors. The exposure unit **40** emits light beams as shown by alternate long and short dashed lines to expose the surfaces of the photosensitive drums **50** to light.

The photosensitive drums **50** include a photosensitive drum **50**Y for yellow, a photosensitive drum **50**M for magenta, a photosensitive drum **50**C for cyan, and a photosensitive drum **50**K for black. The four photosensitive drums **50** are arranged in the sheet conveyance direction in the following sequence: the photosensitive drum **50**Y, the photosensitive drum **50**M, the photosensitive drum **50**C, and the photosensitive drum **50**K.

Specifically, the photosensitive drum **50**Y is located upstream of the photosensitive drum **50**M in a direction of conveyance of a sheet S. The photosensitive drum **50**M is located upstream of the photosensitive drum **50**C in the direction of conveyance of the sheet S. The photosensitive drum **50**C is located upstream of the photosensitive drum **50**K in the direction of conveyance of the sheet S.

In the description and the drawings, each of the members provided for the corresponding colors may be designated by a specific reference numeral with a label Y, M, C, or K appended thereto if distinction in color is necessary for explanation. On the other hand, if explanation is given without distinction in color, the reference numeral without the label Y, M, C, or K may be used.

The image forming apparatus **1** further comprises a drawer **55**. The drawer **55** is movable through the opening **10**A of the housing **10**, which is uncovered by opening the front cover **11**, in directions in which the photosensitive drums **50** are arranged, between an inside position and an outside position. The inside position is a position in which the drawer **55** is installed in the housing **10**. The outside position is a position in which at least a part of the drawer **55** is exposed to view from outside of the housing **10**. In the present embodiment, the outside position is a position in which the drawer **55** has been pulled out frontward from the inside position. The drawer **55** is configured herein to be installable into and removable from the housing **10**.

The drawer **55** comprises a frame **55**F. The frame **55**F supports the four photosensitive drums **50** (**50**Y, **50**M, **50**C, **50**Y) in a manner that renders each of the photosensitive drums **50** rotatable. The frame **55**F also supports four chargers **52**. The chargers **52** electrically charge surfaces of the respective photosensitive drums **50**.

The development cartridges **60** include a development cartridge **60**Y for holding yellow toner, a development cartridge **60**M for holding magenta toner, a development cartridge **60**C for holding cyan toner, and a development cartridge **60**K for holding black toner. The development cartridge **60**Y includes a development roller **61**Y for supplying yellow toner to the photosensitive drum **50**Y. The development cartridge **60**M includes a development roller **61**M for supplying magenta toner to the photosensitive drum **50**M. The development cartridge **60**C includes a development roller **61**C for supplying cyan toner to the photosensitive drum **50**C. The development cartridge **60**K includes a development roller **61**K for supplying black toner to the photosensitive drum **50**K.

The development roller **61**Y is movable relative to the photosensitive drum **50**Y between a contact position in which the development roller **61**Y is in contact with the photosensitive drum **50**Y and a separate position in which the development roller **61**Y is separate from the photosensitive drum **50**Y. The development roller **61**M is movable relative to the photosensitive drum **50**M between a contact position in which the development roller **61**M is in contact with the photosensitive drum **50**M and a separate position in which the development roller **61**M is separate from the photosensitive drum **50**M. The development roller **61**C is movable relative to the photosensitive drum **50**C between a contact position in which the development roller **61**C is in contact with the photosensitive drum **50**C and a separate position in which the development roller **61**C is separate from the photosensitive drum **50**C. The development roller **61**K is movable relative to the photosensitive drum **50**K between a contact position in which the development roller **61**K is in contact with the photosensitive drum **50**K and a separate position in which the development roller **61**K is separate from the photosensitive drum **50**K.

The frame **55**F of the drawer **55** supports the development cartridges **60** (**60**Y, **60**M, **60**C, **60**K) in a manner that permits each of the development cartridges **60** to be installed therein and removed therefrom. Each development cartridge **60** is replaceable when the drawer **55** is located in the outside position or when the drawer **55** is removed from the housing **10**.

The development cartridge **60** is supported by the frame **55**F in a manner that permits the development cartridge **60** to move in a front-rear direction between a first position indicated by a solid line and a second position indicated by a chain double-dashed line. The first position is a position in which the corresponding development roller **61** is located in the contact position. The second position is a position in which the corresponding development roller **61** is located in the separate position.

Specifically, the development cartridge **60**Y is movable relative to the photosensitive drum **50**Y between a first position in which the development roller **61**Y is located in the contact position and a second position in which the development roller **61**Y is located in the separate position. In other words, the development cartridge **60**Y is movable relative to the photosensitive drum **50**Y between the first position in which the development roller **61**Y is in contact with the photosensitive drum **50**Y and the second position in which the development roller **61**Y is separate from the photosensitive drum **50**Y.

The development cartridge **60**M is movable relative to the photosensitive drum **50**M between a first position in which the development roller **61**M is located in the contact position and a second position in which the development roller **61**M is located in the separate position. In other words, the development cartridge **60**M is movable relative to the photosensitive drum **50**M between the first position in which the development roller **61**M is in contact with the photosensitive drum **50**M and the second position in which the development roller **61**M is separate from the photosensitive drum **50**M.

The development cartridge **60**C is movable relative to the photosensitive drum **50**C between a first position in which the development roller **61**C is located in the contact position and a second position in which the development roller **61**C is located in the separate position. In other words, the development cartridge **60**C is movable relative to the photosensitive drum **50**C between the first position in which the development roller **61**C is in contact with the photosensitive drum **50**C and the second position in which the development roller **61**C is separate from the photosensitive drum **50**C.

The development cartridge **60**K is movable relative to the photosensitive drum **50**K between a first position in which the development roller **61**K is located in the contact position and a second position in which the development roller **61**K is located in the separate position. In other words, the development cartridge **60**K is movable relative to the photosensitive drum **50**K between the first position in which the development roller **61**K is in contact with the photosensitive drum **50**K and the second position in which the development roller **61**K is separate from the photosensitive drum **50**K.

The transfer unit **70** includes a drive roller **71**, a follower roller **72**, an endless conveyor belt **73**, and four transfer rollers **74**. The conveyor belt **73** is looped round and stretched between the drive roller **71** and the follower roller **72**. An outside surface of the conveyor belt **73** is in contact with the four photosensitive drums **50**. The transfer rollers

74 are located inside the conveyor belt **73**. The conveyor belt **73** is nipped between each transfer roller **74** and the corresponding photosensitive drum **50**.

The fixing device **80** is a device for fixing a toner image transferred to a sheet S onto the sheet S. The fixing device **80** includes a heating portion **81**, a pressure portion **82**, and a first ejection roller **83** as an example of an ejection roller. The heating portion **81** includes a heating roller **81**A and a heater **81**B. The heating roller **81**A is a cylinder-shaped roller. The heater **81**B is a heater that heats the heating roller **81**A. The heater **81**B is located such that the heater **81**B passes inside the heating roller **81**A.

The pressure portion **82** nips a sheet S between the heating portion **81** and the pressure portion **82**. Specifically, the pressure portion **82** is a pressure roller that nips the sheet S between the heating roller **82** and the pressure portion **82**. The pressure roller is a roller having a metal core and a rubber layer covering the metal core. The fixing device **80** receives a driving force and thereby conveys a sheet S through between the heating roller **81**A of the heating portion **81** and the pressure portion **82** (pressure roller). When receiving the driving force, the fixing device **80** further conveys a sheet S by the first ejection roller **83**.

The image forming unit **30** uniformly charges the surfaces of the photosensitive drums **50** by the chargers **52**, and then exposes the surfaces of the photosensitive drums **50** to light beams emitted from the exposure unit **40**. Thereby, the image forming unit **30** forms an electrostatic latent image based on image data on each photosensitive drum **50**. Thereafter, the image forming unit **30** supplies toner held in the development cartridge **60** to each photosensitive drum **50** via the development roller **61** located in the contact position. Thereby, the image forming unit **30** forms a toner image on the photosensitive drum **50**.

The image forming unit **30** conveys a sheet S fed from the sheet feeder unit **20** through between the photosensitive drum **50** and the transfer roller **74**, and thereby transfers the toner image formed on the photosensitive drum **50** onto the sheet S. Subsequently, the image forming unit **30** conveys the sheet S with the toner image transferred thereon through between the heating roller **81**A and the pressure portion **82** of the fixing device **80**, so that the toner image is fixed onto the sheet.

The first ejection roller **83** and a second ejection roller **91** receive a driving force and thereby eject a sheet S conveyed from between the heating portion **81** and the pressure portion **82** to the outside of the housing **10**. Specifically, the first ejection roller **83** and the second ejection roller **91** eject a sheet S with the toner image fixed thereon, onto an output tray **13**.

As shown in FIG. **2**, the image forming apparatus **1** further comprises a main motor M**1**, a process motor M**2**, a separation mechanism **5**, and an adjusting mechanism **200**.

The main motor M**1** is a motor that drives a separation cam **150** of the separation mechanism **5**, the fixing device **80**, the adjusting mechanism **200**, and the sheet feeder mechanism **22**. In other words, the separation cam **150** of the separation mechanism **5**, the fixing device **80**, the adjusting mechanism **200**, and the sheet feeder mechanism **22** each receive a driving force from the main motor M**1**. The main motor M**1** is rotatable in the forward and reverse directions. The main motor rotates in the forward direction when a sheet S is conveyed from the sheet tray **21** toward the output tray **13** to form an image on the sheet S.

The process motor M**2** is a motor that drives the photosensitive drums **50**, the development rollers **61**, and the transfer unit **70**. In other words, the photosensitive drums **50**, the development rollers **61**, and the transfer unit **70** each receive a driving force from the process motor M**2**.

As shown in FIG. **2** and FIG. **3**, the image forming apparatus **1** further comprises a separation gear train GT**1**, a fixing gear train GT**2**, an adjusting gear train GT**3**, a sheet feeder gear train GT**4**, a drum gear train GT**5**, a first development roller gear train GT**6**, and a second development roller gear train GT**7**.

The separation gear train GT**1** is a gear train configured to transmit a driving force of the main motor M**1** to the separation cams **150** (**150**Y, **150**M, **150**C, **150**K) of the separation mechanism **5**.

The fixing gear train GT**2** is a gear train configured to transmit a driving force of the main motor M**1** as received from the separation gear train GT**1** to the fixing device **80**. Specifically, the fixing gear train GT**2** is configured to transmit the driving force of the main motor M**1** as received from the separation gear train GT**1** to the heating roller **81**A.

The adjusting gear train GT**3** is a gear train configured to transmit the driving force of the main motor M**1** as received from the separation gear train GT**1** to the adjusting cam **230** of the adjusting mechanism **200**.

The sheet feeder gear train GT**4** is a gear train configured to transmit the driving force of the main motor M**1** to the sheet feeder mechanism **22**.

The drum gear train GT**5** is a gear train configured to transmit a driving force of the process motor M**2** to the photosensitive drums **50** (**50**Y, **50**M, **50**C, **50**K).

The first development roller gear train GT**6** is a gear train configured to transmit a driving force of the process motor M**2** to the development rollers **61**Y, **61**M, and **61**C.

The second development roller gear train GT**7** is a gear train configured to transmit a driving force of the process motor M**2** to the development roller **61**K. Specifically, the second development roller gear train GT**7** is configured to transmit the driving force of the process motor M**2** as received from the first development roller gear train GT**6** to the development roller **61**K.

The separation mechanism **5** is a mechanism configured to cause the development rollers **61** to move between the contact position and the separate position when receiving a driving force from the main motor M**1**. The separation mechanism **5** comprises four separation cams **150** and four cam followers **170**.

The separation cams **150** include a separation cam **150**Y, a separation cam **150**M, a separation cam **150**C, and a separation cam **150**K.

The separation cam **150**Y is caused, when receiving the driving force of the main motor M**1**, to rotate and thereby move the development roller **61**Y between the contact position and the separate position. Specifically, the separation cam **150**Y rotates and causes the development cartridge **60**Y to move between the first position and the second position, and thereby causes the development roller **61**Y to move between the contact position and the separate position.

The separation cam **150**M is caused, when receiving the driving force of the main motor M**1**, to rotate and thereby move the development roller **61**M between the contact position and the separate position. Specifically, the separation cam **150**M rotates and causes the development cartridge **60**M to move between the first position and the second position, and thereby causes the development roller **61**M to move between the contact position and the separate position.

The separation cam **150**C is caused, when receiving the driving force of the main motor M**1**, to rotate and thereby move the development roller **61**C between the contact position and the separate position. Specifically, the separation cam **150**C rotates and causes the development cartridge **60**C to move between the first position and the second position, and thereby causes the development roller **61**C to move between the contact position and the separate position.

The separation cam **150**K is caused, when receiving the driving force of the main motor M**1**, to rotate and thereby move the development roller **61**K between the contact position and the separate position. Specifically, the separation cam **150**K rotates and causes the development cartridge **60**K to move between the first position and the second position, and thereby causes the development roller **61**K to move between the contact position and the separate position.

As shown in FIG. **4**, the cam followers **170** include a cam follower **170**Y, a cam follower **170**M, a cam follower **170**C, and a cam follower **170**K. The cam followers **170** are slidable in directions parallel to the rotation axes of the corresponding separation cams **150**. The rotation axes of the separation cams **150** are indicated by the alternate long and short dashed lines in FIG. **4**. The rotation axis direction is also a direction parallel to rotation axes of cam gears **115** (**115**Y, **115**M, **115**C, **115**K) described below.

The cam follower **170**Y is slidable and caused to slide, as the separation cam **150**Y (cam gear **115**Y) rotates, between a push position and a no-push position. For the cam follower **170**Y, the push position is a position in which the cam follower **170**Y pushes and causes the development cartridge **60**Y to be located in the second position, and the no-push position is a position in which the development cartridge **60**Y is located in the first position.

The cam follower **170**M is slidable and caused to slide, as the separation cam **150**M (cam gear **115**M) rotates, between a push position and a no-push position. For the cam follower **170**M, the push position is a position in which the cam follower **170**M pushes and causes the development cartridge **60**M to be located in the second position, and the no-push position is a position in which the development cartridge **60**M is located in the first position.

