US009776433B2

(12) **United States Patent**
Nishimura

(10) **Patent No.: US 9,776,433 B2**
(45) **Date of Patent: Oct. 3, 2017**

(54) **CONVEYOR AND IMAGE RECORDING APPARATUS**

(71) Applicant: **BROTHER KOGYO KABUSHIKI KAISHA**, Nagoya-shi, Aichi-ken (JP)

(72) Inventor: **Yoichiro Nishimura**, Nagoya (JP)

(73) Assignee: **BROTHER KOGYO KABUSHIKI KAISHA**, Nagoya-Shi, Aichi-Ken (JP)

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

(21) Appl. No.: **15/277,438**

(22) Filed: **Sep. 27, 2016**

(65) **Prior Publication Data**

US 2017/0087877 A1 Mar. 30, 2017

(30) **Foreign Application Priority Data**

Sep. 30, 2015 (JP) 2015-194525

(51) **Int. Cl.**

B41J 17/02	(2006.01)
B41J 11/00	(2006.01)
B41J 2/01	(2006.01)
B41J 13/00	(2006.01)
B65H 5/06	(2006.01)
B41J 3/60	(2006.01)

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

CPC ***B41J 11/007*** (2013.01); ***B41J 2/01*** (2013.01); ***B41J 13/009*** (2013.01); ***B41J 17/02*** (2013.01); ***B65H 5/062*** (2013.01); *B41J 3/60* (2013.01)

(58) **Field of Classification Search**

CPC B41J 11/007; B41J 17/02; B41J 13/009; B41J 2/01; B41J 3/60; B65H 5/062

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

2002/0118395 A1*	8/2002	Isozaki	.....	H04N 1/0461 358/400
2013/0256976 A1	10/2013	Samoto et al.		
2015/0273906 A1*	10/2015	Samoto	.....	B41J 23/025 347/104

FOREIGN PATENT DOCUMENTS

JP	2013-203503 A	10/2013

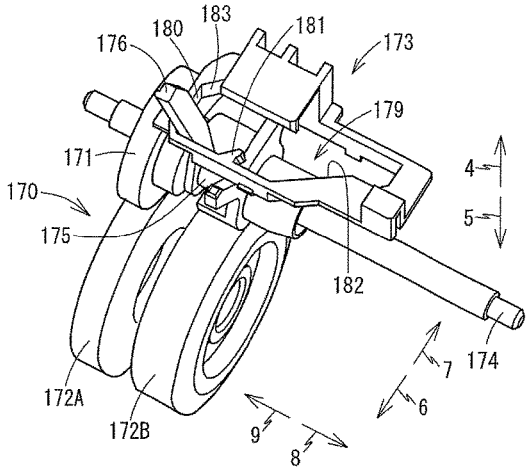
* cited by examiner

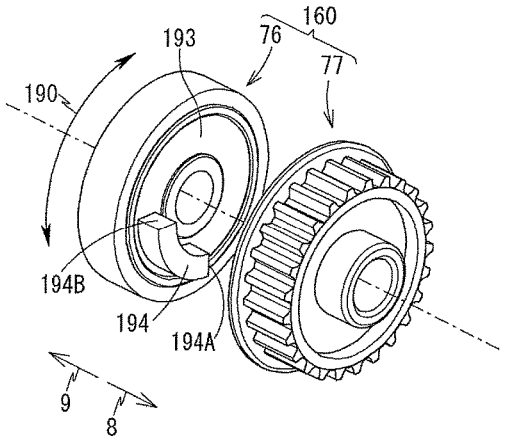
Primary Examiner — Manish S Shah
Assistant Examiner — Yaovi M Ameh
(74) *Attorney, Agent, or Firm* — Merchant & Gould P.C.

(57) **ABSTRACT**

A conveyor includes: a first power transmitting mechanism configured to transmit one of forward rotation and reverse rotation of a motor to a first roller and not to transmit the other from a driven member to the first roller; and a second power transmitting mechanism configured to transmit the other rotation to the first roller and not to transmit the one rotation to the first roller. The first power transmitting mechanism includes a transmission delayer that does not transmit rotation of the motor from the driven member to the first roller until the motor is rotated by a particular amount from a time point at which the motor starts to be rotated in a rotational direction of the one rotation when rotation transmitted from the motor to the driven member is changed from the other rotation to the one rotation.

13 Claims, 10 Drawing Sheets





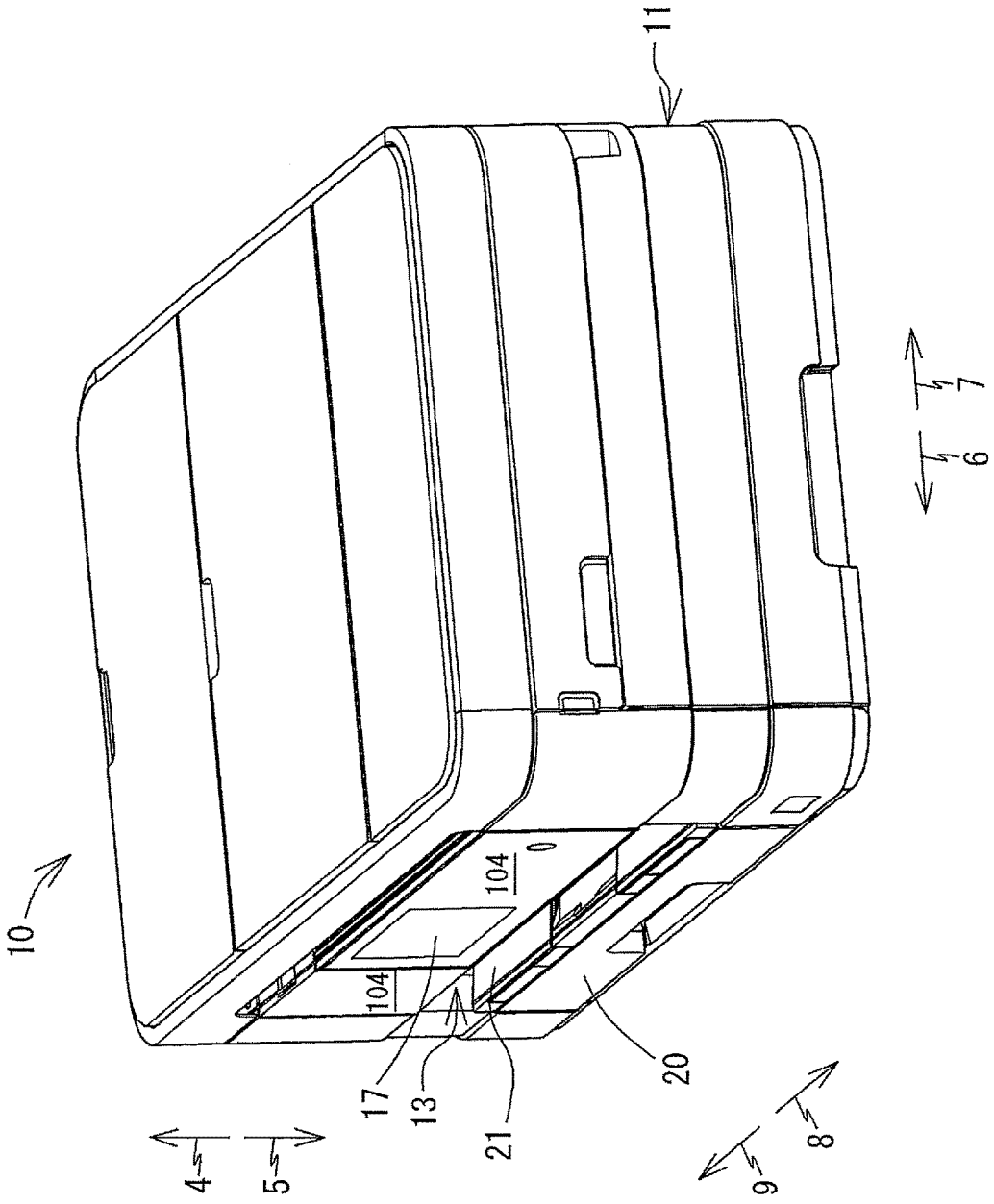


FIG.1

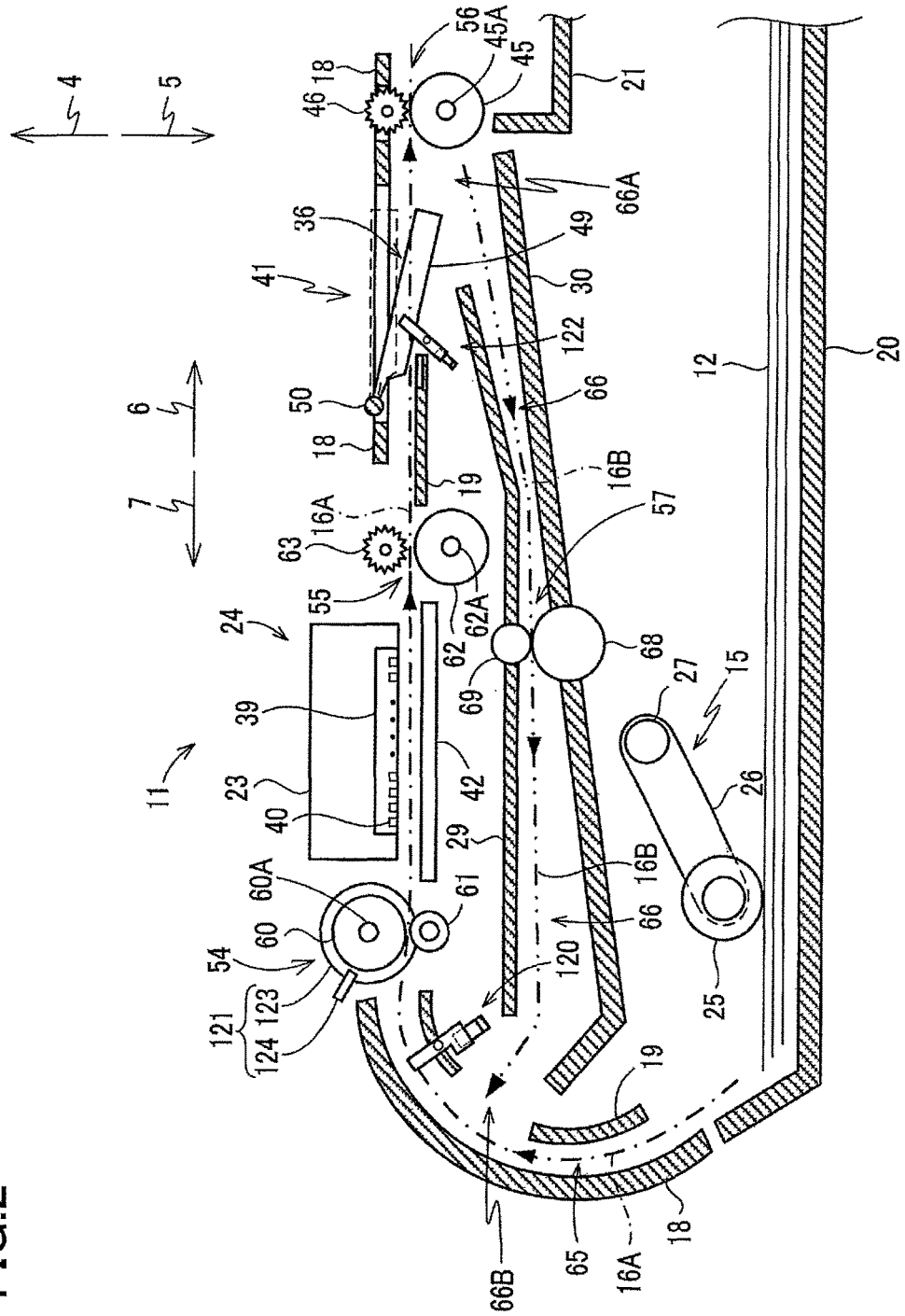

4
5
6
7
11
12
15
16A
16B
18
19
20
21
23
24
25
26
27
29
30
36
39
40
41
42
45
45A
46
49
50
54
55
56
57
60
60A
61
62
62A
63
65
66
66A
66B
68
69
120
121
122
123
124