The cam follower **170**C is slidable and caused to slide, as the separation cam **150**C (cam gear **115**C) rotates, between a push position and a no-push position. For the cam follower **170**C, the push position is a position in which the cam follower **170**C pushes and causes the development cartridge **60**C to be located in the second position, and the no-push position is a position in which the development cartridge **60**C is located in the first position.

The cam follower **17**K is slidable and caused to slide, as the separation cam **150**K (cam gear **115**K) rotates, between a push position and a no-push position. For the cam follower **170**K, the push position is a position in which the cam follower **170**K pushes and causes the development cartridge **60**K to be located in the second position, and the no-push position is a position in which the development cartridge **60**K is located in the first position.

As shown in FIG. **5**A, the drawer **55** includes contact portions **55**A, push members **55**B, and springs **55**C. The contact portions **55**A are portions with which a slide member **66**, which will be described below, is contactable. Each of the contact portions **55**A consists of a roller rotatable on a vertical axis. The push members **55**B are biased by the springs **55**C rearward. When the development cartridge **60** is installed in the drawer **55**, the push member **55**B pushes the development cartridge **60** rearward by the biasing force of the spring **55**C. Thereby, the development cartridge **60** is caused to move to the first position in which the development roller **61** is in contact with the photosensitive drum **50**.

The development cartridge **60** comprises a case **65** that holds toner, and a slide member **66**. The slide member **66** is caused to move in a direction parallel to a rotation axis direction when pushed by the cam follower **170**. The slide member **66** includes a shaft **66**A, a first contact member **66**B, and a second contact member **66**C. The shaft **66**A is supported by the case **65** in such a manner that the shaft **66**A is slidable in directions parallel to the rotation axis. The first contact member **66**B is fixed to one end of the shaft **66**A, and the second contact member **66**C is fixed to the other end of the shaft **66**A.

The first contact member **66**B has a to-be-pushed surface **66**D and an inclined surface **66**E. The second contact member **66**C has an inclined surface **66**F. The to-be-pushed surface **66**D is a surface pushed by the cam follower **170**. The inclined surfaces **66**E and **66**F are surfaces inclined relative to the left-right direction. As shown in FIG. **5**B, when the slide member **66** is pushed by the cam follower **170**, the inclined surfaces **66**E and **66**F come in contact with the contact portions **55**A and cause the development cartridge **60** to move to the front. Thereby, the development cartridge **60** is moved to the second position in which the development roller **61** is separate from the photosensitive drum **50**. A spring **67** is located between the first contact member **66**B and the case **65**. The spring **67** biases the slide member **66** leftward.

As shown in FIG. **4**, the separation cams **150** are end cams. Each separation cam **150** includes a disk portion **151**, a boss **152**, and a cam portion **153**.

The boss **152** extends in a direction parallel to the rotation axis from the center of the disk portion **151**. The boss **152** has a cylindrical shape.

The image forming apparatus **1** further comprises four shafts **159** and a metal sheet **15** (see FIG. **3**). The metal sheet **15** is a member by which the gears of each gear trains are rotatably supported. The shaft **159** is fixed to the metal sheet **15**. The separation cam **150** (cam gear **115**) is rotatably supported by the metal sheet **15** by the engaging of the boss **152** with the shaft **159**.

The cam portion **153** protrudes from the disk portion **151** in a direction parallel to the rotation axis. The cam portion **153** protrudes from a surface of the disk portion **151** facing away from the metal sheet **15** (see FIG. **3**) in a direction parallel to the rotation axis.

As shown in FIGS. **6**A and **6**B, the cam portion **153** includes a retaining surface **153**A and a guide surface **153**B.

The retaining surface **153**A is a surface configured to retain the cam follower **170** in the push position. The retaining surface **153**A is approximately parallel to a plane perpendicular to the rotation axis of the separation cam **150** (cam gear **115**).

The guide surface **153**B is a surface configured to guide the cam follower **170** between the push position and the no-push position. The guide surface **153**B is inclined with respect to a plane perpendicular to the rotation axis of the separation cam **150** (cam gear **115**). Specifically, the guide surface **153**B extending toward the retaining surface **153**A in the direction of rotation of the separation cam **150** slopes gradually away from the disk portion **151**.

As shown in FIGS. **7**A and **7**B, the guide surface **153**B is configured to cause the cam follower **170** to move from the push positon to the no-push position when the separation cam **150** rotates in a first rotation direction R**1**. The first rotation direction R**1** is a direction in which the separation cam **150** rotates when the main motor M**1** rotates in the forward direction. Also, as shown in FIGS. **6**A and **6**B, the guide surface **153**B is configured to cause the cam follower **170** to move from the no-push position to the push position when the separation cam **150** rotates in a second rotation direction R2. The second rotation direction R2 is a direction in which the separation cam **150** rotates when the main motor M1 rotates in the reverse direction. The second rotation direction R2 is a rotation direction opposite to the first rotation direction R1.

The cam follower **170** includes a slide shaft **171**, an arm **172**, a pin **173**, and a rib **174**.

The slide shaft **171** is slidable in a direction parallel to the rotation axis of the separation cam **150**. Specifically, the slide shaft **171** has a cylindrical shape. The slide shaft **171** is engaged with the boss **152** of the separation cam **150**, allowing the slide shaft **171** to slide in a direction parallel to the rotation axis of the separation cam **150** relative to the boss **152**. Thereby, the cam follower **170** is slidable between the no-push position shown in FIGS. **6**A and **6**B and the push position shown in FIGS. **7**A and **7**B.

The arm **172** extends from the slide shaft **171** in a direction perpendicular to the rotation axis of the separation cam **150**. Specifically, the arm **172** extends outward from the slide shaft **171** in a direction aligned with a radius of the slide shaft **171**. The arm **172** is has a shape of a plate.

The pin **173** extends from the arm **172** in the rotation axis of the separation cam **150**. Specifically, the pin **173** extends from an end portion of the arm **172** farther away from the slide shaft **171**, in one direction parallel the rotation axis off the separation cam **150**. The pin **173** has a cylindrical shape, with an end having a convex surface. The end of the pin **173** pushes the development cartridge **60** when the cam follower is caused to move from the no-push position to the push position. Specifically, the end of the pin **173** pushes the to-be-pushed surface **66**D of the slide member **66** provided on the development cartridge **60** (refer to FIG. **5**B).

The rib **174** extends from the slide shaft **171** in a direction perpendicular to the rotation axis of the separation cam **150**. Specifically, the rib **174** extends outward from the slide shaft **171** in a direction aligned with a radius of the slide shaft **171**. The rib **174** extends in a direction different from the direction in which the arm **172** extends. In the present embodiment, the rib **174** extends frontward from the slide shaft **171**, and the arm **172** extends obliquely rearward and downward from the slide shaft **171**.

The image forming apparatus **1** further comprise stoppers **530**. Four pairs of the stoppers **530** corresponding to the four cam followers **170** are provided (refer to FIG. **4**). The stoppers **530** restrain the rotation of the cam follower **170** about the rotation axis of the separation cam **150** (cam gear **115**). Specifically, as shown in FIGS. **8**A and **8**B, the image forming apparatus **1** comprises a gear cover **500**, and the gear cover **500** comprises the stoppers **530**.

The gear cover **150** is fixed to the meatal sheet **15** (refer to FIG. **3**) to thereby cover the separation cams **150** (cam gear **115**) and the cam followers **170**. The gear cover **500** comprises a cover wall **510**. The cover wall **510** is a wall covering the separation cams **150** and the cam followers **170**. When the gear cover **500** is fixed to the metal sheet **15**, the cover wall **510** faces toward a side surface of the metal sheet **15** in a direction parallel to the rotation axis of the separation cam **150**.

The stoppers **530** extend from the cover wall **510** toward the corresponding separation cams **150** in a direction parallel to the rotation axis of the separation cam **150**. The stoppers **530** are each shaped like a wall. A pair of stoppers **530** are arranged side by side in the circumferential direction of the slide shaft **171**, in a position that hold the arm **172** of the cam follower **170** (refer to FIGS. **6**A, **6**B, **7**A, **7**C). With this arrangement, the cam follower **170** is restrained from rotating about the boss **152**.

The cover wall **510** further comprises four insertion holes **520**. As shown in FIGS. **9**A and **9**B, the insertion holes **520** are through holes in which the pins **173** of the cam followers **170** are inserted.

The image forming apparatus **1** further comprises springs **430**. Four springs **430** are provided one for each of the four cam followers **170**. The spring **430** is a spring that biases the corresponding cam follower **170** so as to cause the corresponding cam follower **150** to move from the push position shown in FIG. **9**B toward the no-push position shown in FIG. **9**A. The spring **430** is, for example, a compression coil spring. The spring **430** is located between the gear cover **500** and the slide shaft **171** of the cam follower **170**. Specifically, the spring **430** is located between the cover wall **510** and the slide shaft **171**.

The slide shaft **171** includes a recess **171**A. The recess **171**A is an annular recess that opens toward the cover wall **510** in a direction parallel to the rotation axis of the separation cam **150**. At least one end portion of the spring **430** is located in the recess **171**A. The recess **171**A restrains an undesirable shift of the position of the spring **430**.

As shown in FIGS. **7**A and **7**B, when the development cartridge **60** is located in the second position, i.e., when the development roller **61** is located in the separate position, the cam follower **170** is located in the push position in which the arm **172** is retained by the retaining surface **153**A of the separation cam **150**.

The separation cam **150** is caused to rotate in the first rotation direction R1 when the main motor M1 rotates in the forward direction. Then, the arm **172** of the cam follower **170** is guided from the retaining surface **153**A to the guide surface **153**B and slides over the guide surface **153**B until the arm **172** comes out of contact with the cam portion **153**. As a result, the cam follower **170** is caused to slide from the push position to the no-push position shown in FIGS. **6**A and **6**B by the biasing force of the spring **430** (refer to FIGS. **9**A and **9**B).

Therefore, the development cartridge **60** is caused to move from the second positon to the first position, and the development roller **61** is moved from the separate position to the contact position. The separation cam **150** causes the development roller **61** to move from the separate position to the contact positon when the main motor M1 rotates in the forward direction.

On the other hand, the separation cam **150** is caused to rotate in the second rotation direction R2 when the main motor M1 rotates in the reverse direction. Then, the arm **172** of the cam follower **170** comes in contact with the guide surface **153**B, slides over the guide surface **153**B, and then comes in contact with the retaining surface **153**A. As a result, the cam follower **170** is caused to slide from the no-push position to the push positon shown in FIGS. **7**A and **7**B.

Therefore, the development cartridge **60** is pushed by the cam follower **170** and caused to move from the first position to the second position, and the development roller **61** is moved from the contact position to the separate position. The separation cam **150** causes the development roller **61** to move from the contact position to the separate position when the main motor M1 rotates in the reverse direction.

As shown in FIG. **10**, the separation gear train GT1 includes a first separation gear train GT**11** and a second separation gear train GT **12**.

The first separation gear train GT**11** is a gear train that transmits a driving force of the main motor M1 to the separation cams **150**Y, **150**M, and **150**C.

The first separation gear train **11** comprises a gear **101**, a gear **102**, a gear **103**, a gear **104**, a gear **105**, a gear **106**, a gear **107**, a gear **108**, a gear **109**, an electromagnetic clutch EC**1**, a gear **110**, a gear **111**, a gear **112**, a gear **113**, a gear **114**, a cam gear **115**C, a gear **116**, a cam gear **115**M, an idle gear **118**, and a cam gear **115**Y.

The gear **101** is a two-stage gear including a large-diameter gear and a small-diameter gear. The large-diameter gear engages with a motor gear MG**1**. The motor gear MG**1** is a gear provided on the output shaft of the main motor M**1**. In other words, the image forming apparatus **1** comprises the motor gear MG**1**. The motor gear MG**1** engages with the large-diameter gear of the gear **101**. The gear **101** is an example of a gear included in the separation gear train GT**1**.

The gear **102** engages with the small-diameter gear of the gear **101**.

The gear **103** is a two-stage gear including a large-diameter gear and a small-diameter gear, and the large-diameter gear engages with the gear **102**.

The gear **104** engages with the small-diameter gear of the gear **103**.

The gear **105** is a two-stage gear including a large-diameter gear and a small-diameter gear, and the large-diameter gear engages with the gear **104**.

The gear **106** engages with the small-diameter gear of the gear **105**.

The gear **107** engages with the gear **106**.

The gear **108** engages with the gear **107**.

The gear **109** engages with the gear **108**.

The electromagnetic clutch EC**1** is switchable between a transmit state and a disconnect state. For example, the electromagnetic clutch EC**1** is in the transmit state when energized and is in the disconnect state when not energized. The transmit state is a state in which the electromagnetic clutch EC**1** transmits a driving force from the main motor M**1** to the separation cams **150**Y, **150**M, and **150**C. The disconnect state is a state in which the electromagnetic clutch EC**1** does not transmit the driving force from the main motor M**1** to the separation cams **150**Y, **150**M, and **150**C. The controller **2** (refer to FIG. **1**) controls the electromagnetic clutch EC**1**.

The gear **110** rotates together with the gear **109** when the electromagnetic clutch EC**1** is in the transmit state. When the electromagnetic clutch EC**1** is in the disconnect state, the driving force of the main motor M**1** is not transmitted to the gear **110**; therefore, the gear **110** is not driven.

The gear **111** engages with the gear **110**.

The gear **112** is a two-stage gear including a large-diameter gear and a small-diameter gear, and the large-diameter gear engages with the gear **111**.

The gear **113** is a two-stage gear including a large-diameter gear and a small-diameter gear, and the large-diameter gear engages with the small-diameter gear of the gear **112**.

The gear **114** engages with the small-diameter gear of the gear **113**.

The cam gear **115**C is a gear including the separation cam **150**C. In other words, the separation cam **150**C includes gear teeth at the periphery of the disc portion **151**. The cam gear **115**C engages with the gear **114**.

The gear **116** engages with the cam gear **115**C.

The cam gear **115**M is a gear including the separation cam **150**M. In other words, the separation cam **150**M includes gear teeth at the periphery of the disc portion **151**. The cam gear **115**M engages with the gear **116**. The cam gear **115**M receives a driving force of the main motor M**1** from the cam gear **115**C via the gear **116**.

The idle gear **118** includes a first gear portion **118**B as a gear portion. The first gear portion **118**B of the idle gear **118** engages with the cam gear **115**M.

The cam gear **115**Y is a gear including the separation cam **150**Y. In other words, the separation cam **150**Y includes gear teeth at the periphery of the disc portion **151**. The cam gear **115**Y engages with the first gear portion **118**B of the idle gear **118**. The first gear portion **118**B of the idle gear **118** engages with both the cam gear **115**Y and the cam gear **115**M.

The separation cams **150**Y, **150**M, and **150**C are configured to rotate in synchronization with each other. The length of the retaining surface **153**A of the separation cam **150**C in a direction of rotation of the separation cam **150**C is longer than the length of the retaining surface **153**A of the separation cam **150**M in a direction of rotation of the separation cam **150**M, and the length of the retaining surface **153**A of the separation cam **150**M in a direction of rotation of the separation cam **150**M is longer than the length of the retaining surface **153**A of the separation cam **150**Y in a direction of rotation of the separation cam **150**Y. The cams **150**Y, **150**M, and **150**C are configured such that the phases of the downstream end of the retaining surfaces **153**A in the first rotation direction R**1** thereof coincide substantially with one another, and phases of the guide surfaces **153**B thereof are shifted from one another. Specifically, the guide surface **153**B of the separation cam **150**Y is located downstream of the guide surface **153**B of the separation cam **150**M in the first rotation direction R**1**, and the guide surface **153**B of the separation cam **150**M is located downstream of the guide surface **153**B of the separation cam **150**C in the first rotation direction R**1**

Therefore, the rotation of the separation cams **150**Y, **150**M, and **150**C in the first rotation direction R**1** by the main motor M**1** rotating in the forward direction, made in the state in which the cam followers **170**Y, **170**M, and **170**C are located in the push positions, first causes the cam follower **170**Y to move from the push position to the no-push position to thereby cause the development roller **61**Y to move from the separate position to the contact position. Then, the cam follower **170**M is caused to move from the push position to the no-push position to thereby cause the development roller **61**M to move from the separate positon to the contact position. Finally, the cam follower **170**C is caused to move from the push position to the no-push position to thereby cause the development roller **61**C to move from the separate position to the contact position.

On the other hand, the rotation of the separation cams **150**Y, **150**M, and **150**C in the second rotation direction R**2** by the main motor M**1** rotating in the reverse direction, made in the state in which the cam followers **170**Y, **170**M and **170**C are located in the no-push positions, first causes the cam follower **170**C to move from the no-push position to the push position to thereby cause the development roller **61**C to move from the contact position to the separate position. Then, the cam follower **170**M is caused to move from the no-push position to the push position to thereby cause the development roller **61**M to move from the contact position to the separate position. Finally, the cam follower **170**Y is caused to move from the no-push position to the push position to thereby cause the development roller **61**Y to move from the contact positon to the separate position.

As shown in FIG. **11**A and FIG. **11**B, the idle gear **118** comprises a disc portion **118**A, a first gear portion **118**B, a second gear portion **118**C, a first rib **118**D, and a second rib **118**E.

The first gear portion **118**B is formed on an outer periphery of a cylindrical portion protruding from the disc portion **118**A in a direction parallel to the rotation axis.

The second gear potion **118**C is formed on the outer periphery of the second rib **118**E. A pitch diameter of the second gear portion **118**C is larger than a pitch diameter of the first gear potion **118**B. The second gear portion **118**C outputs a driving force to a switching cam **190** (refer to FIG. **19**) which will be described below.

The first rib **118**D is an annular rib protruding from the disc portion **118**A in one direction parallel to the rotation axis of the idle gear **118**. The second rib **118**E is an annular rib protruding from the disc portion **118**A in the other direction parallel to the rotation axis of the idle gear **118**.

As shown in FIG. **12**, the first rib **118**D protrudes toward the metal sheet **15** in a direction parallel to the rotation axis of the idle gear **118**. The first rib **118**D is located at an end portion of the idle gear **118** in a direction perpendicular to the rotation axis of the idle gear **118**. Specifically, the first rib **118**D is located at the outer end portion of the disc portion **118**A in the radial direction of the disc portion **118**A. The first rib **118**D is pushed by a rotation resistance member **300** which will be described below, and thereby kept in contact with the metal sheet **15**.

The second rib **118**E protrudes away from the metal sheet **15** in the direction parallel to the rotation axis of the idle gear **118**. The end portion of the second rib **118**E in a direction parallel to the rotation axis of the idle gear **118** protrudes farther, than the second gear portion **118**C, from the metal sheet **15**. An internal diameter of the second rib **118**E is smaller than an internal diameter of the first rib **118**D. The internal diameter of the second rib **118**E is larger than the pitch diameter of the first gear portion **118**B.

The idle gear **118** is rotatable relative to the metal sheet **15**. Specifically, the gear cover **500** comprises a shaft **540**. The shaft **540** protrudes from the cover wall **510** from the cover wall **510** in the other direction opposite to the one direction in which the first rib **118**D protrudes parallel to the rotation axis of the idle gear **118**.

The idle gear **118** engages with the shaft **540** and is thereby rotatably supported by the gear cover **500**. With the gear cover **500** being fixed to the metal sheet **15**, the idle gear **118** is rotatable relative to the metal sheet **15**. In other words, the metal sheet **15** supports the idle gear **118** via the gear cover **500** in a manner that renders the idle gear **118** rotatable.

The first gear portion **118**B, and the cam gears **115**Y and **115**M (refer to FIG. **3**) that engage with the first gear portion **118**B, are located at a first side of the metal sheet **15** as defined by a side surface thereof facing in a direction parallel to the rotation axis of the idle gear **118**. The second gear portion **118**C is located at a second side, opposite to the first side, of the metal sheet **15**. The first rib **118**D and the second rib **118**E are also located at the other side of the metal sheet **15**.

Specifically, in FIG. **12**, the first gear portion **118**B and the cam gears **115**Y and **115**M are located at the right side of the metal sheet **15**. The second gear portion **118**C, the first rib **118**D, and the second rib **118**E are located at the left side of the metal sheet **15**.

As shown in FIG. **11**B, the image forming apparatus **1** further comprises a rotation resistance member **300**.

The rotation resistance member **300** is a member that applies rotation resistance to the idle gear **118**. Specifically, the rotation resistance member **300** is configured to push the idle gear **118** in a direction parallel to the rotation axis to apply rotation resistance to the idle gear **118**.

The rotation resistance member **300** is a spring. Specifically, the rotation resistance member **300** is a leaf spring made of a metal sheet. The rotation resistance member **300** has a base portion **310** and four push portions **320**.

The base portion **310** is a portion that is fixed to the shaft **540** of the gear cover **500** by a screw SC. The base portion **310** has a through hole **311** at its center. The through hole **311** is a hole through which a screw portion of the screw SC is inserted. The shaft **540** has a hole **541** in which the screw SC is screwed.

As shown in FIG. **13**, the pressing portions **320** are portions that press the idle gear **118**. The pressing portions **320** extend from the base portion **310**. The four pressing portions **320** are located at positions that are symmetrical with respect to the rotation axis of the idle gear **118**. Specifically, each of the four pressing portions **320** is shifted 90 degrees in the rotation direction of the idle gear **118** from the other pressing portions **320** adjacent thereto.

As shown in FIG. **12**, the rotation resistance member **300** is located at the other side of the metal sheet **15** in the direction parallel to the rotation axis of the idle gear **118**. The four pressing portions **320** of the rotation resistance member **300** fixed to the shaft **540** contact the idle gear **118**, and the rotation resistance member **300** pushes the idle gear **118** in a direction parallel to the rotation axis of the idle gear **118**, which is a direction opposite to the direction in which the side surface of the metal sheet **15** faces.

Specifically, the four pressing portions **320** of the rotation resistance member **300** contact the second rib **118**E of the idle gear **118**E, and the rotation resistance member **300** pushes the second rib **118**E in the direction parallel to the rotation axis of the idle gear **118**, which is a direction opposite to the direction in which the side surface of the metal sheet **15** faces. Therefore, the first rib **118**D of the idle gear **118** is pressed against the metal sheet **15**.

Since the inner diameter of the second rib **118**E is larger than the pitch diameter of the first gear portion **118**B, the pressing portions **320** press the idle gear **118** at positions outward, in the radial direction of the idle gear **118**, of the pitch circle of the first gear portion **118**B.

As shown in FIG. **13**, each of the pressing portions **320** has a contact portion **321**. The contact portion **321** has a part protruding in one direction parallel to the rotation axis of the idle gear **118**, and has a cross section curved in an arcuate shape. The pressing portion **320** contacts the second rib **118**E at a ridgeline portion of the contact portion **321** (refer to the chain double-dashed line). The ridgeline portion of the contact portion **321** extends in approximately the same direction as that in which the pressing portion **320** extends from the base portion **310** in such a manner that the ridgeline portion crosses the rib **118**E.

Since the contact portion **321** configured as described above contacts the second rib **118**E, even if there is some undesirable shift in the location of the rotation resistance member **300** in a direction perpendicular to the rotation axis of the idle gear **118**, the pressing portion **320** can evenly contact the second rib **118**E. Therefore, a load can be evenly applied to the idle gear **118**.

The rotation resistance member **300** is restrained from rotating about the rotation axis of the idle gear **118** by a stopper provided on a cover that covers the rotation resistance member **300**.

As shown in FIG. **10**, the second separation gear train GT**12** is a gear train configured to transmit a driving force of the main motor M**1** as received from the first separation gear train GT**11** to the separation cam **150**K. The second separation gear train 12 comprise a gear 121, an electromagnetic clutch EC2, a gear 122, a gear 123, a gear 124, and a cam gear 115K.

The gear 121 engages with the gear 106 of the first separation gear train 11.

The electromagnetic clutch EC2 is switchable between a transmit state and a disconnect state. For example, the electromagnetic clutch EC2 is in the transmit state when energized and is in the disconnect state when not energized. The transmit state is a state in which the electromagnetic clutch EC2 transmits a driving force received from the main motor M1 to the separation cam 150K. The disconnect state is a state in which the electromagnetic clutch does not transmit the driving force received from the main motor M1 to the separation cam 150K. The controller 2 (refer to FIG. 1) controls the electromagnetic clutch EC2.

The gear 122 rotates together with the gear 121 when the electromagnetic clutch EC2 is in the transmit state. Since the driving force of the main motor M1 is not transmitted to the gear 122 when the electromagnetic clutch EC2 is in the disconnect state, the gear 122 is not driven.

The gear 123 is a two-stage gear including a large-diameter gear and a small-diameter gear, and the large-diameter gear engages with the gear 122.

The gear 124 engages with the small-diameter gear of the gear 123.

The cam gear 115K is a gear including the separation cam 150K. In other words, the separation cam 150K includes gear teeth at the periphery of the disc portion 151. The cam gear 115K engages with the gear 124.

As shown in FIG. 14, the fixing gear train GT2 comprises a moving gear 131 and an output gear 132.

The moving gear 131 is a gear that receives a driving force from the main motor M1. The moving gear 131 engages with the large-diameter gear of the gear 103 included in the first separation gear train GT11. The moving gear 131 is movable relative to the output gear 132 between a transmit position indicated by a solid line and a disconnect position indicated by a chain double-dashed line. Specifically, the moving gear 131 is swingable around the gear 103 between the transmit position and the disconnect position.

The transmit position is a position in which the moving gear 131 engages with the output gear 132, and the disconnect position is a position in which the moving gear 131 does not engage with the output gear 132. The moving gear 131 is located in the transmit position when the main motor M1 rotates in the forward direction, and is located in the disconnect position when the main motor M1 rotates in the reverse direction.

The output gear 132 is a gear that outputs a driving force to the fixing device 80. Specifically, the output gear 132 outputs a driving force to the heating roller 81A. The output gear 132 is a two-stage gear including a large-diameter gear and a small-diameter gear, and the large-diameter gear engages with the moving gear 131 located in the transmit position.

As shown in FIG. 15, the heating roller 81A has a heating roller gear 81G fixed to one end thereof, and the small-diameter gear of the output roller 132 engages with the heating roller gear 81G. The pressure portion 82 (pressure roller) of the fixing device 80 is caused to rotate together with the heating roller 81A when the heating roller 81A rotates.

The first ejection roller 81 and the second ejection roller 82 receive the driving force of the main motor M1 from the fixing gear train GT2. The first ejection roller 83 has a first ejection roller gear 83G fixed to one end. The second ejection roller 91 has a second ejection roller gear 91G fixed to one end.

The image forming apparatus 1 further comprises a gear 133 and an ejection gear train GT21.

The gear 133 engages with the heating roller gear 81G, and the first ejection roller gear 83G engages with the gear 133. Therefore, the first ejection roller 83 is caused to rotate when receiving the driving force of the main motor M1 from the output gear 132 of the fixing gear train GT2, via the heating roller gear 81G and the gear 133.

The ejection gear train GT21 comprises a gear 134A, a gear 134B, a gear 134C, a gear 134D, a gear 134E, a gear 134F, and a gear 134G.

The gear 134A engages with the small-diameter gear of the output gear 132.

The gear 134B engages with the gear 134A.

The gear 134C engages with the gear 134B.

The gear 134D engages with the gear 134C.

The gear 134E is a two-stage gear including a large-diameter gear and a small-diameter gear, and the large-diameter gear engages with the gear 134D.

The gear 134F is a two-stage gear including a large-diameter gear and a small-diameter gear, and the small diameter gear engages with the small-diameter gear of the gear 134E.

The gear 134G engages with the small-diameter gear of the gear 134F.