FIG.2

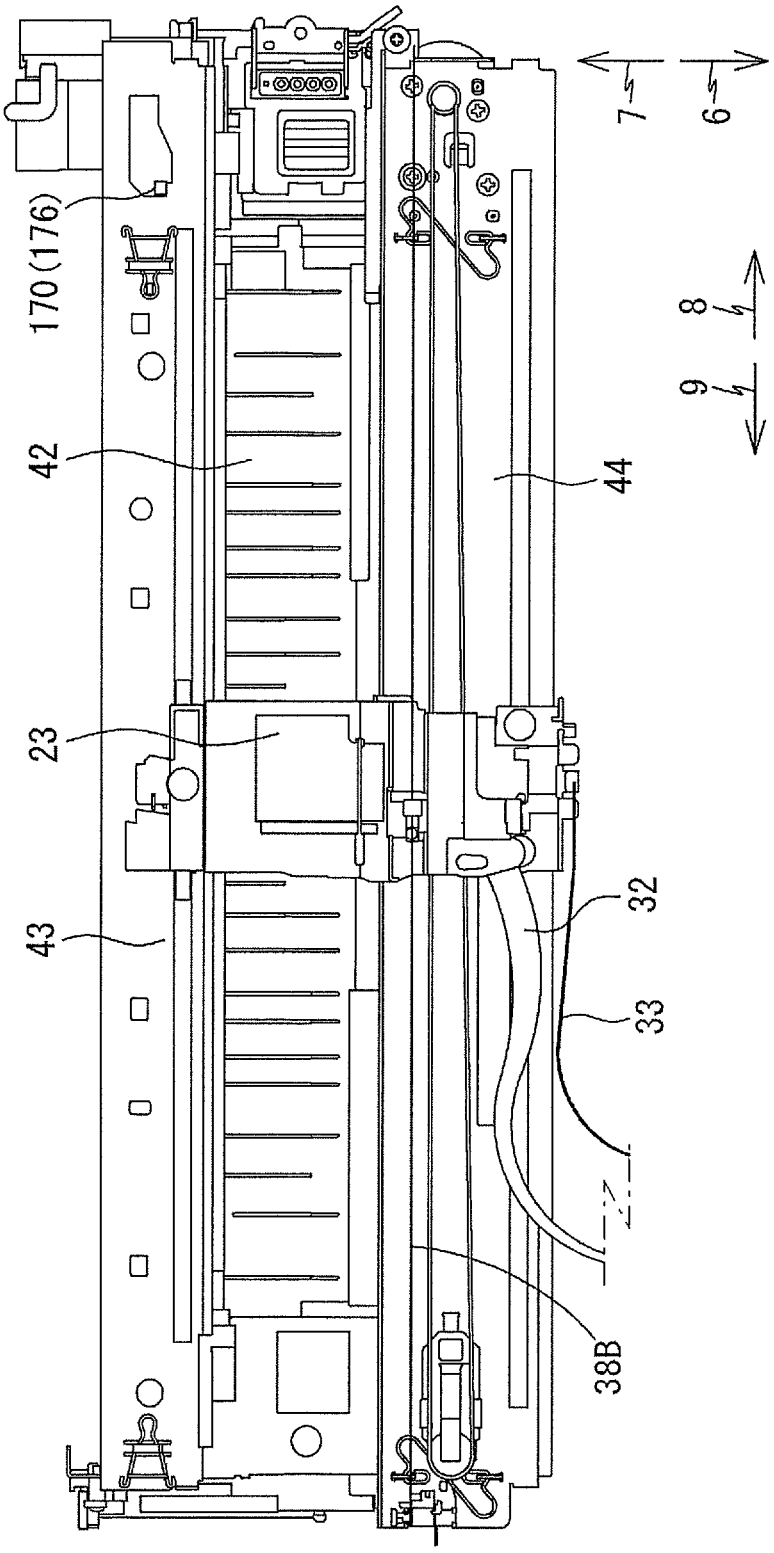


FIG.3

FIG.4A

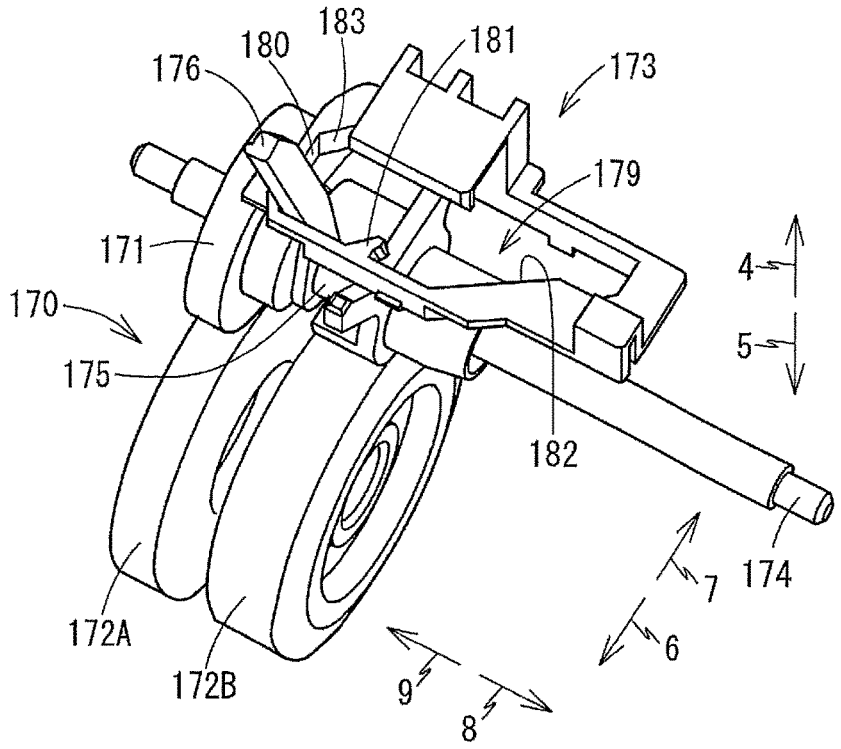

183
180
181
176
173
179
171
170
175
4
5
182
174
7
6
172A
172B
9
8

FIG.4B

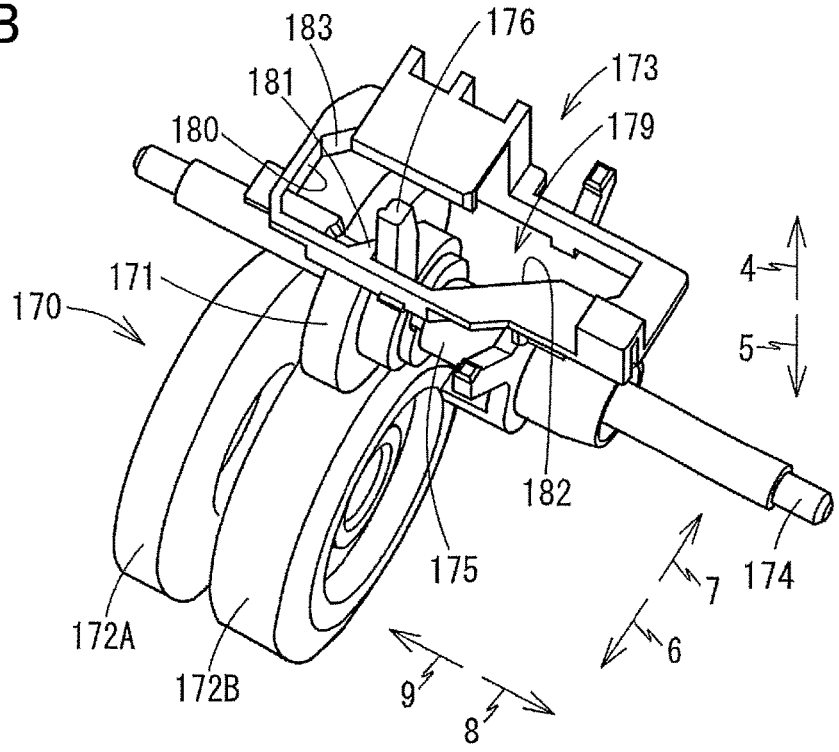

183
176
181
173
180
179
171
170
4
5
182
175
174
7
6
172A
172B
9
8

FIG.5B

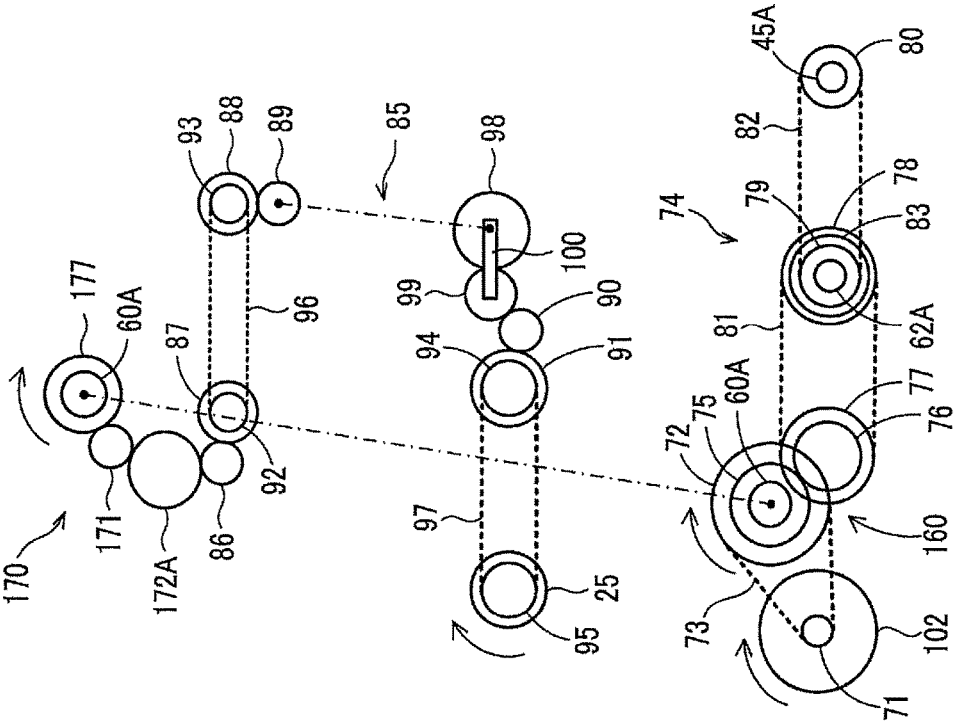

170
171
172A
86
92
87
177
60A
96
93
88
89
85
98
100
99
90
91
94
97
95
25
74
45A
80
82
79
78
83
62A
81
77
76
72
75
60A
73
71
102
160

FIG.5A

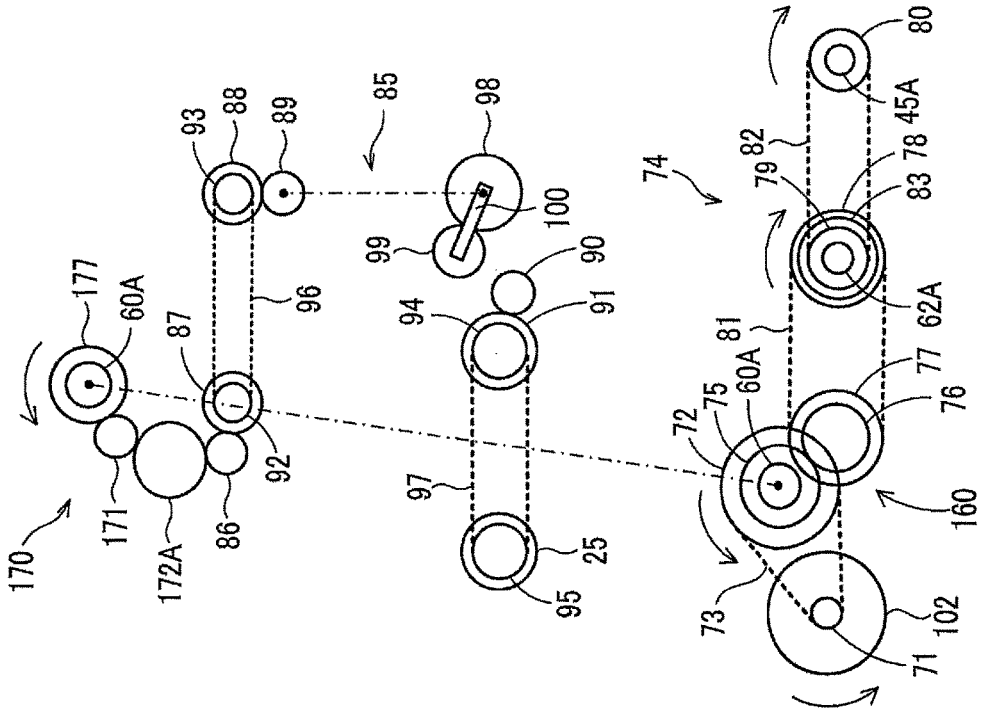

170
171
172A
86
92
87
177
60A
96
93
88
89
85
98
100
99
90
91
94
97
95
25
74
45A
80
82
79
78
83
62A
81
77
76
72
75
60A
73
71
102
160