The second ejection roller gear 91G engages with the gear 134G. Therefore, the second ejection roller 91 is caused to rotate when receiving the driving force of the main motor M1 from the output gear 132 of the fixing gear train GT2 via the ejection gear train GT21.

As shown in FIGS. 16A and 16B, the adjusting mechanism 200 is a mechanism that receives a driving force from the main motor M1 and thereby switches the nip pressure to be produced by the heating portion 81 and the pressure portion 82. Specifically, the adjusting mechanism 200 switches the nip pressure to be produced by the heating roller 81A and the pressure portion 82 between a first nip pressure indicated in FIG. 16A, and a second nip pressure indicated in FIG. 16B.

The second nip pressure is a nip pressure higher than the first nip pressure. In the present embodiment, the first nip pressure is a nip pressure in a standby state before executing a printing process, and the second nip pressure is a nip pressure to be produced when the printing process is executed. In the present embodiment, the heating portion 81 and the pressure portion 82 also contact each other at the first nip pressure. Hereinafter, the first nip pressure will also be referred to as "low nip pressure," and the second nip pressure will also be referred to as "high nip pressure."

The adjusting mechanism 200 is provided in the fixing device 80. The fixing device 80 further comprises a fixing frame 84 and this adjusting mechanism 200.

The fixing frame 84 supports the heating portion 81. Specifically, the fixing frame 84 supports the heating roller 81A in a manner that renders the heating roller 81A rotatable. The fixing frame 84 comprises a shaft 84A and a spring engaging part 84B provided at each of the outer ends of the fixing frame 84 in the directions parallel to the rotation axis.

The adjusting mechanism 200 further comprises an arm 210, a spring 220, and an adjusting cam 230. The arm 210, the spring 220, and the adjusting cam 230 are provided at each of the outer ends of the pressure portion 82 in the direction parallel to the rotation axis.

The arm **210** supports the pressure portion **82** (pressure roller) in a manner that renders the pressure portion **82** rotatable. The arm **210** includes a first end portion **211**, a second end portion **212**, and a cam contact portion **213**. The arm **210** is rotatably supported by the frame **84** at the first end portion **211** engaging with the shaft **84**A. The cam contact portion **213** is located between the first end portion **211** and the second end portion **212**, and extends toward the adjusting cam **230**.

The spring **220** is a spring that biases the pressure portion **82** toward the heating portion **81**. For example, the spring **220** is a tension spring. One end portion of the spring **220** engages with the spring engaging portion **84**B of the fixing frame **84**, and the other end portion of the spring **220** engages with the second end portion **212** of the arm **210**.

The adjusting cam **230** receives the driving force from the main motor M**1** to thereby switch the nip pressure to be produced by the heating portion **81** and the pressure portion **82** between a the first nip pressure and the second nip pressure. The adjusting cam **230** receives the driving force from the main motor M**1** to thereby switch the nip pressure to be produced by the heating roller **81**A and the pressure portion **82** (pressure roller) between the first nip pressure as observed by the arrangement shown in FIG. **16**A and the second nip pressure as observed by the arrangement shown in FIG. **16**B.

The adjusting cam **230** is rotatably supported by the fixing frame **84**. Specifically, the adjusting cam **230** is rotatable about an axis parallel to the rotation axis of the heating roller **81**A. The adjusting cam **230** is rotatable between a first cam phase shown in FIG. **16**A and a second cam phase shown in FIG. **16**B. The adjusting cam **230** is a plate cam. Specifically, the adjusting cam **230** has a first part **231** and a second part **232** at its outer edge surface.

The first part **231** is a part that contacts the cam contact portion **213** when the adjusting cam **230** is in the first cam phase shown in FIG. **16**A. When the nip pressure cam **230** is in the first phase, the nip pressure produced by the heating portion **81** and the pressure portion **82** is the low nip pressure.

The second part **232** is a part facing the cam contact portion **213** when the adjusting cam **230** is in the second phase shown in FIG. **16**B. When the adjusting cam **250** is in the second phase, the second part **232** is distanced from the cam contact portion **213**. When the adjusting cam **230** is in the second phase, the nip pressure produced by the heating portion **81** and the pressure portion **82** is the high nip pressure.

The adjusting mechanism **200** switches the nip pressure to be produced by the heating portion **81** and the pressure portion **82** from the low nip pressure to the high nip pressure, by the adjusting cam **230** rotating in a third rotation direction R**3** shown in FIG. **16**A from the first cam phase 270 degrees to the second cam phase shown in FIG. **16**B. The third rotation direction R**3** is a direction thin which the adjusting cam **230** is caused to rotate when the main motor M**1** rotates in the forward direction.

The adjusting mechanism **200** switches the nip pressure to be produced by the heating portion **81** and the pressure portion **82** from the high nip pressure to the low nip pressure, by the adjusting cam **230** rotating in a fourth rotation direction R**4** shown in FIG. **16**B from the second cam phase to the first cam phase shown in FIG. **16**A. The fourth rotation direction R**4** is a direction in which the adjusting cam **230** is caused to rotate when the main motor M**1** rotates in the reverse direction. The fourth rotation direction R**4** is a rotation direction opposite to the third rotation direction R**3**

As shown in FIG. **14**, the adjusting gear train GT**3** comprises a clutch connecting gear **135**, a gear **136**, and a gear **137**. The image forming apparatus **1** further comprises an electromagnetic clutch EC**3**.

The electromagnetic clutch EC**3** is switchable between a transmit state and a disconnect state. For example, the electromagnetic clutch EC**3** is in the transmit state when energized and is in the disconnect state when not energized. The transmit state is a state in which the driving force of the main motor M**1** is transmitted from the separation gear train GT**1** to the adjusting gear train GT**3**. In other words, the transmit state is a state in which the driving force received from the main motor M**1** is transmitted to the adjusting cam **230**. The disconnect state is a state in which the driving force of the main motor M**1** is not transmitted from the separation gear train GT**1** to the adjusting gear train GT**3**. In other words, the disconnect state is a state in which the driving force received from the main motor M**1** is not transmitted to the adjusting cam **230**. The controller **2** (refer to FIG. **1**) controls the electromagnetic clutch EC**3**.

The clutch connecting gear **135** rotates together with the gear **104** of the separation gear train GT**1** when the electromagnetic clutch EC**3** is in the transmit state. The clutch connecting gear **135** rotates about the same axis as that about which the gear **104** rotates. The gear **104** is an example of a gear included in the separation gear train GT**1**. Since the driving force of the main motor M**1** is not transmitted to the clutch connecting gear **135** when the electromagnetic clutch EC**3** is in the disconnect state, the clutch connecting gear **135** is not driven.

The gear **136** is a two-stage gear including a large-diameter gear and a small-diameter gear, and the large diameter gear engages with the clutch connecting gear **135**.

The gear **137** is a two-stage gear including a large-diameter gear and a small-diameter gear, and the large diameter gear engages with the small-diameter gear of the gear **136**. The adjusting cam **230** of the adjusting mechanism **200** (refer to FIGS. **16**A and **16**B) receives the driving force of the main motor M**1** from the small-diameter gear of the gear **137** to thereby rotate.

As shown in FIG. **15**, the sheet feeder gear train GT**4** comprises a gear **141**, a gear **142**, a gear **143**, a gear **144**, and a gear **145**.

The gear **141** is a two-stage gear including a large-diameter gear and a small-diameter gear, and the large-diameter gear engages with the motor gear MG**1**. In other words, the motor gear MG**1** engages with the large-diameter gear of the gear **141**. The gear **141** is an example of a gear included in the sheet feeder gear train GT**4**.

The gear **142** is a two-stage gear including a large-diameter gear and a small-diameter gear, and the large-diameter gear engages with the small-diameter gear of the gear **141**.

The gear **143** engages with the small-diameter gear of the gear **142**.

The gear **144** engages with the gear **143**.

The gear **145** engages with the gear **144**. The gear **145** outputs a driving force to the sheet feeder mechanism **22**. The sheet feeder mechanism **22** receives the driving force from the main motor M**1** to thereby feed the sheet S toward the image forming unit **30**.

As shown in FIG. **17**, the drum gear train GT**5** comprises a gear **411**, a drum gear **412**M, a gear **413**, a drum gear **412**Y, a drum gear **412**C, a gear **414**, and a drum gear **412**K.

The gear **411** is a two-stage gear including a large-diameter gear and a small-diameter gear, and the large-diameter gear engages with a motor gear MG**2**. The motor gear MG**2** is a gear provided on an output shaft of the process motor M**2**. The motor gear MG**2** is located between a center of rotation of the drum gear **412**M and a center of rotation of the drum gear **412**C, in a front-rear direction that is a direction in which the development rollers **50** are arranged.

The drum gear **412**M is a gear that rotates together with the photosensitive drum **50**M, and engages with the small-diameter gear of the gear **411**.

The gear **413** engages with the drum gear **412**M

The drum gear **412**Y is a gear that rotates together with the photosensitive drum **50**Y, and engages with the gear **413**.

The drum gear **412**C is a gear that rotates together with the photosensitive drum **50**C, and engages with the small-diameter gear of the gear **411**.

The gear **414** engages with the drum gear **412**C.

The drum gear **412**K is a gear that rotates together with the photosensitive drum **50**K, and engages with the gear **414**.

The image forming apparatus **1** further comprises a transfer gear train GT**51**. The transfer gear train GT**51** is a gear train that receives the driving force of the process motor M**2** from the drum gear train GT**5** and transmits the driving force to the transfer unit **70**. The transfer gear train GT**51** comprises a gear **415**, a gear **416**, and a gear **417**.

The gear **415** engages with the large-diameter gear of the gear **411**.

The gear **416** is a two-stage gear including a large-diameter gear and a small-diameter gear, and its large-diameter gear engages with the gear **415**.

The gear **417** is a two-stage gear including a large-diameter gear and a small-diameter gear, and this large-diameter gear engages with the small-diameter gear of the gear **416**. The gear **417** outputs a driving force to the transfer unit **70**. The photosensitive drum **50** and the transfer unit **70** receive the driving force from the process motor M**2** and thereby convey a sheet S through between the photosensitive drum **50** and the transfer roller **74**.

As shown in FIG. **18**, the first development roller gear train GT**6** comprises a gear **421**, a gear **422**, a gear **423**, a moving gear **424**, a first output gear **425**, a coupling gear **426**Y, a coupling gear **426**M, a gear **427**, and a coupling gear **426**C.

The gear **421** is a two-stage gear including a large-diameter gear and a small-diameter gear, and this large-diameter gear engages with the motor gear MG**2**. The motor gear MG**2** is located between a center of rotation of the coupling gear **426**M and a center of rotation of the coupling gear **426**C in the front-rear direction.

The gear **422** engages with the small-diameter gear of the gear **421**.

The gear **423** engages with the gear **422**.

The moving gear **424** is a gear that receives a driving force from the process motor M**2**, and engages with the gear **423**. The moving gear **424** is movable relative to the first output gear **425** between a first transmit position indicated by a solid line and a first disconnect position indicated by a chain double-dashed line. Specifically, the moving gear **424** is swingable around the gear **423** between the first transmit position and the first disconnect position. A shaft **424**A of the moving gear **424** is swingably supported by the metal sheet **15** (refer to FIG. **19**).

The first transmit position is a position in which the moving gear **424** engages with the first output gear **425**, and the first disconnect position is a position in which the moving gear **424** does not engage with the first output gear **425**. The moving gear **424** is biased from the first disconnect position toward the first transmit position by a spring. The moving gear **424** is caused to move between the first transmit position and the first disconnect position by a switching cam **190** (refer to FIG. **19**) which will be described below.

The first output gear **425** is a gear that outputs a driving force to the development rollers **61**Y, **61**M, and **61**C. The first output gear **425** is a two-stage gear including a large-diameter gear and a small-diameter gear, and this large-diameter gear engages with the moving gear **424** located in the first transmit position.

The coupling gear **426**Y engages with the small-diameter gear of the first output gear **425**. The coupling gear **426**Y is a gear that outputs the driving force received from the process motor M**2** to the development roller **61**Y. Specifically, the coupling gear **426**Y outputs the driving force received from the process motor M**2** to the development cartridge **60**Y.

The coupling gear **426**M engages with the small-diameter gear of the first output gear **425**. The coupling gear **426**M is a gear that outputs the driving force received from the process motor M**2** to the development roller **61**M. Specifically, the coupling gear **426**M outputs the driving force received from the process motor M**2** to the development cartridge **60**M.

The gear **427** engages with the coupling gear **426**M.

The coupling gear **426**C engages with the gear **427**. The coupling gear **426**C is a gear that outputs the driving force received from the process motor M**2** to the development roller **61**C. Specifically, the coupling gear **426**C outputs the driving force received from the process motor M**2** to the development cartridge **60**C.

As shown in FIG. **19**, the image forming apparatus **1** further comprises a switching cam **190** and a switching gear train GT**8**.

The switching gear train GT**8** is a gear train that transmits a driving force of the main motor M**1** to the switching cam **190**. The switching gear train GT**8** receives the driving force of the main motor M**1** from the first separation gear train GT**11** (refer to FIG. **10**) and transmits the driving force to the switching cam **190**. Specifically, the switching gear train GT**8** receives the driving force of the main motor M**1** from the idle gear **118** of the first separation gear train GT**11** and transmits the driving force to the switching cam **190**.

The switching gear train GT**8** comprises a gear **441**, a gear **442**, and a gear **443**.

The gear **441** engages with the second gear portion **118**C of the idle gear **118**.

The gear **442** is a two-stage gear including a large-diameter gear and a small-diameter gear, and this large-diameter gear engages with the gear **441**.

The gear **443** engages with the small-diameter gear of the gear **442**. The gear **443** engages with the gear potion **191**, which will be described below, of the switching cam **190**.

The first gear portion **118**B of the idle gear **118** and the cam gear **115**M are located on a first side of the metal sheet **15** as defined by a side surface thereof facing in a direction parallel to the rotation axis of the idle gear **118**. On the other hand, the second gear portion **118**C of the idle gear **118**, the gears **441** to **443** of the switching gear train GT**8**, and the switching cam **190** are located on the second side, opposite to the first side, of the metal sheet **15**.

The switching cam **190** is a plate cam that receives a driving force from the main motor M**1** to thereby rotate. The switching cam **190** receives the driving force of the main motor M**1** from the cam gear **115**M. Specifically, the switching cam **190** receives the driving force of the main motor M**1** from the cam gear **115** via the idle gear **118** and the switching gear train GT**8**.

The switching cam **190** rotates and thereby causes the moving gear **424** of the first development roller gear train GT**6** to move between the first transmit position indicated in FIG. **19** and the first disconnect position indicated in FIG. **20**. The switching cam **190** is rotatable between a first phase indicated in FIG. **20**, and a second phase indicated in FIG. **19**. The first phase is a phase in which the moving gear **424** is located in the first disconnect position, and the second phase is a phase in which the moving gear **424** is located in the first transmit position.

The switching cam **190** comprises a gear portion **191** and a cam portion **192**.

The gear portion **191** engages with the gear **443** of the switching gear train GT**8**.

The cam portion **192** includes a first part **192**A, a second part **192**B, and a third part **192**C on the outer peripheral surface.

The first part **192**A is a part that is in contact with the shaft **424**A of the moving gear **424** when the switching cam **190** is in the first phase indicated in FIG. **20**. The first part **192**A has a shape of a segment of a circle of which a center coincides with the rotation axis of the switching cam **190**.

The second part **192**B is a part facing the shaft **424**A of the moving gear **424** when the switching cam **190** is in the second phase indicated in FIG. **19**. The distance from the center of rotation of the switching cam **190** to the second part **192**B is shorter than the distance from the center of rotation of the switching cam **190** to the first part **192**A. When the switching cam **190** is in the second phase, the second part **192**B may be located in contact with the shaft **424**A, or located apart from the shaft **424**A.

The third part **192**C is a part that contacts the shaft **424**A of the moving gear **424** and causes the moving gear **424** to move between the first disconnect position and the first transmit position when the switching cam **190** is caused to rotate between the first phase and the second phase. The third part **192**C is a flat surface connecting the first part **192**A and the second part **192**B.

The switching cam **190** is rotates from the first phase indicated in FIG. **20** to the second phase indicated in FIG. **19** to cause the moving gear **424** to move from the first disconnect position to the first transmit position when the main motor M**1** is rotated in the forward direction. The switching cam **190** rotates from the second phase shown in FIG. **19** to the first phase shown in FIG. **20** to cause the moving gear **424** to move from the first transmit position to the first disconnect position when the main motor M**1** is rotated in the reverse direction.

When the switching cam **190** causes the moving gear **424** to move from the first disconnect position to the first transmit position, the cam portion **192** of the switching cam **190**, causes the moving gear **424** to be located in the first transmit position at a time before the development rollers **61**Y, **61**M, and **61**C are located in the contact positon. Therefore, the development rollers **61**Y, **61**M, and **61**C are caused to rotate by the driving force transmitted thereto from the process motor M**2** before the development rollers **61**Y, **61**M, and **61**C are located in the contact positions. Thereafter, the rotating development rollers **61**Y, **61**M, and **61**C are brought into contact with the corresponding rotating photosensitive drums **50**Y, **50**M, and **50**C.

When the switching cam **190** causes the moving gear **424** to move from the first transmit position to the first disconnect position, the cam portion **192** of the switching cam **190**, causes the moving gear **424** to be located in the first disconnect position at a time after the development rollers **61**Y, **61**M, and **61**C are located in the separate positions. Therefore, after the development rollers **61**Y, **61**M, and **61**C are located in the separate positions, transmission of the driving force from the process motor M**2** thereto is stopped with the result that the development rollers **61**Y, **61**M, and **61**C stop rotating. The development rollers **61**Y, **61**M, and **61**C which have not stopped rotating separate from the corresponding rotating photosensitive drums **50**Y, **50**M, and **50**C.

As shown in FIG. **21**A, the second development roller gear train GT**7** comprises a gear **431**, a gear **432**, a gear **433**, a gear **434**, a gear **435**, a first gear **436**, a planetary gear train **180**, and a coupling gear **426**K as an example of a second gear.

The gear **431** engages with the gear **422** of the first development roller gear train GT**6**.

The gear **432** engages with the gear **431**.

The gear **433** engages with the gear **432**.

The gear **434** engages with the gear **433**. The gear **434** rotates about the same axis as that about which the coupling gear **426**C included in the first development roller gear train GT**6** rotates.

The gear **435** engages with the gear **424**.

The first gear **436** is a gear that receives a driving force from the process motor M**2**, and engages with the gear **435**. As shown in FIG. **21**B, the first gear **436** engages with a first outer peripheral gear **185**, which will be described below, of the planetary gear train **180**. The first outer peripheral gear **185** is a gear provided on an input element **180**A, which will be described below, of the planetary gear train **180**. The gear **436** rotates about the same axis as that about which the coupling gear **426**K rotates.

As shown in FIG. **22**, the planetary gear train **180** comprises an input element **180**A, an output element **180**B, and a transmission element **180**C. The input element **180**A, the output element **180**B, and the transmission element **180**C are coaxially rotatable.

The planetary gear train **180** further comprises a sun gear **181**, a ring gear **182**, a carrier **183**, and four planet gears **184**. In the planetary gear train **180**, one of the input element **180**A, the output element **180**B, and the transmission element **180**C includes the sun gear **181**, another of the input element **180**A, the output element **180**B, and the transmission element **180**C (e.g. an element other than the element including the sun gear **181**) includes the ring gear **182**, and a remaining one of the input element **180**A, the output element **180**B, and the transmission element **180**C (e.g. an element other than the element including the sun gear **181** and the element including the ring gear **182**) includes the carrier **183**. In the present embodiment, the transmission element **180**C includes the sun gear **181**, the input element **180**A includes the ring gear **182**, and the output element **180**B includes the carrier **183**.

The input element **180**A is an element that receives a driving force of the process motor M**2**. The input element **180**A includes the ring gear **182** and the first outer peripheral gear **185** located on the outer periphery of the ring gear **182**. The ring gear **182** is an internal gear provided on the input element **180**A and engages with the four planet gears **184**.

The output element **180**B is an element that outputs a driving force to the development roller **61**K. The output element **180**B includes the carrier **183**, and a second outer peripheral gear **186** located on the outer periphery of the carrier **183**. The carrier **183** includes four shafts **183**A by which the four planet gears **184** are rotatably supported.

The transmission element **180**C is an element configured to allow the driving force to be transmitted from the input element **180**A to the output element **180**B when a rotation of the transmission element **180**C is restrained, and to not allow the driving force to be transmitted from the input element **180**A to the output element **180**B when the rotation of the transmission element **180**C is not restrained. The transmission element **180**C includes the sun gear **181**, a rotatory plate **187** that rotates together with the sun gear **181**, and two pawl portions **188** located on the outer periphery of the rotatory plate **187**.

The four planet gears **184** are rotatably supported by the shaft **183**A of the carrier **183**. The planet gears **184** engage with the sun gear **181**. The planet gears **184** also engage with the ring gear **182**.

When the transmission element **180**C of the planetary gear train **180** is caused to stop rotating, the planetary gear train **180** is in a transmit state in which a driving force input to the first outer peripheral gear **185** is allowed to be transmitted to the second outer peripheral gear **186**. On the other hand, when the transmission element **180**C is in a rotatable state, the planetary gear train **180** is in a disconnect state in which a driving force in put to the first outer peripheral gear **185** is not allowed to be transmitted to the second outer peripheral gear **186**. When the planetary gear train **180** is in the disconnect state and the second outer peripheral gear **186** is under load conditions, if a driving force is input to the first outer peripheral gear **185**, the output element **180**B is not caused to rotate, and the transmission element **180**C run idle.

As shown in FIG. **21**B, the coupling gear **426**K is a gear that outputs the driving force received from the process motor M**2** to the development roller **61**K. Specifically, the coupling gear **426**K outputs the driving force to the development cartridge **60**K. The coupling gear **426**K engages with the second peripheral gear **186** of the planetary gear train **180**. The second peripheral gear **186** is the gear provided on the output element **180**B of the planetary gear train **180**.

As shown in FIGS. **23**A and **23**B, the image forming apparatus **1** further comprises a switching lever **160**. The separation cam **150**K corresponding to black further comprises a protrusion **154**.

The protrusion **154** protrudes from an outer peripheral surface of the cam portion **153**. The protrusion **154** is contactable with the switching lever **160**. The protrusion **154** causes the switching lever **160** to move between a second transmit position shown in FIG. **23**A and a second disconnect position shown in FIG. **23**B according to rotation of the separation cam **150**K.

The switching lever **160** movable relative to the planetary gear train **180** between the second transmit positon and the second disconnect position according to rotation of the separation cam **150**K. Specifically, the switching lever **160** is rotatable between the second transmit position and the second disconnect position. The switching lever **160** comprises a rotation support portion **161**, a first arm **162**, and a second arm **163**. The first arm **162** extends from the rotation support portion **161**. The second arm **162** extends from the rotation support portion **161** in a direction different from a direction in which the first arm **162** extends.

The rotation support portion **161** is rotatably supported by the metal sheet **15** (refer to FIG. **3**). Therefore, the switching lever **160** is swingable about a swinging axis **160**A between the second transmit positon indicated in FIG. **23**A and the second disconnect positon indicated in FIG. **23**B. The switching lever **160** is biased by a spring from the second disconnect position toward the second transmit position.

An end portion of the second arm **163** extends toward the outer periphery of the transmission element **180**C. As shown in FIG. **23**A, when the switching lever **160** is located in the second transmit position, the end portion of the second arm **163** engages with the pawl portion **188** of the transmission element **180**C, and restrains the rotation of the transmission element **180**C. Therefore, the driving force of the process motor M**2** input to the planetary gear train **180** is transmitted to the development cartridge **60**K via the coupling gear **426**K (refer to FIG. **18**), and the development roller **61**K is caused to rotate.

As shown in FIG. **23**B, when the switching lever **160** is located in the second disconnect position, the end portion of the second arm **163** is disengaged from the pawl portion **188** of the transmission element **180**C, and does not restrain the rotation of the transmission element **180**C. Therefore, the driving force of the process motor M**2** input to the planetary gear train **180** is not transmitted to the development cartridge **60**K, and the development roller **61**K is not caused to rotate.

The first arm **162** is contactable with the protrusion **154** of the separation cam **150**K. As shown in FIG. **23**A, when the contact of the first arm **162** and the protrusion **154** is broken up, the switching lever **160** is caused to swing to the second transmit position by the biasing force of the spring. As shown in FIG. **23**B, when the first arm **162** comes in contact with the protrusion **154**, the switching lever **160** is caused to swing to the second disconnect position against the biasing force of the spring.

When the switching lever **160** is caused to move from the second disconnect position to the second transmit position, the protrusion **154** causes the switching lever **160** to be located in the second transmit position at a time before the development roller **61**K is located in the contact position. Specifically, the protrusion **154** separates from the switching lever **160** at a time before the development roller **61**K is located in the contact position, and the switching lever **160** is caused to swing from the second disconnect position to the second transmit position.

Therefore, before the development roller **61**K is located in the contact position, the development roller **61**K receives the driving force from the process motor M**2** to start rotating. Thereafter, the development roller **61**K while rotating contacts the rotating photosensitive drum **50**K.

When the switching lever **160** is caused to move from the second transmit position to the second disconnect position, the protrusion **154** cause the switching lever **160** to be located in the disconnect position at a time after the development roller **61**K is located in the separate position. Specifically, the protrusion **154** contacts the switching lever **160** at a time after the development roller **61**K is located in the separate positon, and the switching lever **160** is caused to swing from the second transmit position to the second disconnect position.

Therefore, after the development roller **61**K is located in the separate position, the driving force from the process motor M**2** to the development roller **61**K is stopped, and as a result, the development roller **61**K stops rotating. The development roller **61**K separates from the rotating photosensitive drum **50**K while rotating.

The controller **2** (refer to FIG. **1**) comprises a central processing unit or CPU, a read-only memory or ROM, a random-access memory or RAM, and an input/output circuit, and executes a pre-stored program to execute various processes of control. The controller **2** controls the driving and stopping of the main motor M**1**, and the rotational direction of the output shaft of the main motor M**1**. The controller **2** also controls the driving and stopping of the process motor M**2**. The controller **2** also controls the electromagnetic clutches EC**1** to EC**3**.

Therefore, the controller **2** controls the contacting and separating of the development rollers **61** with and from the photosensitive drums **50**. The controller **2** also controls the driving and stopping of the photosensitive drums **50**, the development rollers **61**, and the heating roller **81**A. The controller **2** also controls the nip pressure to be produced by the heating portion **81** and the pressure potion **82** of the fixing device **80**.

The controller **2** is capable of executing a printing process in a print mode selected from a color print mode as a first mode, and a black-and-white print mode as a second mode.

The color print mode is a print mode in which the development roller **61**Y, the development roller **61**M, the development roller **61**Y, and the development roller **61**K are used to form an image on a sheet S.

When the image forming apparatus **1** is in the standby state before the printing process is executed, all development rollers **61** are located in the separate positions. The color print mode is a print mode in which all development rollers **61** (**61**Y, **61**M, **61**C, and **61**K) are moved from the separate positions to the contact positions to form an image on a sheet S.

The black-and-white print mode is a print mode in which only the development roller **61**K is used to form an image on a sheet S. Specifically, the black-and-white print mode is a print mode in which only the development roller **61**K is moved from the separate position to the contact position to form an image on a sheet S.

As shown in FIG. **2**, the image forming apparatus **1** further comprises sensors **4**K and **4**C. The sensor **4**K is a sensor configured to detect the location of the cam follower **170**K. The sensor **4**C is a sensor configured to detect the location of the cam followers **170**Y, **170**M, and **170**C. The sensor **4**C directly detects the location of the cam follower **170**C, and indirectly detects the location of the cam followers **170**Y and **170**M.