FIG.6A

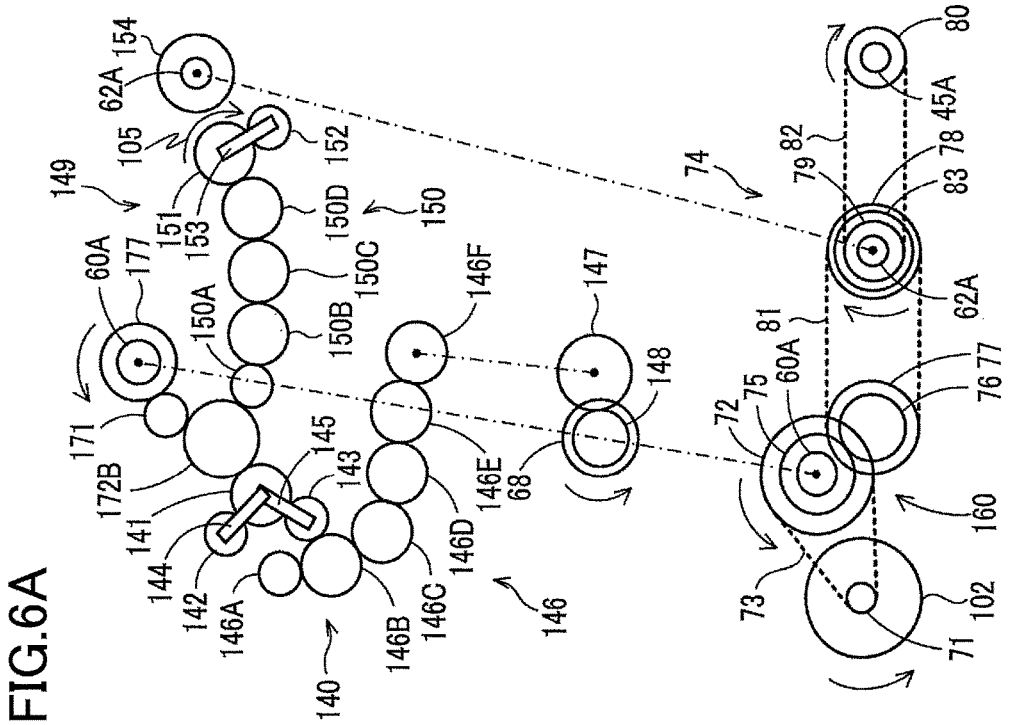
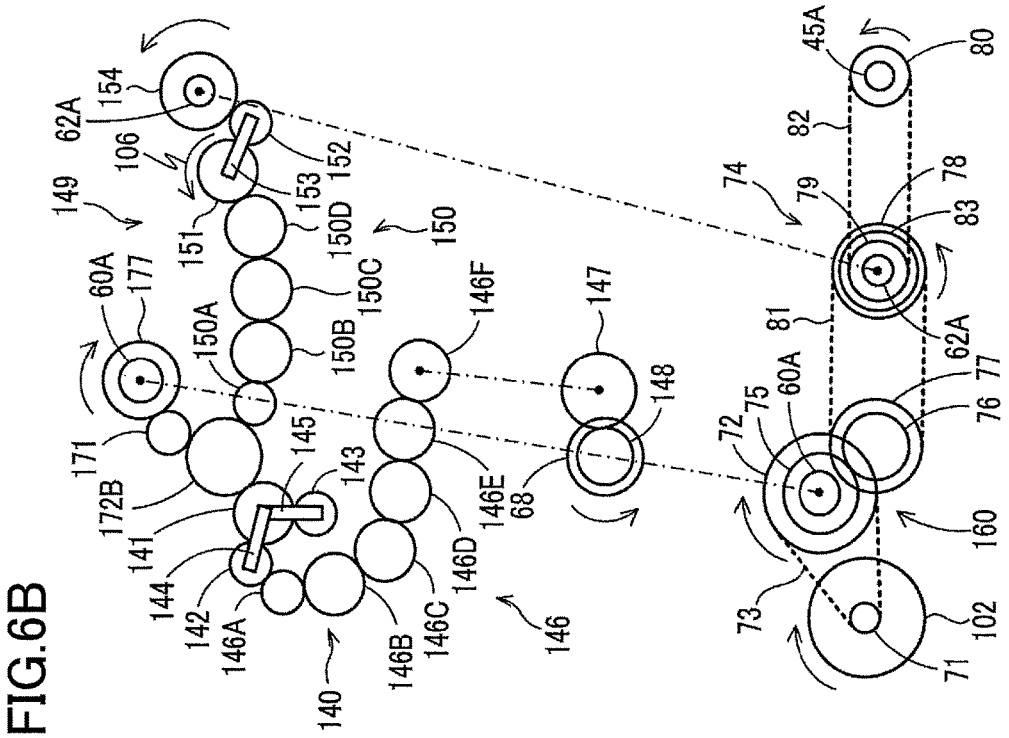

62A
154
105
152
149
151
153
150D
150
150C
60A
177
150A
150B
146F
147
171
172B
145
143
148
141
146E
68
144
146D
142
146A
146C
146
140
146B
74
79
82
45A
80
78
83
62A
81
60A
72
75
76
77
160
73
102
71

FIG.6B


62A
154
106
152
149
151
153
150D
150
150C
60A
177
150A
150B
146F
147
171
172B
145
143
148
141
146E
68
144
146D
142
146A
146C
146
140
146B
74
79
82
45A
80
78
83
62A
81
60A
72
75
76
77
160
73
102
71

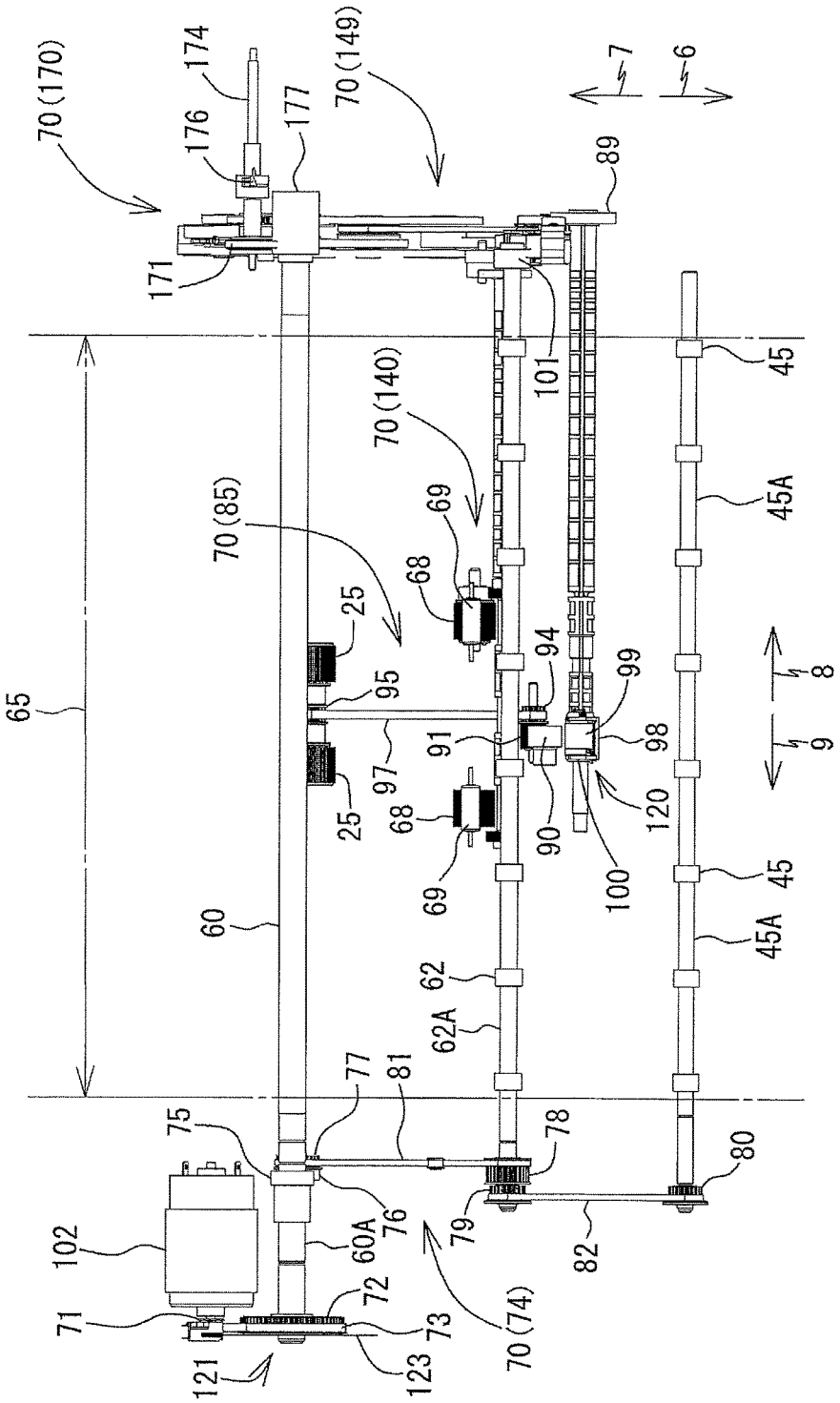

70(170)
174
176
177
70(149)
7
6
89
171
101
45
70(140)
45A
70(85)
69
68
25
94
99
65
95
91
98
8
9
97
120
90
100
60
62
62A
77
81
75
78
80
102
60A
76
79
82
72
71
73
70(74)
121
123

FIG.7

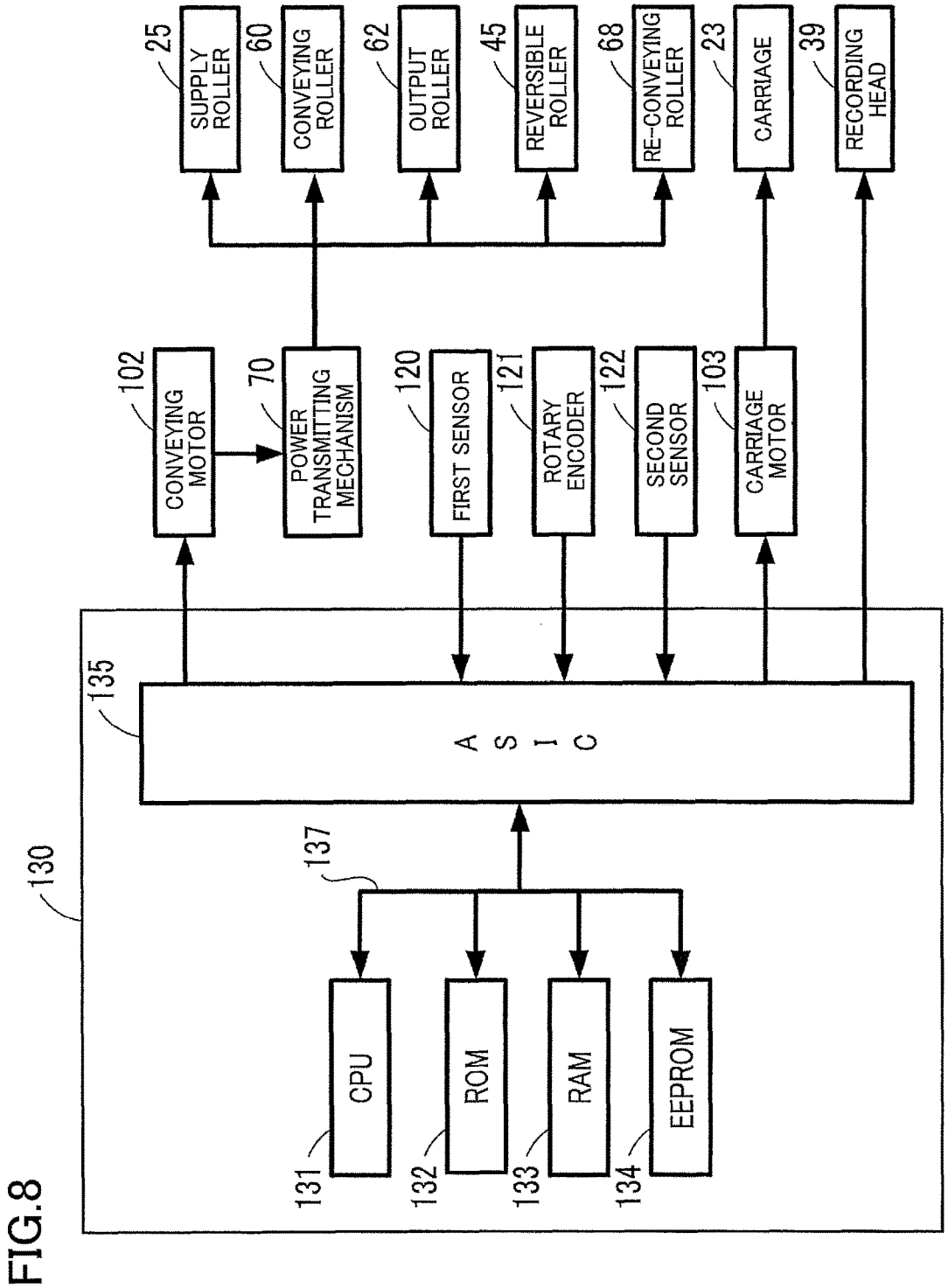

25
SUPPLY ROLLER
60
CONVEYING ROLLER
62
OUTPUT ROLLER
45
REVERSIBLE ROLLER
68
RE-CONVEYING ROLLER
23
CARRIAGE
39
RECORDING HEAD
102
CONVEYING MOTOR
70
POWER TRANSMITTING MECHANISM
120
FIRST SENSOR
121
ROTARY ENCODER
122
SECOND SENSOR
103
CARRIAGE MOTOR
135
A S I C
130
137
CPU
ROM
RAM
EEPROM
131
132
133
134

FIG.8

FIG.9

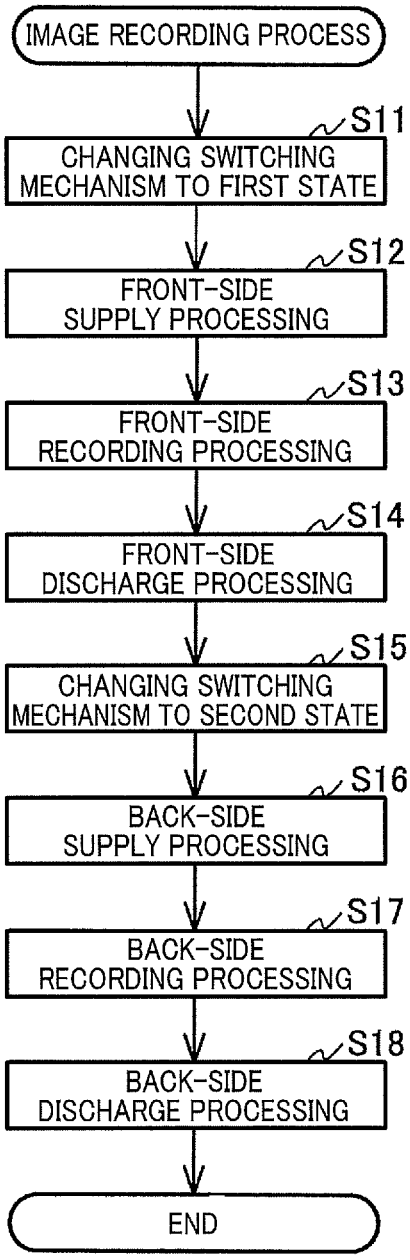


IMAGE RECORDING PROCESS
S11
CHANGING SWITCHING MECHANISM TO FIRST STATE
S12
FRONT-SIDE SUPPLY PROCESSING
S13
FRONT-SIDE RECORDING PROCESSING
S14
FRONT-SIDE DISCHARGE PROCESSING
S15
CHANGING SWITCHING MECHANISM TO SECOND STATE
S16
BACK-SIDE SUPPLY PROCESSING
S17
BACK-SIDE RECORDING PROCESSING
S18
BACK-SIDE DISCHARGE PROCESSING
END

FIG.10A

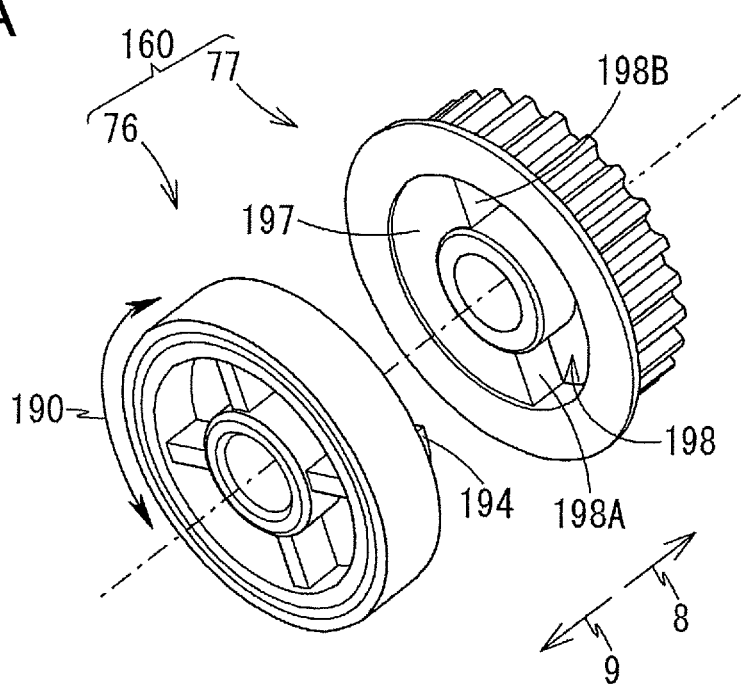
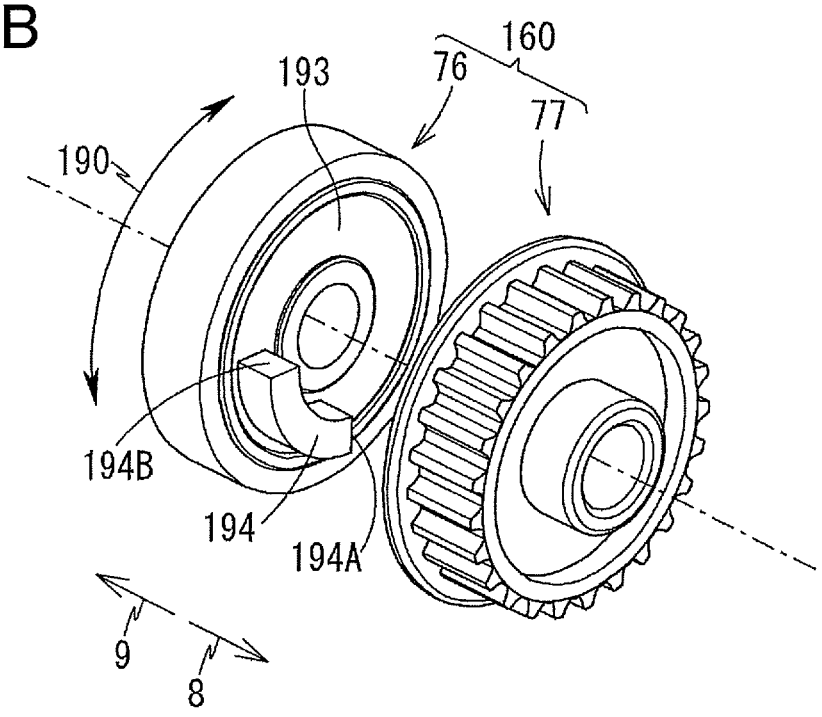


FIG.10B



CONVEYOR AND IMAGE RECORDING APPARATUS

CROSS REFERENCE TO RELATED APPLICATION

The present application claims priority from Japanese Patent Application No. 2015-194525, which was filed on Sep. 30, 2015, the disclosure of which is herein incorporated by reference in its entirety.

BACKGROUND

Technical Field

The following disclosure relates to a conveyor configured to convey a sheet along a conveyance path and to an image recording apparatus including the conveyor and configured to perform image recording on the sheet.

Description of the Related Art

There is known a conveyor configured to convey a sheet along a conveyance path. An image recording apparatus for performing image recording on a sheet is one example of an apparatus including the conveyor. The image recording apparatus includes a plurality of driven members which are driven by a motor. Examples of the driven members include rollers. The rollers are rotated to convey the sheet.

To reduce the size and cost of the image recording apparatus, a smaller number of motors are preferably provided in the image recording apparatus. That is, the driven members provided in the image recording apparatus are preferably driven by the same motor. Also, recently expanding functionality of the image recording apparatus increases a demand of a construction in which in the case where some of the driven members are driven, the other driven members are driven or stopped. For example, there is a demand of a construction in which in the case where some of a plurality of rollers are rotated forwardly, the other rollers are rotated reversely, and a construction in which in the case where some of the rollers are rotated, the other rollers are stopped.

One example of such an image recording apparatus includes: an output roller for conveying a sheet to an output tray after image recording on the sheet by a recorder; and a conveying roller for conveying the sheet to the recorder. The image recording apparatus includes: first and second power transmitters for transmitting power produced by a motor from the conveying roller to the output roller; and a switcher that selectively allows or disallows the power transmission from the motor to the second power transmitter. The first power transmitter includes the one-way clutch and thereby transmits only forward rotation of the motor from the conveying roller to the output roller. The second power transmitter includes: a planetary gear mechanism constituted by a sun gear and a planetary gear; and a transmission gear and thereby transmits only reverse rotation of the motor from the conveying roller to the output roller. That is, upon the reverse rotation of the conveying roller, the planetary gear is engaged with the transmission gear in the second power transmitter, and upon the forward rotation of the conveying roller, the planetary gear is moved off and away from the transmission gear in the second power transmitter. In the image recording apparatus constructed as described above, the first power transmitter and the second power transmitter can transmit the forward rotation and the reverse rotation of the motor from the conveying roller to the output roller, while the switcher can interrupt the power transmission from the motor to the second power transmitter to stop the output roller while rotating the conveying roller.

SUMMARY

However, the image recording apparatus described above may suffer from the following problems. In a state in which the reverse rotation of the motor is transmittable from the conveying roller to the output roller by the second power transmitter, when the rotation of the motor is switched from the reverse rotation to the forward rotation, the planetary gear is moved off the transmission gear, and thereby the power transmission to the output roller via the second power transmitter is interrupted, and the power transmission to the output roller via the first power transmitter is allowed. In this state, the forward rotation of the motor is transmittable to the transmission gear of the second power transmitter via the first power transmitter and the output roller though the transmission gear normally transmits the reverse rotation of the motor to the output roller.

In the case where the timing of the power transmission to the output roller via the first power transmitter is earlier than the timing at which the planetary gear is moved off the transmission gear when the rotation of the motor is switched from the reverse rotation to the forward rotation, the transmission gear is to be rotated by the forward rotation of the motor transmitted via the first power transmitter and the output roller in the state in which the transmission gear is engaged with the planetary gear. As a result, the planetary gear cannot be moved off the transmission gear, resulting in increase in load on the motor, whereby the motor is locked and cannot be rotated.

Accordingly, an aspect of the disclosure relates to a conveyor capable of preventing establishment of a lock state of a motor for applying rotation to a roller, and to an image recording apparatus including the conveyor.

In one aspect of the disclosure, a conveyor includes: a motor that is rotated forwardly and reversely; a driven member that is driven by rotation caused by at least one of forward rotation and reverse rotation of the motor, the caused rotation being transmitted from the motor; a first roller provided on a first conveyance path through which a sheet is to be conveyed; a first power transmitting mechanism configured to transmit rotation caused by one of the forward rotation and the reverse rotation of the motor to the first roller and not to transmit rotation caused by the other of the forward rotation and the reverse rotation of the motor from the driven member to the first roller; and a second power transmitting mechanism configured to transmit the rotation caused by the other of the forward rotation and the reverse rotation of the motor to the first roller and not to transmit the rotation caused by the one of the forward rotation and the reverse rotation of the motor to the first roller. The second power transmitting mechanism includes: a sun gear that is rotated in a first rotational direction by receiving the rotation caused by the one of the forward rotation and the reverse rotation of the motor from the driven member and that is rotated in a second rotational direction by receiving the rotation caused by the other of the forward rotation and the reverse rotation of the motor from the driven member, the second rotational direction being reverse to the first rotational direction; an arm pivotably supported by the sun gear; a planetary gear rotatably supported by the arm in a state in which the planetary gear is engaged with the sun gear, the planetary gear being configured to be revolved around the sun gear; and a transmission gear engageable with the planetary gear and configured to transmit, to the

first roller, rotation of the motor which is transmitted from the planetary gear. The planetary gear is configured to be revolved, in a direction in which the planetary gear is moved away from the transmission gear, by rotation of the sun gear in the first rotational direction, the planetary gear being configured to be revolved, in a direction in which the planetary gear is to be engaged with the transmission gear, by rotation of the sun gear in the second rotational direction. The first power transmitting mechanism includes a transmission delayer that does not transmit the rotation of the motor from the driven member to the first roller until the motor is rotated by a particular amount from a time point at which the motor starts to be rotated in a rotational direction of the one of the forward rotation and the reverse rotation when rotation transmitted from the motor to the driven member is changed from the other of the forward rotation and the reverse rotation to the one of the forward rotation and the reverse rotation.