Each of the sensors **4**K and **4**C includes a light-emitting portion **4**P and a light-receiving portion **4**R. The light-emitting portion **4**P emits a light beam to be detected, and the light-receiving portion **4**R can receive the light beam emitted by the light emitting portion **4**P. The sensors **4**K and **4**C are provided through the through holes **550** of the gear cover **500** (see FIGS. **8**A and **8**B), and their light-emitting portions **4**P and their light-receiving portions **4**R are located inside the gear cover **500**.

The cam follower **170**K is located in a position between the light-emitting portion **4**P and the light-receiving portion **4**R when the cam follower **170**K is located in the push position. The cam follower **170**K is located outside of the position between the light-emitting portion **4**P and the light-receiving portion **4**R when the cam follower **170**K is located in the no-push position. Likewise, the cam follower **170**C is located in a position between the light-emitting portion **4**P and the light-receiving portion **4**R when the cam follower **170**C is located in the push position. The cam follower **170**C is located outside of the position between the light-emitting portion **4**P and the light-receiving portion **4**R when the cam follower **170**C is located in the no-push position.

Therefore, the light-receiving portion **4**R of each of the sensors **4**K and **4**C fails to receive a light beam emitted from the corresponding light-emitting portion **4**P when the corresponding cam follower **170** is located in the push position because the light beam is interrupted by the rib **174**. On the other hand, the light-receiving portion **4**R successfully receives a light beam emitted from the light-emitting portion **4**R when the cam follower **170** is located in the no-push position. The sensors **4**K and **4**C determines whether the cam follower **170** is located in the push position or the no-push position by detecting the change in the result of detection of an emitted light beam.

When the cam follower **170** is located in the push position, the corresponding development roller **61** is located in the separate position. When the cam follower **170** is located in the no-push position, the corresponding development roller **61** is located in the contact position. Therefore, the sensors **4**K and **4**C can determine whether the development roller **61** is located in the contact position or in the separate position via determination of the position of the cam follower **170**.

The rib **174** of the cam follower **170**K is detectable by the sensor **4**K, and the rib **174** of the cam follower **170**C is detectable by the sensor **4**C. In the present embodiment, the four cam followers **170** are common components, and each include a rib **174**, but the ribs **174** of the cam followers **170**Y and **170**M do not function as parts to be detected by the sensors **4**K and **4**C.

An example of an operation of the controller **2** executing a printing process will be described below. Hereafter, putting the electromagnetic clutches EC**1** to EC**3** in the transmit state will be indicated as turning ON, and putting the electromagnetic clutches EC**1** to EC**3** in the disconnect state will be indicated as turning OFF.

First, the operation of the controller **2** as performed when the printing process is executed in the color print mode will be described with reference to a time chart. As shown in FIG. **24**, the image forming apparatus **1** in the standby state (refer to t**0**) has all the development rollers **61** located in the separate positions. The image forming apparatus **1** in the standby state has the nip pressure (as produced by the heating portion **81** and the pressure portion **82**) set at the low nip pressure.

When the printing process is executed in the color print mode, the controller **2** causes the main motor M**1** to run in the forward rotation direction (time t**1**). Therefore, the moving gear **131** is moved from the disconnect position to the transmit positon, the driving force of the main motor M**1** is transmitted to the heating roller **81**A, and the heating roller **81**A and the pressure portion **82** (pressure roller) are caused to rotate. The driving force of the main motor M**1** is also transmitted to the first ejection roller **83** and the second ejection roller **91**, causing the first ejection roller **83** and the second ejection roller **91** to rotate.

Next, the controller **2** activates the process motor M**2** (time t**2**). Therefore, the driving force of the process motor M**2** is transmitted to the photosensitive drum **50**, and the photosensitive drum **50** is caused to rotate.

Next the controller **2** turns ON the electromagnetic clutch EC**3** (time t**3**). Therefore, the driving force of the main motor M**1** is transmitted to the adjusting cam **230** of the adjusting mechanism **200** and causes the adjusting cam **230** to rotate in the third rotation direction R**3**, from the first cam phase to the second cam phase. Therefore, the nip pressure produced by the heating portion **81** and the pressure portion **82** is switched from the low nip pressure to the high nip pressure (time t**4** to t**5**).

The controller **2** turns OFF the electromagnetic clutch EC**3** after the nip pressure produced by the heating portion **81** and the pressure portion **82** has been switched to the high nip pressure (time t**6**).

Thereafter, the controller **2** turns ON the electromagnetic clutch EC**1** (time t**7**). Therefore, the driving force of the main motor M**1** is transmitted to the switching cam **190** and the separation cams **150**Y, **150**M, and **150**C, and the switching cam **190** is caused to rotate from the first phase to the second phase, and the separation cams **150**Y, **150**M, and **150**C are caused to rotate in the first rotation direction R**1**.

Thereafter, the moving gear **424** is caused to move from the first disconnect position to the first transmit position by the rotation of the switching cam **190** to the second phase. Therefore, the driving force of the process motor M**2** is transmitted to the development rollers **61**Y, **61**M, and **61**C, and causes the development rollers **61**Y, **61**M, and **61**C to rotate (time t**8**).

Next, the development roller **61**Y is moved from the separate position to the contact position by the separation cam **150**Y rotating in the first rotation direction R**1** (time t**9** to t**10**). Next, the development roller **61**M is moved from the separate position to the contact position by the separation cam **150**M rotating in the first rotation direction R**1** (time t**11** to t**12**). Next, the development roller **61**C is moved from the separate position to the contact position by the separation cam **150**C rotating in the first rotation direction R**1** (time t**13** to t**14**).

The controller **2** turns OFF the electromagnetic clutch EC**1** after a predetermined amount of time has elapsed from the time at which the sensor **4**C has determined that the development rollers **561**Y, **61**M, and **61**C are located in the contact positions (time t**15**).

The controller **2** also turns ON the electromagnetic clutch EC**2** at a time when the development roller **61**K moves from the separate position to the contact position after the development roller **61**C moves from the separate position to the contact positon (time t**16**). Therefore, the driving force of the main motor M**1** is transmitted to the separation cam **150**K, and the separation cam **150**K is caused to rotate in the first rotation direction R**1**.

Thereafter, the protrusion **154** of the separation cam **150**K rotating in the first rotation direction R**1** contacts the switching lever **160**, and causes the switching lever **160** to swing from the second disconnect position to the second transmit position. Therefore, the driving force of the process motor M**2** is transmitted via the planetary gear train **180**, and the development roller **61**K is caused to rotate (time t**17**).

Next, the development roller **61**K moves from the separate position to the contact position by the separation cam **150**K rotating in the first rotation direction R**1** at a time after the time t**14** when the development roller **61**C moves from the separate position to the contact position (time t**18** to t**19**).

The controller turns OFF the electromagnetic clutch EC**2** after a predetermined amount of time has elapsed from the time when the sensor **4**K has determined that the development roller **61**K is located in the contact position (time t**20**).

As described above, when the main motor M**1** rotates in the forward direction, the controller **2** controls the operation of the separation mechanism **5** and causes the development rollers **61** (development roller **61**Y, development roller **61**M, development roller **61**C. and development roller **61**K, in this sequence) in the separate positions to move to the contact position (times t**9** to t**19**).

Specifically, when the main motor M**1** rotates in the forward direction, the separation mechanism **5** causes the development roller **61**M to move from the separate position to the contact position after causing the development roller **61**Y to move from the separate position to the contact position. The separation mechanism **5** causes the development roller **61**C to move from the separate position to the contact position after causing the development roller **61**M to move from the separate position to the contact position. When the main motor M**1** rotates in the forward direction, the controller **2** operates the electromagnetic clutch EC**2** to control the separation mechanism, and causes the development roller **61**K to move from the separate position to the contact position after causing the development roller **61**C to move from the separate position to the contact position.

The controller **2** executes the printing process after causing the development rollers **61**Y, **61**M, **61**C, and **61**K to be located in the contact positions. When the sheet S is ejected in the output tray **13** and the printing process is completed, the controller **2** temporally stops the main motor M**1** (time t**21**). Thereafter, the controller **2** causes the main motor M**1** to run in the reverse rotation direction (t**22**).

Therefore, the moving gear **131** is caused to move from the transmit position to the disconnect position, and the transmission of the driving force of the main motor M**1** to the heating roller **81**A is stopped, and the heating roller **81**A and the pressure portion (pressure roller) are caused to stop. Transmission of the driving force from the main motor M**1** to the first ejection roller **83** and the second ejection roller **91** is also stopped, and the first ejection roller **83** and second ejection roller **91** are caused to stop rotating.

The controller **2** turns ON the electromagnetic clutch EC**2** after driving the main motor M**1** in the reverse rotation direction (time t**23**). Therefore, the driving force of the main motor M**1** is transmitted to the separation cam **150**K, and causes the separation cam **150**K to rotate in the second rotation direction R**2**.

The separation cam **150**K rotating in the second direction R**2** causes the development roller **61**K to move from the contact position to the separate position (time t**24** to t**25**).

Next, the protrusion **154** of the separation cam **150**K separates from the switching lever **160**, and the switching lever **160** is caused to swing from the second transmit position to the second disconnect position. Therefore, the transmission of the driving force from the process motor M**2** to the development roller **61**K is stopped, and the development roller **61**K to stop (time t**26**).

The controller **2** turns OFF the electromagnetic clutch EC**2** after a predetermined amount of time has elapsed from the time when the sensor **4**K determines that the development roller **61**K is located in the separate position (time t**27**).

The controller **2** turns ON the electromagnetic clutch EC**1** at a time (time t**28**) when the development roller **61**C is caused to move from the contact position to the separate position after the development roller **61**K moves from the contact position to the separate position. Therefore, the driving force of the main motor M**1** is transmitted to the switching cam **190** and the separation cams **150**Y, **150**M, and **150**C, causing the switching cam **190** to rotate from the second phase to the first phase, and the separation cams **150**Y, **150**M, and **150**Y to rotate in the second rotation direction R**2**.

Thereafter, the development roller **61**C is caused to move from the contact position to the separate position by the separation cam **150** rotating in the second rotation direction R**2**, at a time after the time t**25** when the development roller **61**K has moved from the contact position to the separate position (time t**29** to t**30**). Next, the development roller **61**M is caused to move from the contact position to the separate position by the separation cam **150**M in the second rotation direction R2 (time t31 to t32). Finally, the development roller 61Y is caused to move from the contact position to the separate position by the separation cam 150Y rotating in the second rotation direction R2 (time t33 to t34).

Next, the switching cam 190 rotating to the first phase causes the moving gear 424 to move from the first transmit position to the first disconnect position. Therefore, the driving force of the process motor M2 is not transmitted to the development rollers 61Y, 61M, and 61C, and the rotation of the development rollers 61Y, 61M, and 61C are caused to stop rotating (time t35).

The controller 2 turns OFF the electromagnetic clutch EC1 after a predetermined amount of time has elapsed from the time when the sensor 4C has determined that the development rollers 61Y, 61M, and 61C are located in the separate positions (time t36).

As described above, when the main motor M1 rotates in the reverse direction, the controller 2 controls the operation of the separation mechanism 5 and causes the development rollers 61 (development roller 61Y, development roller 61M, development roller 61C, and development roller 61K) in the contact positions to move to the separate position.

Specifically, when the main motor M1 rotates in the reverse direction, the controller 2 operates the electromagnetic clutch EC1 to thereby control the separation mechanism 5 and causes the development roller 61C to move from the contact position to the separate position after causing the development roller 61K to moves from the contact position to the separate position. The separation mechanism 5 causes the development roller 61M to move from the contact position to the separate position after causing the development roller 61C to move from the contact position to the separate position. The separation mechanism 5 also causes the development roller 61Y to move from the contact position to the separate position after causing the development roller 61M to move from the contact position to the separate position.

The controller 2 stops the rotation of the process motor M2 after the development rollers 61Y, 61M, 61C, and 61K are located in the separate positions (time t37). Therefore, the driving force of the process motor is not transmitted to the photosensitive drums 50, and the photosensitive drums 50 are caused to stop rotating.

Thereafter, the controller 2 turns ON the electromagnetic clutch EC3 (time t38). Therefore, the driving force of the main motor M1 is transmitted to the adjusting cam 230 of the adjusting mechanism 200 and causes the adjusting cam 230 to rotate in the fourth rotation direction R4, from the second cam phase to the first cam phase. Therefore, the nip pressure produced by the heating portion 81 and the pressure portion 82 is switched from the high nip pressure to the low nip pressure (time t39 to t40).

The controller 2 turns OFF the electromagnetic clutch EC3 when the nip pressure produced by the heating portion 81 and the pressure portion 82 has been switched from the high nip pressure to the low nip pressure (time t41). Thereafter, the controller 2 stops the main motor M1 (time t42).

In the present embodiment, the controller 2 operates the electromagnetic clutch EC2 to control the separation mechanism 5, and causes the development roller 61K located in the separate position to move from the separate position to the contact position (time t18 to t19), and after causing the development roller 61K to move to the contact position causes the development roller 61K to move from the contact position to the separate position (time t24 to t25) while the development roller 61C is located in the contact positon (time t14 to t29).

The separation mechanism 5 also causes the development roller 61C located in the separate position to move from the separate position to the contact position (time t13 to t14), and after causing the development roller 61C to move to the contact position, causes the development roller 61C to move from the contact position to the separate position (time t29 to t30) while the development roller 61M is located in the contact position (time t12 to t31).

The separation mechanism 5 also causes the development roller 61M located in the separate position to move from the separate position to the contact position (time t11 to t12), and after causing the development roller 61M to move to the contact position, causes the development roller 61C to move from the contact position to the separate position (time t31 to t32) while the development roller 61Y is located in the contact position (time t10 to t33).

When executing the printing process in the black-and-white print mode, the controller 2 keeps the electromagnetic clutch EC2 turned OFF, and controls the main motor M1, the process motor M2, the electromagnetic clutch EC1, and the electromagnetic clutch EC3 as in the case where the printing process is executed in the color print mode.

Next, advantageous effects of the image forming apparatus 1 configured as described above in accordance with the present embodiment will be described.