In another aspect of the disclosure, an image recording apparatus includes: a conveyor including (i) a motor that is rotated forwardly and reversely, (ii) a driven member that is driven by rotation caused by at least one of forward rotation and reverse rotation of the motor, the caused rotation being transmitted from the motor, (iii) a first roller provided on a first conveyance path through which a sheet is to be conveyed, (iv) a first power transmitting mechanism configured to transmit rotation caused by one of the forward rotation and the reverse rotation of the motor to the first roller and not to transmit rotation caused by the other of the forward rotation and the reverse rotation of the motor from the driven member to the first roller, and (v) a second power transmitting mechanism configured to transmit the rotation caused by the other of the forward rotation and the reverse rotation of the motor to the first roller and not to transmit the rotation caused by the one of the forward rotation and the reverse rotation of the motor to the first roller; and an image recorder provided on the first conveyance path and configured to record an image on the sheet. The second power transmitting mechanism includes: a sun gear that is rotated in a first rotational direction by receiving the rotation caused by the one of the forward rotation and the reverse rotation of the motor from the driven member and that is rotated in a second rotational direction by receiving the rotation caused by the other of the forward rotation and the reverse rotation of the motor from the driven member, the second rotational direction being reverse to the first rotational direction; an arm pivotably supported by the sun gear; a planetary gear rotatably supported by the arm in a state in which the planetary gear is engaged with the sun gear, the planetary gear being configured to be revolved around the sun gear; and a transmission gear engageable with the planetary gear and configured to transmit, to the first roller, rotation of the motor which is transmitted from the planetary gear. The planetary gear is configured to be revolved, in a direction in which the planetary gear is moved away from the transmission gear, by rotation of the sun gear in the first rotational direction, the planetary gear being configured to be revolved, in a direction in which the planetary gear is to be engaged with the transmission gear, by rotation of the sun gear in the second rotational direction. The first power transmitting mechanism includes a transmission delayer that does not transmit the rotation of the motor from the driven member to the first roller until the motor is rotated by a particular amount from a time point at which the motor starts to be rotated in a rotational direction of the one of the forward rotation and the reverse rotation when rotation transmitted from the motor to the driven member is changed from the other of the forward rotation and the reverse rotation to the one of the forward rotation and the reverse rotation.

BRIEF DESCRIPTION OF THE DRAWINGS

The objects, features, advantages, and technical and industrial significance of the present disclosure will be better understood by reading the following detailed description of the embodiment, when considered in connection with the accompanying drawings, in which:

FIG. **1** is a perspective view of a multi-function peripheral (MFP);

FIG. **2** is an elevational view in vertical cross section schematically illustrating an internal structure of a printer;

FIG. **3** is a plan view of a carriage and guide rails;

FIG. **4**A is a perspective view of a switching mechanism in a first state, and FIG. **4**B is a perspective view of the switching mechanism in a second state;

FIG. **5**A is a schematic view of a first transmitter and a third transmitter, with a conveying motor being rotated forwardly, and FIG. **5**B is a schematic view of the first transmitter and the third transmitter, with the conveying motor being rotated reversely;

FIG. **6**A is a schematic view of the first transmitter, a second transmitter, and a fourth transmitter, with the conveying motor being rotated forwardly, and FIG. **6**B is a schematic view of the first transmitter, the second transmitter, and the fourth transmitter, with the conveying motor being rotated reversely,

FIG. **7** is a plan view of a drive-power transmitting mechanism and rollers;

FIG. **8** is a block diagram illustrating the printer;

FIG. **9** is a flow chart illustrating an image recording process; and

FIGS. **10**A and **10**B are perspective views of a transmission delayer.

DETAILED DESCRIPTION OF THE EMBODIMENT

Hereinafter, there will be described one embodiment by reference to the drawings. It is to be understood that the following embodiment is described only by way of example, and the disclosure may be otherwise embodied with various modifications without departing from the scope and spirit of the disclosure. A multi-function peripheral (MFP) **10** is used in a state illustrated in FIG. **1**. In the following explanation, up and down directions **4**, **5** are defined in this state. Also, front and rear directions **6**, **7** are defined by regarding a side of the MFP **10** on which an opening **13** is formed as a front side (a front surface **104**), and right and left directions **8**, **9** are defined in a state in which the MFP **10** is viewed from the front. The up direction **4** and the down direction **5** are opposite each other. The front direction **6** and the rear direction **7** are opposite each other. The right direction **8** and the left direction **9** are opposite each other. The up direction **4**, the front direction **6**, and the right direction **8** are perpendicular to one another.

Overall Construction of MFP **10**

As illustrated in FIG. **1**, the MFP **10** as one example of an image recording apparatus has a generally rectangular parallelepiped shape. The MFP **10** includes a printer **11** at its lower portion. The printer **11** is an ink-jet printer configured to record an image or images on a sheet **12** (see FIG. **2**). The MFP **10** has various functions including a facsimile function and a printing function. It is noted that the printer **11** may

employ various recording techniques other than the ink-jet technique, for example, the printer **11** may use electronic photography to record an image or images on the sheet **12**.

As illustrated in FIG. **2**, the printer **11** includes a conveyor, an image recorder **24**, and a platen **42**. The conveyor includes a supplier **15**, a supply tray **20** as one example of a tray, an output tray **21**, a conveying unit **54**, a sheet discharger **55**, a reversing device **56**, a re-conveying unit **57**, a conveying motor **102** as one example of a motor (see FIG. **7**), and a drive-power transmitting mechanism **70** (see FIG. **7**).

Supply Tray **20** and Output Tray **21**

As illustrated in FIGS. **1** and **2**, the supply tray **20** is inserted into the printer **11** in the rear direction **7** and removed in the front direction **6** through the opening **13** formed in a front portion of the printer **11**. The supply tray **20** supports the sheets **12** stacked on one another. The output tray **21** is disposed on the supply tray **20**. The output tray **21** supports the sheets **12** discharged by the reversing device **56** through the opening **13**.

Supplier **15**

As illustrated in FIG. **2**, the supplier **15** includes a supply roller **25**, a supply arm **26**, and a shaft **27**. The supply roller **25** is rotatably supported at a distal end portion of the supply arm **26**. Reverse rotation of the conveying motor **102** (see FIG. **7**) rotates the supply roller **25** in a direction in which the sheet **12** supported on the supply tray **20** is conveyed in a first conveying direction **16**A as one example of a conveying direction. The first conveying direction **16**A is a direction along a first conveyance path **65** which will be described below and indicated by the one-dot-chain-line arrows in FIG. **2**. The sheet **12** supplied by the supply roller **25** in the first conveying direction **16**A travels toward the conveying unit **54** disposed on the first conveyance path **65**. The supply arm **26** is pivotably supported by the shaft **27** that is supported by a frame of the printer **11**.

In the following explanation, rotation of the supply roller **25** in the direction in which the sheet **12** is conveyed in the first conveying direction **16**A may be hereinafter referred to as "forward rotation".

First Conveyance Path **65** and Second Conveyance Path **66**

As illustrated in FIG. **2**, the printer **11** has the first conveyance path **65** and a second conveyance path **66** through which the sheet **12** is conveyed. The first conveyance path **65** is a space defined in the printer **11** by guide members **18**, **19** that are opposed to each other with a predetermined distance therebetween.

The first conveyance path **65** includes a curved conveyance path and a straight conveyance path. The curved conveyance path makes an upward U-turn in a rear portion of the printer **11**. The straight conveyance path extends from the conveying unit **54** to the output tray **21** via the image recorder **24**. In the present embodiment, the sheet discharger **55** and the reversing device **56** are arranged on the straight conveyance path of the first conveyance path **65**.

It is noted that the first conveyance path **65** is constituted by the curved conveyance path and the straight conveyance path in FIG. **2** in the present embodiment but may be constituted by only the straight conveyance path, for example.

The second conveyance path **66** is a space defined in the printer **11** by guide members **29**, **30** that are opposed to each other with a predetermined distance therebetween. After image recording performed by the image recorder **24**, the sheet **12** is conveyed in the second conveyance path **66** in which the sheet **12** is turned upside down and conveyed toward the image recorder **24** for back-side recording. In the present embodiment, the second conveyance path **66** is branched off from the first conveyance path **65** at a branch position **66**A (as one example of a first connecting position) and merged with the first conveyance path **65** at a merge position **66**B (as one example of a second connecting position). The branch position **66**A is located downstream of the image recorder **24** in the first conveying direction **16**A. The merge position **66**B is located upstream of a first sensor **120**, which will be described below, in the first conveying direction **16**A. A second conveying direction **16**B in which the sheet **12** is to be conveyed in the second conveyance path **66** is indicated by the two-dot-chain-line arrows in FIG. **2**.

Conveying Unit **54**, Sheet Discharger **55**, Reversing Device **56**, and Re-Conveying Unit **57**

As illustrated in FIG. **2**, the conveying unit **54** is disposed on the first conveyance path **65** at a position located between the first sensor **120** and the image recorder **24**. The conveying unit **54** includes a conveying roller **60** and a pinch roller **61** opposed to each other. The conveying roller **60** is one example of a driven member and a second roller. The conveying roller **60** is driven by the conveying motor **102**. The pinch roller **61** is rotated by rotation of the conveying roller **60**.

The sheet discharger **55** is disposed on the first conveyance path **65** at a position located between the image recorder **24** and the branch position **66**A. The sheet discharger **55** includes an output roller **62** and a spur **63** opposed to each other. The output roller **62** is one example of a first roller. The output roller **62** is driven by the conveying motor **102**. The spur **63** is rotated by rotation of the output roller **62**.

The reversing device **56** is disposed on the first conveyance path **65** at a position located downstream of the branch position **66**A in the first conveying direction **16**A. The reversing device **56** includes a reversible roller **45** and a spur **46** opposed to each other. The reversible roller **45** is one example of a fourth roller. The reversible roller **45** is driven by the conveying motor **102**. The spur **46** is rotated by rotation of the reversible roller **45**.

As will be described below, each of the conveying roller **60**, the output roller **62**, and the reversible roller **45** is rotatable in (i) a direction in which the sheet **12** is to be conveyed in the first conveying direction **16**A and (ii) a direction reverse to this direction. In the following explanation, rotation of each of the rollers **60**, **62**, **45** in the direction for conveying the sheet **12** in the first conveying direction **16**A may be hereinafter referred to as "forward rotation". Rotation of each of the rollers **60**, **62**, **45** in the direction reverse to the direction of the forward rotation may be hereinafter referred to as "reverse rotation".

The re-conveying unit **57** is disposed on the second conveyance path **66**. The re-conveying unit **57** includes a re-conveying roller **68** and a driven roller **69** opposed to each other. The re-conveying roller **68** is one example of a third roller. The re-conveying roller **68** is driven by the conveying motor **102**. The driven roller **69** is rotated by rotation of the re-conveying roller **68**.

As will be described below, the re-conveying roller **68** is rotatable in such a direction that the sheet **12** is to be conveyed in the second conveying direction **16**B. In the following explanation, rotation of the re-conveying roller **68** in such a direction that the sheet **12** is to be conveyed in the second conveying direction **16**B may be hereinafter referred to as "forward rotation".

Image Recorder **24**

As illustrated in FIG. **2**, the image recorder **24** is disposed on the straight conveyance path of the first conveyance path

65. In the present embodiment, the image recorder **24** is disposed on the first conveyance path **65** at a position located between the conveying unit **54** and the sheet discharger **55**.

The image recorder **24** is disposed over and opposed to the platen **42**. An upper surface of the platen **42** supports the sheet **12** conveyed by the conveying unit **54**. The image recorder **24** includes a carriage **23** and a recording head **39**.

As illustrated in FIG. **3**, an ink tube **32** and a flexible flat cable **33** extend from the carriage **23**. The ink is supplied from an ink cartridge to the recording head **39** through the ink tube **32**. The flexible flat cable **33** is electrically connected between the recording head **39** and a control board on which a controller **130** (see FIG. **8**) is mounted.

The carriage **23** is supported by guide rails **43**, **44**. The guide rails **43**, **44** are spaced apart from each other in the front and rear directions **6**, **7**. The guide rails **43**, **44** extend in the right and left directions **8**, **9**. The carriage **23** is coupled to a well-known belt mechanism provided on the guide rail **44**. The belt mechanism is rotated by a carriage motor **103** (see FIG. **8**). This rotation of the belt mechanism reciprocates the carriage **23** in the right and left directions **8**, **9**.

As illustrated in FIG. **2**, the recording head **39** is mounted on the carriage **23**. A lower surface of the recording head **39** has a multiplicity of nozzles **40**. The recording head **39** ejects fine ink droplets from the nozzles **40**. During movement of the carriage **23**, the recording head **39** ejects the ink droplets onto the sheet **12** supported on the platen **42**. As a result, an image is recorded on the sheet **12**.

Path Switcher **41**

As illustrated in FIG. **2**, the printer **11** includes a path switcher **41** disposed on the first conveyance path **65** at a position located between the sheet discharger **55** and the reversing device **56**. The path switcher **41** includes a flap **49** and the shaft **50**. The flap **49** extends from the shaft **50** generally in the first conveying direction **16**A. The flap **49** is pivotably supported by the shaft **50**. The flap **49** pivots about the shaft **50** between a flip position (indicated by the solid lines in FIG. **2**) at which the flap **49** closes the first conveyance path **65** and a discharge position (indicated by the broken lines in FIG. **2**) at which the flap **49** allows passage of the sheet **12** on the first conveyance path **65**. It is noted that the flap **49** may be moved between the flip position and the discharge position by operations other than the pivotal movement of the flap **49**. For example, the flap **49** may be moved between the flip position and the discharge position by movement of the flap **49** in the up and down directions **4**, **5**, for example.

In a normal state, the flap **49** is located at the flip position by its own weight. The flap **49** may be urged to the flip position by a spring, for example. The sheet **12** conveyed in the first conveying direction **16**A causes upward pivotal movement of the flap **49** about the shaft **50** from the flip position to the discharge position. In this state, the flap **49** guides the sheet **12** conveyed in the first conveying direction **16**A. When a trailing end of the sheet **12** (i.e., an upstream end of the sheet **12** in the first conveying direction **16**A) conveyed in the first conveying direction **16**A has reached the branch position **66**A, the flap **49** is moved from the discharge position to the flip position by its own weight.