Since the image forming apparatus 1 comprises the separation gear train GT1, the fixing gear train GT2, and the adjusting gear train GT3, the contact and separation of the development rollers 61, the driving of the fixing device 80, and the switching of the nip pressure of the fixing device 80 can be operated by one main motor M1. Therefore, the number of motors in the image forming apparatus can be reduced.

Since the moving gear 131 is used to switch the state of the transmission of the driving force from the main motor M1 to the fixing device 80 between a transmit state and a disconnect state, the cost can be reduced compared to an alternative configuration in which an electromagnetic clutch is used, for example.

Since the moving gear 131 is located in the transmit position when the main motor M1 rotates in the forward direction, a sheet S can be conveyed by the fixing device 80. Also, since the moving gear 131 is located in the disconnect positon when the main motor M1 rotates in the reverse direction, transmission of the driving force of the main motor M1 to the fixing device 80 can be stopped.

Since the clutch connecting gear 135 rotates about an axis common to that about which the gear 104 of the separation gear train GT1 rotates, a gear train including the separation gear train GT1 and the adjusting gear train GT3 can be arranged in a more compact manner overall.

Since the rotation direction of the separation cam 150 is switched to the first rotation direction R1 and to the second rotation direction R2, the shape of the separation cam 150 can be designed more freely. Since the separation cam 150 can be made smaller in size, the image forming apparatus 1 can be made smaller in size.

To elaborate, if a separation cam is rotated only in one direction to slide the cam follower 170 between the no-push position and the push position, the separation cam needs a first guide surface for guiding the cam follower 170 from the no-push position to the push position, and a second guide surface for guiding the cam follower 170 from the push position to the no-push position. Therefore, the shape of the cam portion is determined for this end to a certain extent, and there is little freedom in the design of the shape of the separation cam. Since two guide surfaces are needed, the cam portion needs to be made larger, and the separation cam needs to be made larger. There is no such limitation in the present embodiment, so the shape of separation cam can be designed more freely, and the separation cam **150** can be made smaller in size.

Since the motor gear MG**1** of the main motor M**1** engages with both the gear **101** of the separation gear train GT**1** and the gear **141** of the sheet feeder gear train GT**4**, the driving force of the main motor M**1** can be directly transmitted to the separation gear train GT**1** and the sheet feeder gear train GT**4**.

Since the first ejection roller **83** and the second ejection roller **91** receive the driving force of the main motor M**1** from the fixing gear train GT**2**, the first ejection roller **83** and the second ejection roller **91** can be driven by the main motor M**1**. As a result, the number of motors in the image forming apparatus **1** can be reduced.

Since the development roller **61**K in the separate position is moved from the separate position to the contact positon and the development roller **61**K moved to the contact position is moved to the separate position, while the development roller **61**C is located in the contact positon, the development roller **61**C does not move from the contact position to the separate position when the development roller is located in the contact position.

In the image forming apparatus **1**, when the development roller **61**C moves from the contact position to the separate position, the cam follower **170**C pushes the development cartridge **60**C, and the development cartridge **60**C is pushed in the direction parallel to the rotation axis, thus, the drawer **55** would possibly move to some extent or bend. Consequently, the drawer **55** would undesirably shift in position, so that the relative position of the photosensitive drum **50**K and the sheet S would shift undesirably. In the present embodiment, since the development roller **61**C does not move from the contact position to the separate position when the development roller **61**K is located in the contact position, the relative position of the photosensitive drum **50**K and the sheet S is not shifted undesirably when the toner image on the photosensitive drum **50**K is being transferred to the sheet S, the image quality is not degraded.

Since the rotation direction of the separation cam **150** of the separation mechanism **5** can be switched by the main motor M**1** rotating in the forward direction and the reverse direction, the shape of the separation cam **150** can be designed more freely. The separation cam **150** can also be made smaller in size. Therefore, the image forming apparatus **1** can be made smaller in size.

When executing a printing process in the color print mode, the time for which the development roller **61**K, (i.e., the roller more frequently used because the development roller **61**K is used in both the color print mode and the black-and-white print mode) is in contact with the photosensitive drum **50**K can be made shorter in that the development roller **61**K contacts the photosensitive drum **50**K after the development roller **61**C contacts the photosensitive drum **50**C, and the development roller **61**K separates from the photosensitive drum **50**K before the development roller **61**C separates from the photosensitive drum **50**C. Therefore, the black toner used in the development roller **61**K and the development roller **61**K can be made long-lasting.

Since the electromagnetic clutch EC**1** regulates the motion of the separation cams **150**Y, **150**M, and **150**C, and the electromagnetic clutch EC**2** regulates the motion of the separation cam **150**K, the contact and separation of each development rollers **61** (**61**Y, **61**M, **61**C, and **61**K) can be controlled more precisely.

Since one electromagnetic clutch EC**1** regulates the motion of the separation cams **150**Y, **150**M, and **150**C, the cost can be reduced compared to an alternative configuration in which each separation cam **150**Y, **150**M, and **150**C comprises an electromagnetic clutch, for example.

Since the electromagnetic clutch EC**3** disconnect when the main motor M**1** rotate in the reverse direction, the driving force from the main motor M**1** can be stopped from being transmitted to the adjusting cam **230**.

Since the switching cam **190**, which is a member that moves the moving gear **424**, moves the moving gear **424** to the first transmit position when the main motor M**1** rotates in the forward direction, and moves the moving gear **424** to the first disconnect position when the main motor M**1** rotates in the reverse direction, the shape of the switching cam **190** can be designed more freely. The switching cam can also be made smaller in size.

To elaborate, if a switching cam is configured to rotate in only one direction to move the moving gear **424** between the first transmit position and the first disconnect position, the whole circumference of the switching cam (cam portion) is used to cause the moving gear **424** to move from the first disconnect positon to the first transmit position, to be restrained in the first transmit position, to move from the first transmit position to the first disconnect position, and to be retained in the first disconnect position. Therefore, the shape of the switching cam is determined to a certain extent, and the shape of the switching cam cannot be designed freely. The cam portion also becomes larger in size, and the switching cam becomes larger in size. In the present embodiment, there is no such limitation, and the shape of the switching cam **190** can be designed more freely, and the switching cam can also be made smaller in size.

In the present embodiment, the timing of the contact and separation of the development rollers **61**Y, **61**M, and **61**C as regulated by the separation cams **1501**Y, **150**M, and **150**C and the timing of the starting and stopping of the rotations of the development rollers **61**Y, **61**M, and **61**C as regulated by just controlling the switching cam **190** can be synchronized by the operation of the electromagnetic clutch EC**1**. Therefore, the number of electromagnetic clutches can be reduced compared to an alternative configuration in which an electromagnetic clutch for regulating the motions of the separation cams **1501**Y, **150**M, and **150**C and an electromagnetic clutch for regulating the motions of the switching cam **190** are provided separately, and the timing of the contact and separation of the development rollers **61**Y, **61**M, and **61**C and the timing of the starting and stopping of the rotation of the development rollers **61**Y, **61**M, and **61**C are synchronized. Therefore, the cost can be reduced. Also, the synchronization of the timing of the contact and separation, and the starting and stopping of the rotations, of the development rollers **61**Y, **61**M, and **61**C can be regulated with more simplicity.

Since the moving gear **424** is used to switch the transmitting and disconnecting of the driving force to the development rollers **61**Y, **61**M, and **61**C, the cost can be reduced compared to an alternative configuration in which electromagnetic clutches are used, for example.

Since the switching cam **190** receives the driving force of the main motor M**1** from the cam gear **115**M, the gear train can be arranged in a compact manner compared to an alternative configuration in which the image forming apparatus **1** comprises another gear train, as provided beside the separation gear train GT**1**, for transmitting a driving force of the main motor M**1** to the switching cam **190**.

The starting and the stopping of the rotation of the switching cam **190** can be controlled by controlling the starting and the stopping of the rotations of the cam gears **115**Y, **115**M, and **115**C. Therefore, the control of the cam gears **115**Y, **115**M, and **115**C, and switching cam **190** can be simplified.

Since the cam gear **115** is located on a first side as defined by a side surface thereof facing in a direction parallel to the rotation axis of the idle gear **118**, and the switching cam **190** is located on a second side, opposite to the first side, of the metal sheet **15**, the shape and position of the switching cam **190** can be designed more freely. The gear train including the separation gear train GT**1** and the switching gear train GT**8** can also be arranged in a more compact manner overall.

Since the moving gear **424** is located in the first transmit position at a time before the development rollers **61**Y, **61**M, and **61**C are located in the contact positions, the development rollers **61**Y, **61**M, and **61**C can be caused to rotate before the development rollers **61**Y, **61**M, and **61**C come in contact with the corresponding photosensitive drums **50**Y, **50**M, and **50**C. Since the moving gear **424** is located in the first disconnect positon at a time after the development rollers **61**Y, **61**M, and **61**C are located in the separate positions, the development rollers **61**Y, **61**M, and **61**C can be stopped rotating after the development rollers **61**Y, **61**M, and **61**C separate from the corresponding photosensitive drums **50**Y, **50**M, and **50**C.

Since the switching lever **160** is located in the second transmit position at a time before the development roller **61**K is located in the contact position, the development roller **61**K can be caused to rotate before the development roller **61**K comes in contact with the photosensitive drum **50**K. Since the switching lever **160** is located in the second disconnect position at a time after the development roller **61**K is located in the separate position, the development roller **61**K can be stopped rotating after the development roller **61**K separate from the photosensitive drum **50**K.

Since the first gear **436** of the second development roller gear train GT**7** rotates about the same axis as that about which the coupling gear **426**K rotates, the second development roller gear train GT**7** can be arranged more compactly as viewed from the direction parallel to the axis of rotation of the first gear **436** and the coupling gear **426**K.

Since the rotation resistance member **300** for applying rotation resistance to the idle gear **118** that engages with the cam gear **115**Y is provided, the free rotating of the cam gear **115**Y can be restrained. Therefore, the sudden sliding of the cam follower **170**Y by the free rotation of the cam gear **115**Y can be restrained.

Since the rotation resistance member **300** pushes the idle gear **118** in a direction parallel to the rotation axis of the idle gear **118**, the rotation resistance member **300** can be arranged more compactly relative to the idle gear **118** as viewed from the direction parallel to the rotation axis of the idle gear **118**.

Since the rotation resistance member **300** is a leaf spring, the rotation resistance member **300** can be arranged more compactly relative to the idle gear **118**. Since the rotation resistance member **300** is a leaf spring, the rotation resistance member **300** can be arranged more compactly in the direction of the rotation axis of the idle gear **118** compared to an alternative configuration in which the rotation resistance member **300** is a coil spring, for example.

Since the annular first rib **118**D of the idle gear **118** is kept in contact with the metal sheet **15** by the pushing force of the rotation resistance member **300**, a necessary amount of rotation resistance can be applied to the idle gear **118** without restraining the rotation of the idle gear **118** too much.

Since the first rib **118**D is located at an end portion of the idle gear **118** in a plane perpendicular to the rotation axis of the idle gear **118**, the contact area of the first rib **118**D and the metal sheet **15** can be increased. Therefore, a necessary amount of rotation resistance can be applied sufficiently to the idle gear **118** by the contact of the first rib **118**D and the metal sheet **15**.

Since the cam gear **115**Y and the rotation resistance member **300** are located on opposite sides of the metal sheet **15** as defined by the opposite side surfaces facing in the directions parallel to the rotation axis of the idle gear, the shape and location of the rotation resistance member **300** can be designed more freely.

Since the rotation resistance member **300** push a second rib **118**E having a pitch diameter larger than the pitch diameter of the first gear portion **118**B, a necessary amount of rotation resistance can be applied to the idle gear **118** with a smaller load. Since the diameter of the first gear portion **118**B can be made smaller, the separation gear train can be made compact, and the members such as the photosensitive drums can be arranged compactly. Therefore, the image forming apparatus can be made smaller in size.

Since the idle gear **118**, to which the rotation resistance is applied, engages with both the cam gear **115**Y and the cam gear **115**M, the free rotation of the cam gear **115**Y and the cam gear **115**M can be restrained. Therefore, the sudden sliding of the cam follower **170**Y and cam follower **170**M by the free rotation of the cam gear **115**Y and the cam gear **115**M can be restrained.

Since the cam gear **115**C engages with the cam gear **115**M via one gear **116**, the idling of the cam gear **115**C can be restrained. Therefore, the sudden sliding of the cam follower **170**C by the free rotation of the cam gear **115**C can be restrained.

Since the stopper **530** is provided, the rotation of the cam follower **170** can be restrained. Therefore, the sudden sliding of the cam follower **170** by the rotation of the cam follower **170** can be restrained.

In the configuration that the cam follower **170** is biased by the spring **430** toward the no-push position, because the free rotation of the cam gears **115**Y, **115**M, and **115**C can be restrained by the rotation resistance member **300**, the sudden sliding of the cam followers **170**Y, **170**M, and **170**C by the free rotation of the cam gears **115**Y, **115**M, and **115**C can be restrained.

While the invention has been described in conjunction with various example structures outlined above and illustrated in the figures, various alternatives, modifications, variations, improvements, and/or substantial equivalents, whether known or that may be presently unforeseen, may become apparent to those having at least ordinary skill in the art. Accordingly, the example embodiments of the disclosure, as set forth above, are intended to be illustrative of the invention, and not limiting the invention. Various changes may be made without departing from the spirit and scope of the disclosure. Therefore, the disclosure is intended to embrace all known or later developed alternatives, modifications, variations, improvements, and/or substantial equivalents. Some specific examples of potential alternatives, modifications, or variations in the described invention are provided below:

In the above-described embodiment, the fixing gear train GT**2** is configured to transmit the driving force of the main motor M1 to the heating roller **81**A (heating portion **81**); it is however to be understood that the fixing gear train may be configured to transmit the driving force of the main motor, for example, to the pressure portion. The fixing gear train may alternatively be configured to transmit the driving force of the main motor M1 to both the heating portion and the pressure portion.

In the above-described embodiment, the heating portion **81** is configured to include the heating roller **81**A; it is however to be understood that a heating portion may be configured to include an endless belt, for example. Also, in the above-described embodiment, the pressure portion **82** is a pressure roller; it is however to be understood that a pressure portion may be a configuration, for example, comprising an endless belt, and a pad that nips the belt between the pad and the heating portion.

In the above-described embodiment, the separation cam **150** is configured to move the development roller **61** from the separate position to the contact position when the main motor M1 rotates in the forward direction, and moves the development roller **61** from the contact positon to the separate position when the main motor M1 rotates in the reverse direction. It is however to be understood that, for example, a separation cam may be configured to, when a main motor that rotates in only one direction rotates, move a development roller from the separate position to the contact position, and move the development roller from the contact position to the separate position.

In the above-described embodiment, the transmitting and disconnecting of the driving force to the fixing device **80** is switched by the moving gear **131**; it is however to be understood that a transmitting and disconnecting of the driving force to the fixing device may be switched by a electromagnetic clutch, for example.

In the above-described embodiment, the nip pressure cam **230** is configured to switch the nip pressure to be produced by the heating portion **81** and the pressure portion **82** between two pressures; the low nip pressure and the high nip pressure. It is however to be understood that a nip pressure may be switched to three or more pressures, for example. In other words, the second nip pressure may include a plurality of nip pressures. The heating portion and the pressure portion may also be separate from each other at the first nip pressure.

In the above-described embodiment, the adjusting cam **230** is configured to move the pressure portion **82** to switch the nip pressure; it is however to be understood that an adjusting cam may be configured to move the heating portion instead of the pressure portion to switch the nip pressure. The adjusting cam may alternatively move both the heating portion and the pressure portion to switch the nip pressure.

In the above-described embodiment, the separation cams **150**Y, **150**M, and **150**C are controlled in synchronization; it is however to be understood that separation cams **150**Y, **150**M, and **150**C may be controlled individually.

In the above-described embodiment, the transmitting and disconnecting of the driving force to the development roller **61**K is switched by the switching lever **160** and the planetary gear train **180**; it is however to be understood that transmitting and disconnecting of a driving force to a development roller **61**K may be switched by a switching cam as is the case with the development rollers **61**Y, **61**M, and **61**C.

In the above-described embodiment, the cam gear **115** is located on a first side as defined by a side surface thereof facing in a direction parallel to the rotation axis of the idle gear **118**, and the switching cam **190** is located on a second side, opposite to the first side, of the metal sheet **15**; it is however to be understood that a cam gear and a switching gear may be located at the same side of a metal sheet.

In the above-described embodiment, switching cam **190** is configured to receive the driving force from the separation gear train GT**1**; it is however to be understood that a gear train for transmitting a driving force to a switching cam may be provided other than a separation gear train.

In the above-described embodiment the stopper **530** has a shape of a wall; it is however to be understood that a stopper may have a shape of a bar. In the above-described embodiment, the stopper **530** is formed integrally with the cover wall **510**; it is however to be understood that the stopper may be a member fixed to a cover wall.

Further, for example, if a separation cam is configured to rotate only in one direction, a stopper may be configured to have one stopper that contacts a side of an arm to restrain a cam follower from rotating instead of a configuration having two stoppers that hold an arm. An image forming apparatus may also be configured to not comprise a stopper, and instead a boss of the cam and a slide shaft of a cam follower may engage, and the cross section of the engaging part may have a triangular shape, a rectangular shape, a D shape, an oval shape, and the like that restrains the rotation of the cam follower.

In the above-described embodiment, the first rib **118**D is located at an end portion of the idle gear **118** in the plane perpendicular to the rotation axis of the idle gear **118**; it is however to be understood that a first rib may be located inside of an end portion of an idle gear in a plane perpendicular to a rotation axis of an idle gear.

In the above-described embodiment, the rotation resistance member **300** is a leaf spring; it is however to be understood that a rotation resistance member may be a coil spring and the like instead of a leaf spring. Further a rotation resistance member may be a sponge and the like that is an elastic body other than a spring. Further, a rotation resistance member may push the idle gear in a direction parallel to the rotation axis, opposite to the direction in the present embodiment. A rotation resistance member may also push an idle gear in a direction perpendicular to a rotation axis of the idle gear.

In the above-described embodiment, the photosensitive drums **50** are rotatably supported by the drawer **55**; it is however to be understood that photosensitive drums may be installable in and detachable from a drawer. Specifically, an image forming apparatus may be configured to comprise at least one drum cartridge having a photosensitive drum, and the drum cartridge may be installable into and detachable from the drawer. The image forming apparatus may be configured to comprise a cartridge having both the drum cartridge and the development cartridge **60** in the above-described embodiment, and the cartridge may be installable into and detachable from the drawer.

In the above-described embedment, the image pharming apparatus **1** is a color printer that can from a color image; it is however to be understood that an image forming apparatus may be a black-and white only printer that may form only a black-and-white image. Further the image forming apparatus may be a photocopier, a multifunction printer, or the like.

Each element explained above in connection with the embodiments and modified examples may be combined where appropriate for practical implementation.

What is claimed is:

1. An image forming apparatus, comprising:

a first photosensitive drum;

a first development roller movable relative to the first photosensitive drum between a contact position in which the first development roller is in contact with the first photosensitive drum and a separate position in which the first development roller is separate from the first photosensitive drum;

a first separation cam configured to move the first development roller between the contact position and the separate position when receiving a driving force;

a fixing device comprising a heating portion and a pressure portion, the fixing device being configured to convey a sheet nipped between the heating portion and the pressure portion when receiving a driving force;

an adjusting cam configured to switch a nip pressure to be produced by the heating portion and the pressure portion between a first nip pressure and a second nip pressure higher than the first nip pressure when receiving a driving force;

a main motor;

a separation gear train configured to transmit a driving force of the main motor to the first separation cam;

a fixing gear train configured to transmit the driving force of the main motor received from the separation gear train to the fixing device; and

an adjusting gear train configured to transmit the driving force of the main motor received from the separation gear train to the adjusting cam

wherein the main motor is rotatable in forward and reverse directions, and

wherein the first separation cam is configured to move the first development roller from the separate position to the contact position when the motor rotates in the forward direction and move the first development roller from the contact position to the separate position when the main motor rotates in the reverse direction.

2. The image forming apparatus according to claim 1, wherein the fixing gear train comprises:

an output gear configured to output the driving force of the main rotor to the fixing device; and

a moving gear capable of being moved, when receiving a driving force, relative to the output gear between-a transmit position in which the moving gear is engaged with the output gear, and a disconnect position in which the moving gear is disengaged from the output gear.

3. The image forming apparatus according to claim 2,

wherein the moving gear is located in the transmit position when the main motor rotates in the forward direction, and is located in the disconnect position when the main motor rotates in the reverse direction.

4. The image forming apparatus according to claim 2, further comprising an electromagnetic clutch switchable to a transmit state in which the driving force of the main motor is transmitted from the separation gear train to the adjusting gear train, and a disconnect state in which the driving force of the main motor is not transmitted from the separation gear train to the adjusting gear train.

5. The image forming apparatus according to claim 4, wherein the adjusting gear train includes a clutch connecting gear configured to rotate when the electromagnetic clutch is located in the transmit state, and

wherein the clutch connecting gear rotates about an axis that is coaxial with an axis of a gear included in the separation gear train.

6. The image forming apparatus according to claim 5, wherein the first separation cam is configured to move the first development roller between the contact position and the separate position when receiving a driving force.

7. The image forming apparatus according to claim 6, further comprising:

a first development cartridge comprising the first development roller, the first development cartridge being movable relative to the first photosensitive drum between a first position in which the first development roller is located in the contact position and a second position in which the first development roller is located in the separate position; and

a first cam follower configured to slide, according as the first separation cam is rotated, in a direction parallel to a rotation axis of the first separation cam between a push position in which the first cam follower pushes and causes the first development cartridge to be located in the second position and a non-push position in which the first development cartridge is located in the first position.

8. The image forming apparatus according to claim 6, wherein the moving gear is located in the transmit position when the main motor rotates in the forward direction, and is located in the disconnect position when the main motor rotates in the reverse direction.

9. The image forming apparatus according to claim 1, wherein

the heating portion includes a heating roller,

the pressure portion is a pressure roller, the fixing device being configured to nip a sheet between the heating roller and the pressure roller, and

the fixing gear train is configured to transmit the driving force of the main motor received from the separation gear train to the heating roller.

10. The image forming apparatus according to claim 1, further comprising a process motor configured to drive the first photosensitive drum and the first development roller.

11. The image forming apparatus according to claim 1, further comprising an ejection roller configured to eject a sheet conveyed out from between the heating portion and the pressure portion, when receiving the driving force of the main motor from the fixing gear train.

12. The image forming apparatus according to claim 1, comprising:

a second photosensitive drum;

a second development roller movable relative to the second photosensitive drum between a contact position in which the second development roller is in contact with the second photosensitive drum and a separate position in which the second development roller is separate from the second photosensitive drum; and

a second separation cam configured to move the second development roller between the contact position and the separate position when receiving a driving force.

13. The image forming apparatus according to claim 12, wherein the first separation cam is configured to receive a driving force to rotate and move the first development roller between the contact position and the separate position, and the second separation cam is configured to receive a driving force to rotate and move the second development roller between the contact position and the separate position,

wherein the separation gear train includes:

a first separation gear train configured to transmit the driving force of the main motor to the first separation cam; and a second separation gear train configured to transmit the driving force of the main motor received from the first separation gear train to the second separation cam.

14. An image forming apparatus, comprising:

a first photosensitive drum;

a first development roller movable relative to the first photosensitive drum between a contact position in which the first development roller is separate from the first photosensitive drum;

a first separation cam configured to move the first development roller between the contact position and the separate position when receiving a driving force;

a fixing device comprising a heating portion and a pressure portion, the fixing device being configured to convey a sheet ripped between the heating portion and the pressure portion when receiving a driving force;

an adjusting cam configured to switch a nip pressure to be produced by the heating portion and the pressure portion between a first nip pressure and a second nip pressure higher than the first nip pressure when receiving a driving force;

a main motor;

a separation gear train configured to transmit a driving force of the main motor to the first separating cam;

a fixing gear train configured to transmit the driving force of the main motor received from the separation gear train to the fixing device; and

an adjusting gear train configured to transmit the driving force of the main motor received from the separation gear train to the adjusting cam;

a sheet feeder mechanism configured to feed a sheet to the first photosensitive drum when receiving a driving force;

a sheet feeder gear train configured to transmit the driving force of the main motor to the sheet feeder unit; and

a motor gear provided on an output shaft of the main motor,

wherein the motor gear is engaged with a gear included in the separation gear train, and a gear included in the sheet feeder gear train.

15. An image forming apparatus, comprising:

a first photosensitive drum;

a first development roller movable relative to the first photosensitive drum between contact position in which the first development roller is in contact with the first photosensitive drum and a separate position in which the first development roller is separate from the first photosensitive drum;

a first separation cam configured to move the first development roller between the contact position and the separate position when receiving a driving force,

a fixing device comprising a heating portion and a pressure portion, the fixing device being configured to convey a sheet nipped bot the heating portion and the pressure portion when receiving a driving force;

an adjusting cam configured to switch a nip pressure to be produced by the beating portion and the pressure portion between a first nip pressure and a second nip pressure higher than the first nip pressure when giving a driving force;

a main motor;

a separation gear train configured to it a driving force of the main motor to the first separation cam;

a fixing gear train configured to transmit the driving force of the main motor received from the separation gear train to the fixing device; and

an adjusting gear train configured to transmit the driving force of the main motor received from the separate gear train to the adjusting cam;

a second photosensitive drum located downstream of the first photosensitive drum in a direction of conveyance of a sheet;

a second development roller movable relative to the second photosensitive drum between a contact position in which the second development roller is in contact with the second photosensitive drum and a separate position in which the second development roller is separate from the second photosensitive drum;

a separation mechanism including the first separation cam configured to rotate and thereby cause the first development roller to move between the contact position and the separate position, and a second separation cam configured to rotate and thereby cause the second development roller to move between the contact position and the separate position; and

a controller,

wherein the controller is configured to exercise control over the separation mechanism such that while the first development roller is located in the contact position, the second development roller located in the separate position is moved from the separate position to the contact position, and thereafter moved from the contact position to the separate position.

16. The image forming apparatus according to claim **15**, wherein the controller exercises control over the separation mechanism such that the first development roller is moved from the separate position to the contact position, and thereafter the second development roller is moved from the separate position to the contact position, and

wherein the controller exercises control over the separation mechanism such that the second development roller is moved from the contact position to the separate position, and thereafter the first development roller is moved from the contact position to the separate position.

17. The image forming apparatus according to claim **16**, wherein the main motor is a motor that drives the separation mechanism and is configured rotate in forward and reverse directions,

wherein when the main motor rotates in the forward direction, the controller is configured to exercise control over the separation mechanism such that the first development roller is moved from the separate position to the contact position, and thereafter the second development roller is moved from the separate position to the contact position, and

wherein when the main motor rotates in the reverse direction, the controller is configured to exercise control over the separation mechanism such that the second development roller is moved from the contact position to the separate position, and thereafter the first development roller is moved from the contact position to the separate position.

18. The image forming apparatus according to claim **17**, further comprising:

a first development cartridge having the first development roller being movable relative to the first photosensitive drum between a first position in which the first development roller is located in the contact position and a second position in which the first development roller is located in the separate position; and

a second development cartridge having the second development roller being movable relative to the second photosensitive drum between a first position in which the second development roller is located in the contact position and a second position in which the second development roller is located in the separate position,

wherein the separation mechanism includes:

a first cam follower configured to slide, according as the first separation cam is rotated, in a direction parallel to a rotation axis of the first separation cam, between a push position in which the first cam follower pushes and causes the first development cartridge to be located in the second position and a no-push position in which the first development cartridge is located in the first position; and

a second cam follower configured to slide, according as the second separation cam is rotated, in a direction parallel to a rotation axis of the second separation cam, between a push position in which the second cam follower pushes and causes the second development cartridge to be located in the second position and a no-push position in which the second development cartridge is located in the first position.

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