When the reversible roller **45** of the reversing device **56** is kept rotated forwardly in this state, the sheet **12** is conveyed in the first conveying direction **16**A and discharged onto the output tray **21** as will be described below. When the rotation of the reversible roller **45** of the reversing device **56** is switched from the forward rotation to the reverse rotation, the sheet **12** is conveyed along the second conveyance path **66** in the second conveying direction **16**B in a state in which the upstream end of the sheet **12** in the first conveying direction **16**A serves as a leading end as will be described below.

First Sensor **120** and Second Sensor **122**

As illustrated in FIG. **2**, the printer **11** includes the well-known first sensor **120** disposed on the first conveyance path **65** at a position located between the merge position **66**B and the conveying unit **54**. The first sensor **120** detects the presence of the sheet **12** at a position at which the first sensor **120** is disposed. The sheet **12** conveyed by the supplier **15** or the re-conveying unit **57** is conveyed to the conveying unit **54** after passing through the position at which the first sensor **120** is disposed. When the sheet **12** is present at the position at which the first sensor **120** is disposed, the first sensor **120** outputs one of a high-level signal and a low-level signal (the low-level signal in the present embodiment) to the controller **130** (see FIG. **8**). When the sheet **12** is absent at the position at which the first sensor **120** is disposed, the first sensor **120** outputs the other of the high-level signal and the low-level signal (the high-level signal in the present embodiment) to the controller **130**.

The printer **11** includes a second sensor **122** disposed at the branch position **66**A. Like the first sensor **120**, when the sheet **12** is present at a position at which the second sensor **122** is disposed, the second sensor **122** outputs one of a high-level signal and a low-level signal (the low-level signal in the present embodiment) to the controller **130**. When the sheet **12** is absent at the position at which the second sensor **122** is disposed, the second sensor **122** outputs the other of the high-level signal and the low-level signal (the high-level signal in the present embodiment) to the controller **130**.

Rotary Encoder **121**

As illustrated in FIG. **2**, the printer **11** includes a well-known rotary encoder **121** which produces a pulse signal in accordance with the rotation of the conveying roller **60**. The rotary encoder **121** includes an encoder disc **123** and an optical sensor **124**. The encoder disc **123** is rotated with the rotation of the conveying roller **60**. The optical sensor **124** reads the encoder disc **123** being rotated, produces the pulse signal, and outputs the produced pulse signal to the controller **130**.

Drive-Power Transmitting Mechanism **70**

As illustrated in FIG. **8**, the drive-power transmitting mechanism **70** transmits rotation of the single conveying motor **102** (i.e., power generated by the rotation of the conveying motor **102**) to the supply roller **25**, the conveying roller **60**, the output roller **62**, the reversible roller **45**, and the re-conveying roller **68**. The drive-power transmitting mechanism **70** is constituted by combination of all or some of gears, pulleys, endless belts, planetary gear mechanisms, one-way clutches, and other similar components.

As illustrated in FIGS. **5**A-**7**, the drive-power transmitting mechanism **70** includes: a pulley **71** that is rotated together with a shaft of the conveying motor **102**; a pulley **72** that is rotated together with a shaft **60**A of the conveying roller **60**; and an endless belt **73** looped over the pulleys **71**, **72**. When the forward rotation of the conveying motor **102** is transmitted to the conveying roller **60**, the conveying roller **60** is rotated forwardly. When the reverse rotation of the conveying motor **102** is transmitted to the conveying roller **60**, the conveying roller **60** is rotated reversely. The forward rotation of the conveying roller **60** conveys the sheet **12** in the first conveying direction **16**A, with the sheet **12** being nipped between the conveying roller **60** and the pinch roller **61**.

As illustrated in FIG. **7**, the drive-power transmitting mechanism **70** includes: a switching mechanism **170** configured to switch a destination of transmission of the rotation of the conveying motor **102**; and first to fourth transmitters **74**, **149**, **85**, **140** configured to transmit the rotation of the conveying motor **102** to the rollers **25**, **62**, **45**, **68** via the shaft **60**A of the conveying roller **60**. It is noted that a construction for transmitting the rotation of the conveying motor **102** to the rollers **25**, **60**, **62**, **45**, **68** is not limited to the construction described below. The first transmitter **74** is one example of a first drive-power transmitting mechanism. The second transmitter **149** is one example of a second drive-power transmitting mechanism. The third transmitter **85** is one example of a third drive-power transmitting mechanism. The fourth transmitter **140** is one example of a fourth drive-power transmitting mechanism.

Switching Mechanism **170**

The switching mechanism **170** illustrated in FIGS. **4**A-**7** switches a state of transmission of the rotation of the conveying motor **102** between a first state and a second state.

In the first state, the rotation of the conveying motor **102** is allowed to be transmitted from the conveying roller **60** to the supply roller **25** via the third transmitter **85**, the rotation of the conveying motor **102** is inhibited from being transmitted from the conveying roller **60** to the output roller **62** and the reversible roller **45** via the second transmitter **149**, and the rotation of the conveying motor **102** is inhibited from being transmitted from the conveying roller **60** to the re-conveying roller **68** via the fourth transmitter **140**.

In the second state, the rotation of the conveying motor **102** is inhibited from being transmitted from the conveying roller **60** to the supply roller **25** via the third transmitter **85**, the rotation of the conveying motor **102** is allowed to be transmitted from the conveying roller **60** to the output roller **62** and the reversible roller **45** via the second transmitter **149**, and the rotation of the conveying motor **102** is allowed to be transmitted from the conveying roller **60** to the re-conveying roller **68** via the fourth transmitter **140**.

The switching mechanism **170** is provided to the right of the first conveyance path **65**. The switching mechanism **170** includes a switching gear **171**, a gear **177**, two receiving gears **172**A, **172**B, a holder **173**, a pushing member **175**, a switching lever **176**, a first spring, not illustrated, and a second spring, not illustrated.

The switching gear **171** is rotatable about a support shaft **174** and movable in the axial direction of the support shaft **174**, i.e., in the right and left directions **8**, **9**. The rotation of the conveying motor **102** is transmitted to the switching gear **171** via the shaft **60**A of the conveying roller **60** and the gear **177**. The gear **177** is mounted on the shaft **60**A of the conveying roller **60** and rotated together with the shaft **60**A of the conveying roller **60**. The receiving gears **172**A, **172**B are provided under the support shaft **174** so as to be rotatable about the same axis extending in the right and left directions **8**, **9**. Each of the receiving gears **172**A, **172**B is engageable with the switching gear **171**. That is, the switching gear **171** is moved in the right and left directions **8**, **9** and thereby engaged with any one of the receiving gears **172**A, **172**B.

The receiving gear **172**A transmits the rotation of the conveying motor **102** to the supply roller **25** via the third transmitter **85**. The receiving gear **172**B transmits the rotation of the conveying motor **102** to the output roller **62** and the reversible roller **45** via the second transmitter **149** and to the re-conveying roller **68** via the fourth transmitter **140**. When the switching gear **171** is in engagement with the receiving gear **172**A, the switching mechanism **170** is in the first state. When the switching gear **171** is in engagement with the receiving gear **172**B, the switching mechanism **170** is in the second state.

The pushing member **175** is disposed to the right of the switching gear **171**. The support shaft **174** is inserted in the pushing member **175** such that the pushing member **175** is movable in the right and left directions **8**, **9**. The pushing member **175** is rotatable about the support shaft **174**. The switching lever **176** protrudes upward from the pushing member **175** so as to extend through an opening **179** of the holder **173** to a portion of a moving path of the carriage **23**, which portion is located outside a region through which the sheet **12** travels. The switching gear **171** is urged in the right direction **8** by the first spring, not illustrated, and the pushing member **175** is urged in the left direction **9** by the second spring, not illustrated. An urging force of the second spring is greater than that of the first spring. Thus, the switching gear **171** and the pushing member **175** are urged in the left direction **9** by the second spring.

The holder **173** is provided over the switching gear **171**. The holder **173** has the opening **179**. The switching lever **176** is inserted in the opening **179** in the up direction **4**. An edge portion of the holder **173** which defines the opening **179** includes a first stopper **180**, a second stopper **181** provided to the right of the first stopper **180**, and an inclined surface **182** provided to the right of the second stopper **181**.

As illustrated in FIG. **4**A, the first stopper **180** is in contact with the switching lever **176** when the switching gear **171** is in engagement with the receiving gear **172**A, that is, when the switching mechanism **170** is in the first state. This contact prevents the switching gear **171** from being moved leftward by the urging force of the second spring from a position of the switching gear **171** illustrated in FIG. **4**A. The first stopper **180** does not prevent the switching gear **171** from moving rightward from the position of the switching gear **171** illustrated in FIG. **4**A.

As illustrated in FIG. **4**B, the second stopper **181** is engaged with the switching lever **176** when the switching gear **171** is in engagement with the receiving gear **172**B, that is, when the switching mechanism **170** is in the second state. This engagement of the second stopper **181** prevents the switching gear **171** from being moved leftward by the urging force of the second spring from a position illustrated in FIG. **4**B. The second stopper **181** does not prevent the switching gear **171** from moving rightward from the position of the switching gear **171** illustrated in FIG. **4**B.

As illustrated in FIG. **4**A, the switching lever **176** is moved against the urging force of the second spring when the switching lever **176** is pushed by the carriage **23** moving rightward in the state in which the switching gear **171** is in engagement with the receiving gear **172**A, that is, in the first state of the switching mechanism **170**. As a result, the pushing member **175** is moved rightward with the switching lever **176**. Since the switching gear **171** is urged in the right direction **8** by the first spring, the switching gear **171** is moved rightward when the pushing member **175** is moved rightward. When the switching lever **176** is engaged with the second stopper **181**, the switching gear **171** is thereby kept in engagement with the receiving gear **172**B. That is, the switching mechanism **170** is kept in the second state (see FIG. **4**B). The switching mechanism **170** is changed from the first state to the second state in a manner described above.

As illustrated in FIG. **4**B, the switching lever **176** is moved rightward against the urging force of the second spring when the switching lever **176** is pushed by the carriage **23** moving rightward in the state in which the

switching gear **171** is in engagement with the receiving gear **172**B, that is, in the second state of the switching mechanism **170**. As a result, the pushing member **175** is moved rightward with the switching lever **176**. Since the switching gear **171** is urged in the right direction **8** by the first spring, the switching gear **171** is moved rightward when the pushing member **175** is moved rightward. In this movement, the switching lever **176** is moved along the inclined surface **182** so as to be rotated such that a protruding distal end, i.e., an upper end, of the switching lever **176** is moved rearward.

When the switching lever **176** is located to the right of the second stopper **181**, the carriage **23** is kept in contact with the switching lever **176** to prevent the switching gear **171** from being moved leftward by the urging force of the second spring.

When the carriage **23** is moved leftward off the switching lever **176** in a state in which the switching lever **176** is in contact with the inclined surface **182** at a position located to the right of the position of the switching lever **176** illustrated in FIG. **4**B, the switching lever **176** is moved leftward by the urging force of the second spring. In this movement, as described above, the switching lever **176** is rotated such that its protruding distal end is moved rearward. Thus, the switching lever **176** is moved to a position located to the left of the second stopper **181** without engagement with the second stopper **181**. As a result, the switching lever **176** is moved leftward until the switching lever **176** is brought into contact with the first stopper **180**. In this movement, the switching gear **171** is moved leftward by being pushed by the pushing member **175** and is engaged with the receiving gear **172**A (see FIG. **4**A). That is, the switching mechanism **170** is kept in the first state. The switching mechanism **170** is changed from the second state to the first state in a manner described above.

When being moved leftward, the switching lever **176** is moved along an inclined surface **183** formed on the edge portion of the opening **179** near the first stopper **180**. This movement rotates the switching lever **176** such that its protruding distal end is moved frontward.

First Transmitter **74**

The forward rotation of the conveying motor **102** which is transmitted via the shaft **60**A of the conveying roller **60** is transmitted to the output roller **62** and the reversible roller **45** by the first transmitter **74** illustrated in FIGS. **5**A-**6**B. As illustrated in FIG. **7**, the first transmitter **74** is provided to the left of the first conveyance path **65**. That is, the first transmitter **74** transmits the rotation from a left side of the output roller **62** (as one example of one of opposite sides of the first roller in its axial direction) to the output roller **62**. It is noted that the position of the first transmitter **74** is not limited to the position thereof illustrated in FIG. **7**. For example, the first transmitter **74** may be provided to the right of the first conveyance path **65**.

As illustrated in FIGS. **5**A-**6**B, the first transmitter **74** includes: gears **75**, **76** engaged with each other; pulleys **77**-**80**; endless belts **81**, **82**; and a one-way clutch **83**. The pulley **77** is one example of a first pulley. The pulley **78** is one example of a second pulley. The pulley **79** is one example of a third pulley. The pulley **80** is one example of a fourth pulley. The belt **81** is one example of a first belt. The belt **82** is one example of a second belt.

The gear **75** is engaged with the gear **76** and rotated together with the shaft **60**A of the conveying roller **60**. The gear **76** and the pulley **77** are rotated coaxially and together with each other. That is, the pulley **77** is rotated in conjunction with the rotation of the conveying roller **60**. The pulley **78** is mounted on a shaft **62**A of the output roller **62**, with the one-way clutch **83** therebetween. That is, the output roller **62** is rotated in conjunction with rotation of the pulley **78**.

The one-way clutch **83** is rotated together with the output roller **62** upon receiving the forward rotation of the conveying motor **102**. That is, the forward rotation of the conveying motor **102** which is transmitted to the pulley **78** is transmitted to the shaft **62**A of the output roller **62** and the pulley **79** by the one-way clutch **83**. The one-way clutch **83** is idled with respect to the output roller **62** when the reverse rotation of the conveying motor **102** is transmitted to the one-way clutch **83**. That is, the reverse rotation of the conveying motor **102** which is transmitted to the pulley **78** is not transmitted to the shaft **62**A of the output roller **62** and the pulley **79** by the one-way clutch **83**. It is noted that a well-known one-way clutch is used as the one-way clutch **83**.

The pulley **79** is rotated together with the shaft **62**A of the output roller **62**. That is, the pulley **79** is rotated in conjunction with the rotation of the pulley **78**. The pulley **80** is rotated together with a shaft **45**A of the reversible roller **45**. That is, the reversible roller **45** is rotated in conjunction with rotation of the pulley **80**.

The belt **81** is looped over the pulleys **77**, **78**. The belt **82** is looped over the pulleys **79**, **80**.

As illustrated in FIG. **5**A, the first transmitter **74** transmits the forward rotation of the conveying motor **102** from the conveying roller **60** to the output roller **62** and the reversible roller **45** to rotate the rollers **62**, **45** forwardly. As illustrated in FIG. **5**B, the first transmitter **74** does not transmit the reverse rotation of the conveying motor **102** from the conveying roller **60** to the output roller **62** and the reversible roller **45**.

In view of the above, when the forward rotation of the conveying motor **102** is transmitted to the output roller **62** via the first transmitter **74**, the output roller **62** is rotated in such a direction that the sheet **12** nipped between the output roller **62** and the spur **63** is to be conveyed in the first conveying direction **16**A. When the forward rotation of the conveying motor **102** is transmitted to the reversible roller **45** via the first transmitter **74**, the reversible roller **45** is rotated in such a direction that the sheet **12** nipped between the reversible roller **45** and the spur **46** is to be conveyed in the first conveying direction **16**A. As a result, the sheet **12** is discharged onto the output tray **21**.

Second Transmitter **149**

The reverse rotation of the conveying motor **102** which is transmitted via the shaft **60**A of the conveying roller **60** and the switching mechanism **170** being in the second state is transmitted to the output roller **62** and the reversible roller **45** by the second transmitter **149** illustrated in FIGS. **6**A and **6**B. As illustrated in FIG. **7**, the second transmitter **149** is provided to the right of the first conveyance path **65**. That is, the second transmitter **149** transmits the rotation from a right side of the output roller **62** (as one example of the other of opposite sides of the first roller in its axial direction) to the output roller **62**. It is noted that the position of the second transmitter **149** is not limited to the position thereof illustrated in FIG. **7**. For example, the second transmitter **149** may be provided to the left of the first conveyance path **65**. In the case where the second transmitter **149** is provided to the left of the first conveyance path **65**, the first transmitter **74** is preferably provided to the right of the first conveyance path **65**.

As illustrated in FIGS. **6**A and **6**B, the second transmitter **149** includes a gear train **150**, a sun gear **151**, a planetary gear **152**, an arm **153**, a gear **154** (as one example of a

transmission gear), the pulleys **79**, **80**, and the belt **82**. The pulleys **79**, **80** and the belt **82** are included in both of the first transmitter **74** and the second transmitter **149**.

The gear train **150** includes a plurality of gears **150**A-**150**D. Each adjacent two of the gears **150**A-**150**D are engaged with each other. The gear **150**A is engaged with the receiving gear **172**B. The sun gear **151** is engaged with the gear **150**D. The planetary gear **152** is engaged with the sun gear **151** and moved into and out of contact with the gear **154**. The arm **153** is pivotably supported on the sun gear **151** at its one end. The arm **153** supports the planetary gear **152** at the other end such that the planetary gear **152** can be rotated on its axis and revolved around the sun gear **151**. Thus, when the sun gear **151** is rotated, the planetary gear **152** is revolved around the sun gear **151** while rotating on the axis of the planetary gear **152**. The gear **154** is rotated together with the shaft **62**A of the output roller **62**. That is, the gear **154** transmits, to the output roller **62**, the rotation of the conveying motor **102** which is transmitted from the planetary gear **152** engaged with the gear **154**.

When the forward rotation of the conveying motor **102** is transmitted to the sun gear **151**, the sun gear **151** is rotated in a first rotational direction **105** indicated by the arrow in FIG. **6**A. This rotation causes the planetary gear **152** to be revolved in the first rotational direction **105** and moved off and away from the gear **154**. As a result, the second transmitter **149** does not transmit the forward rotation of the conveying motor **102** from the conveying roller **60** to the output roller **62** and the reversible roller **45**.

When the reverse rotation of the conveying motor **102** is transmitted to the sun gear **151**, the sun gear **151** is rotated in a second rotational direction **106** that is indicated by the arrow in FIG. **6**B and reverse to the first rotational direction **105**. This rotation causes the planetary gear **152** to be revolved in the second rotational direction **106** and engaged with the gear **154**. As a result, the second transmitter **149** transmits the reverse rotation of the conveying motor **102** from the conveying roller **60** to the output roller **62** and the reversible roller **45** to rotate the rollers **62**, **45** reversely.

When the reverse rotation of the conveying motor **102** is transmitted to the reversible roller **45** via the second transmitter **149**, the reversible roller **45** is rotated in such a direction that the sheet **12** nipped between the reversible roller **45** and the spur **46** is conveyed in a direction reverse to the first conveying direction **16**A. In this case, when the flap **49** is in the normal state, the sheet **12** is guided to the second conveyance path **66** such that the upstream end of the sheet **12** in the first conveying direction **16**A serves as a leading end, and the sheet **12** is conveyed in the second conveying direction **16**B through the second conveyance path **66**.

The second transmitter **149** includes a speed reducer configured to reduce the speed of the rotation of the conveying roller **60** and transmit the rotation to the output roller **62**. This speed reduction enables the speed of the rotation of the re-conveying roller **68** to be greater than the speed of the rotation of the output roller **62** and the reversible roller **45**. This construction can prevent the sheet **12** from being bent on the second conveyance path **66** at a position located between the re-conveying roller **68** and the reversible roller **45**. In the case where the sheet **12** is nipped by both of the reversing device **56** and the re-conveying unit **57** in the state in which the reversible roller **45** is rotated forwardly, both of the reversing device **56** and the re-conveying unit **57** pull the sheet **12**. Even in case where both of the reversing device **56** and the re-conveying unit **57** pull the sheet **12**, the sheet **12** can be guided to the second conveyance path **66** by the re-conveying roller **68** with the higher speed of the rotation.

In the present embodiment, the speed reducer is constituted by (i) the gear **150**A located on the most upstream side in a direction in which the rotation is transmitted from the conveying roller **60** to the output roller **62** in the second transmitter **149** and (ii) the gear **154** located on the most downstream side in the direction in which the rotation is transmitted from the conveying roller **60** to the output roller **62** in the second transmitter **149**. A ratio between the number n**1** of teeth of the gear **150**A and the number n**2** of teeth of the gear **154** (n**2**/n**1**) is greater than one. It is noted that the construction of the speed reducer is not limited to the construction described above. For example, the distance between teeth of any of the gears of the second transmitter **149** (e.g., the gear **150**B) may be greater than the distance between teeth of the other of the gears of the second transmitter **149** (i.e., the gears of the second transmitter **149** other than the gear **150**B). In this case, the gear **150**B serves as the speed reducer. The distance between teeth of any one of the gears different from the gear **150**B may be greater than the distance between teeth of the other gears.

Third Transmitter **85**

The rotation of the conveying motor **102** which is transmitted via the shaft **60**A of the conveying roller **60** and the switching mechanism **170** being in the first state is transmitted to the supply roller **25** via the third transmitter **85** illustrated in FIGS. **5**A and **5**B. As illustrated in FIG. **5**, the third transmitter **85** includes gears **86**-**91**, pulleys **92**-**95**, endless belts **96**, **97**, a sun gear **98**, a planetary gear **99**, and an arm **100**.

The gear **86** is in engagement with the receiving gear **172**A and the gear **8**. The gear **87** and the pulley **92** are rotated coaxially and together with each other. The gear **88** and the pulley **93** are rotated coaxially and together with each other. The gear **89** is in engagement with the gear **88**. The sun gear **98** and the gear **89** are rotated coaxially and together with each other. The planetary gear **99** is engaged with the sun gear **98** and moved into and out of contact with the gear **90**. The arm **100** is pivotably supported on the sun gear **98** at its one end. The arm **100** supports the planetary gear **99** at the other end such that the planetary gear **99** can be rotated on its axis and revolved around the sun gear **98**. Thus, when the sun gear **98** is rotated, the planetary gear **99** is revolved around the sun gear **98** while rotating on the axis of the planetary gear **99**. The gear **90** is in engagement with the gear **91**. The gear **91** and the pulley **94** are rotated coaxially and together with each other. The pulley **95** and the supply roller **25** are rotated coaxially and together with each other. The belt **96** is looped over the pulleys **92**, **93**. The belt **97** is looped over the pulleys **94**, **95**.

As illustrated in FIG. **5**A, when the forward rotation of the conveying motor **102** is transmitted to the sun gear **98**, the planetary gear **99** is moved off and away from the gear **90**. As a result, the third transmitter **85** transmits the forward rotation of the conveying motor **102** to the supply roller **25**. As illustrated in FIG. **5**B, when the reverse rotation of the conveying motor **102** is transmitted to the sun gear **98**, the planetary gear **99** is engaged with the gear **90**. As a result, the third transmitter **85** transmits the reverse rotation of the conveying motor **102** to the supply roller **25** to forwardly rotate the supply roller **25**.

Fourth Transmitter **140**

The rotation of the conveying motor **102** which is transmitted via the shaft **60**A of the conveying roller **60** and the switching mechanism **170** being in the second state is transmitted to the re-conveying roller **68** by the fourth

transmitter **140** illustrated in FIG. **6**. As illustrated in FIG. **6**, the fourth transmitter **140** includes a sun gear **141**, planetary gears **142**, **143**, arms **144**, **145**, a gear train **146**, and gears **147**, **148**.

The sun gear **141** is engaged with the receiving gear **172**B. The planetary gear **142** is engaged with the sun gear **141** and moved into and out of contact with a gear **146**A. The planetary gear **143** is engaged with the sun gear **141** and moved into and out of contact with a gear **146**B. The arm **144** is pivotably supported on the sun gear **141** at its one end. The arm **144** supports the planetary gear **142** at the other end such that the planetary gear **142** can be rotated on its axis and revolved around the sun gear **141**. The arm **145** is pivotably supported on the sun gear **141** at its one end. The arm **145** supports the planetary gear **143** at the other end such that the planetary gear **143** can be rotated on its axis and revolved around the sun gear **141**. The gear train **146** includes a plurality of gears **146**A-**146**F. Each adjacent two of the gears **146**A-**146**F are engaged with each other. The gear **147** and the gear **146**F are rotated coaxially and together with each other. The gear **148** is engaged with the gear **147**. The gear **148** and a shaft of the re-conveying roller **68** are rotated coaxially and together with each other.

As illustrated in FIG. **6**A, when the forward rotation of the conveying motor **102** is transmitted to the sun gear **141**, the planetary gear **142** is moved off and away from the gear **146**A, so that the planetary gear **143** is engaged with the gear **146**B. That is, the forward rotation of the conveying motor **102** is transmitted from the conveying roller **60** to the re-conveying roller **68** via the gears **146**B-**146**F. As illustrated in FIG. **6**B, when the reverse rotation of the conveying motor **102** is transmitted to the sun gear **141**, the planetary gear **142** is engaged with the gear **146**A, and the planetary gear **143** is moved off and away from the gear **146**B. That is, the reverse rotation of the conveying motor **102** is transmitted from the conveying roller **60** to the re-conveying roller **68** via the gears **146**A-**146**F. With this construction, the re-conveying roller **68** is rotated forwardly even in the case where any of the forward rotation and the reverse rotation of the conveying motor **102** is transmitted to the re-conveying roller **68**. The sheet **12** nipped between the re-conveying roller **68** and the driven roller **69** is conveyed in the second conveying direction **16**B by the forward rotation of the re-conveying roller **68**.

Transmission Delayer **160**

As illustrated in FIGS. **5**A-**6**B, the first transmitter **74** includes a transmission delayer **160**. In the present embodiment, the transmission delayer **160** includes the gear **76** (as one example of a second rotary member) and the pulley **77** (as one example of a first rotary member).

There will be next explained a construction of the transmission delayer **160** with reference to FIGS. **10**A and **10**B. It is noted that FIGS. **10**A and **10**B omit illustration of teeth formed on the gear **76**.

The gear **76** is rotatably supported on a support shaft, not illustrated, extending in the right and left directions **8**, **9**. Like the gear **76**, the pulley **77** is rotatably supported on the support shaft. That is, the pulley **77** and the gear **76** are rotated coaxially.

A protrusion **194** (as one example of a contact portion) protruding in the right direction **8** is provided on a right surface **193** of the gear **76**. In other words, the protrusion **194** protruding toward the pulley **77** is provided on the surface (the right surface **193**) of the gear **76** which faces the pulley **77**. One end surface **194**A of the protrusion **194** in circumferential directions **190** is contactable with a side surface **198**A of a recessed portion **198** of the pulley **77**. The other end surface **194**B of the protrusion **194** in the circumferential directions **190** is contactable with a side surface **198**B of the recessed portion **198** of the pulley **77**. That is, the length of the protrusion **194** in the circumferential directions **190** is equal to a distance in the circumferential directions **190** between (i) the one end surface **194**A of the protrusion **194** which contacts the side surface **198**A and (ii) the other end surface **194**B of the protrusion **194** which contacts the side surface **198**B.

The pulley **77** has a left surface **197** that faces the gear **76**. The left surface **197** has the recessed portion **198**. The recessed portion **198** extends in the circumferential directions **190**. One end of the recessed portion **198** in the circumferential directions **190** is defined by the side surface **198**A as one example of a first surface. The other end of the recessed portion **198** in the circumferential directions **190** is defined by the side surface **198**B as one example of a second surface. The distance between the side surfaces **198**A, **198**B in the circumferential directions **190** is longer than the length of the protrusion **194** in the circumferential directions **190**.

The gear **76** and the pulley **77** are arranged in a state in which the right surface **193** of the gear **76** and the left surface **197** of the pulley **77** face each other. In this state, the protrusion **194** is inserted in the recessed portion **198**. That is, the protrusion **194** is located between the side surfaces **198**A, **198**B of the recessed portion **198** in the circumferential directions **190**.

With the constructions described above, the gear **76** and the pulley **77** are rotated as follows.

When the forward rotation of the conveying motor **102** is transmitted to the gear **76**, the gear **76** is rotated forward in such a direction that the protrusion **194** is to be moved toward the side surface **198**A. When the reverse rotation of the conveying motor **102** is transmitted to the gear **76**, the gear **76** is rotated reversely in such a direction that the protrusion **194** is to be moved toward the side surface **198**B. The side surface **198**A of the pulley **77** is pressed by the protrusion **194** of the gear **76** being rotated forwardly, and thereby the pulley **77** is rotated forwardly together with the gear **76**. The side surface **198**B of the pulley **77** is pressed by the protrusion **194** of the gear **76** being rotated reversely, and thereby the pulley **77** is rotated reversely together with the gear **76**.

When the forward rotation is transmitted from the conveying motor **102** to the conveying roller **60**, the protrusion **194** is in contact with the side surface **198**A. When the rotation transmitted from the conveying motor **102** to the conveying roller **60** is changed from the forward rotation to the reverse rotation in this state, the gear **76** having received the reverse rotation of the conveying motor **102** is rotated reversely in such a direction that the protrusion **194** is to be moved away from the side surface **198**A and toward the side surface **198**B. During this rotation, the gear **76** is idled with respect to the pulley **77**. That is, the pulley **77** is not rotated during the reverse rotation of the gear **76** until the protrusion **194** is brought into contact with the side surface **198**B from the start of the reverse rotation of the gear **76**. As a result, the reverse rotation of the conveying motor **102** is not transmitted to the output roller **62** during the idle of the gear **76** with respect to the pulley **77**. When the protrusion **194** is brought into contact with the side surface **198**B by the reverse rotation of the gear **76** so as to push the side surface **198**B, the pulley **77** is rotated reversely together with the gear **76**. As a result, the reverse rotation of the conveying motor **102** is transmitted to the output roller **62**.

When the reverse rotation is transmitted from the conveying motor **102** to the conveying roller **60**, the protrusion **194** is in contact with the side surface **198**B. When the rotation transmitted from the conveying motor **102** to the conveying roller **60** is changed from the reverse rotation to the forward rotation in this state, the gear **76** having received the forward rotation of the conveying motor **102** is rotated forwardly in such a direction that the protrusion **194** is to be moved away from the side surface **198**B and toward the side surface **198**A. During this rotation, the gear **76** is idled with respect to the pulley **77**. That is, the pulley **77** is not rotated during the forward rotation of the gear **76** until the protrusion **194** is brought into contact with the side surface **198**A from the start of the forward rotation of the gear **76**. As a result, the forward rotation of the conveying motor **102** is not transmitted to the output roller **62** during the idle of the gear **76** with respect to the pulley **77**. When the protrusion **194** is brought into contact with the side surface **198**A by the forward rotation of the gear **76** so as to push the side surface **198**A, the pulley **77** is rotated forwardly together with the gear **76**. As a result, the forward rotation of the conveying motor **102** is transmitted to the output roller **62**.

In summary, in any of the case where the rotation transmitted from the conveying motor **102** to the conveying roller **60** is changed from the forward rotation to the reverse rotation and the case where the rotation transmitted from the conveying motor **102** to the conveying roller **60** is changed from the reverse rotation to the forward rotation, the transmission delayer **160** does not transmit the rotation of the conveying motor **102** from the conveying roller **60** to the output roller **62** during rotation of the conveying motor **102** by a particular amount. Here, the particular amount of the rotation is an amount of rotation of the conveying motor **102** during a period extending from a point in time when the protrusion **194** is moved off one of the side surfaces **198**A, **198**B and brought into contact with the other of the side surfaces **198**A, **198**B.

While the gear **76** includes the one protrusion, and the pulley **77** has the one recess in the present embodiment, a plurality of protrusions and a plurality of recesses may be provided.

While the gear **76** includes the protrusion, and the pulley **77** has the recess to which the protrusion is inserted in the present embodiment, the MFP **10** may be configured such that the pulley **77** includes the protrusion, and the gear **76** has the recess to which the protrusion is inserted.

While the gear **76** includes the protrusion, and the pulley **77** has the recess to which the protrusion is inserted in the present embodiment, the MFP **10** may have any configuration as long as a protrusion provided on one of the gear **76** and the pulley **77** is inserted in a space defined between two surfaces which are provided on the other of the gear **76** and the pulley **77** so as to be spaced apart from each other in the circumferential directions **190**.

For example, the MFP **10** may be configured such that each of the gear **76** and the pulley **77** includes two protrusions spaced apart from each other in the circumferential directions **190**, and one of the protrusions of one of the gear **76** and the pulley **77** is inserted in a space defined between side surfaces of the two protrusions of the other of the gear **76** and the pulley **77**, which surfaces face each other. In this construction, the side surfaces facing each other are another example of the first surface and the second surface.

The transmission delayer **160** is constituted by the gear **76** and the pulley **77** in the present embodiment but may be constituted by a gear and a pulley different from the gear **76** and the pulley **77**. For example, the transmission delayer **160** may be constituted by the pulley **78** and the pulley **79**. In this example, the construction of the pulley **78** is the same as that of one of the gear **76** and the pulley **77**, and the construction of the pulley **79** is the same as that of the other of the gear **76** and the pulley **77**.

The transmission delayer **160** may not include the two rotary members adjacent to each other, as long as the transmission delayer **160** is constructed such that, when the direction of the rotation transmitted from the conveying motor **102** to the conveying roller **60** is switched, the rotation of the conveying motor **102** is not transmitted from the conveying roller **60** to the output roller **62** during the rotation of the conveying motor **102** by the particular amount.

For example, the transmission delayer **160** may be similar in construction to the planetary gear mechanism included in the second transmitter **149** (the sun gear **151**, the planetary gear **152**, and the arm **153**). In this example, the gear **75** and the gear **76** are not in engagement with each other, and a planetary gear mechanism is disposed between the gear **75** and the gear **76**. A sun gear of the planetary gear mechanism is engaged with the gear **75**, and a planetary gear of the planetary gear mechanism is moved into and out of contact with the gear **76**. It is noted that the planetary gear mechanism is disposed such that the planetary gear is engaged with the gear **76** when the forward rotation is transmitted from the conveying motor **102** to the conveying roller **60**, and the planetary gear is moved off and away from the gear **76** when the reverse rotation is transmitted from the conveying motor **102** to the conveying roller **60**. As a result, when the rotation transmitted from the conveying motor **102** to the conveying roller **60** is changed from the reverse rotation to the forward rotation, the planetary gear mechanism as the transmission delayer **160** does not transmit the rotation of the conveying motor **102** from the conveying roller **60** to the output roller **62** during rotation of the conveying motor **102** by a particular amount. This particular amount of the rotation is an amount of rotation of the conveying motor **102** during a period in which the planetary gear spaced apart from the gear **76** is engaged with the gear **76** by revolving around the sun gear.

Controller **130**

As illustrated in FIG. **8**, the controller **130** includes a CPU **131**, a ROM **132**, a RAM **133**, an EEPROM **134**, and an ASIC **135** which are connected to each other by an internal bus **137**. The ROM **132** stores programs and information to be used by the CPU **131** to control various operations. The RAM **133** is used as a working area for data processing or as a storage area for temporarily storing data, signals, and the like to be used by the CPU **131** to execute the above-described programs. The EEPROM **134** stores settings, flags, and the like to be kept also after the MFP **10** is turned off.

The conveying motor **102** and the carriage motor **103** are connected to the ASIC **135**. The ASIC **135** creates drive signals for rotating the motors to control the motors based on the created signals. Each of the motors is rotated forwardly or reversely based on the drive signals created by the ASIC **135**. For example, the controller **130** controls the conveying motor **102** to rotate the rollers. The controller **130** controls the carriage motor **103** to reciprocate the carriage **23**. The controller **130** controls the recording head **39** to eject the ink from the nozzles **40**.

The first sensor **120**, the rotary encoder **121**, and the second sensor **122** are connected to the ASIC **135**. The controller **130** detects the presence of the sheet **12** at each of the first sensor **120** and the second sensor **122** based on

detection signal output from the sensor. The controller **130** detects the position of the sheet **12** based on the detection signal output from the first sensor **120** and the pulse signal output from the rotary encoder **121**.

Image Recording Process

There will be next explained an image recording process in the present embodiment with reference to FIG. **9**. This image recording process is executed by the CPU **131** of the controller **130**. It is noted that the processings may be executed by the CPU **131** reading the programs stored in the ROM **132** and may be executed by hardware circuits mounted on the controller **130**.

The controller **130** executes the image recording process upon receiving a recording instruction that is input by a user to record images on both sides of the sheet. The recording instruction may be obtained in any manner. For example, the recording instruction may be obtained via an input device **17** provided on the MFP **10** (see FIG. **1**) and may be obtained from an external device over a communication network. The controller **130** controls the rollers, the carriage **23**, and the recording head **39** according to the obtained recording instruction to record images on the sheet **12**.

FIG. **9** illustrates the flow of the image recording process. This flow begins with S**11** at which the controller **130** switches the switching mechanism **170** to the first state. Specifically, the controller **130** controls the carriage **23** to move in the right and left directions **8**, **9** to bring the switching lever **176** into contact with the first stopper **180**. As a result, the switching gear **171** is moved to engage the switching gear **171** and the receiving gear **172**A with each other. In the case where the switching mechanism **170** has already been in the first state, however, the controller **130** executes processings at S**12** and subsequent steps without executing the processing at S**11**.

The controller **130** at S**12** executes a front-side supply processing for supplying the sheet **12** for recoding on a front surface of the sheet **12**. In this front-side supply processing, the leading end of the sheet **12** supported on the supply tray **20** (the downstream end of the sheet **12** in the first conveying direction **16**A) is moved to the conveying unit **54**. Specifically, the controller **130** causes the reverse rotation of the conveying motor **102** to rotate the supply roller **25**.

The controller **130** at S**13** executes a front-side recording processing for image recording on the front surface of the sheet **12**. In this front-side recording processing, an image is recorded on the front surface of the sheet **12**. Specifically, the controller **130** at S**13** alternately repeats a conveyance processing and an ejection processing. In the conveyance processing, the sheet **12** having reached the conveying unit **54** is conveyed by at least one of the conveying unit **54**, the sheet discharger **55**, and the reversing device **56** by a predetermined linefeed distance in the first conveying direction **16**A. In the ejection processing, the ink is ejected by the recording head **39** onto the sheet **12** conveyed by the predetermined linefeed distance.

Specifically, the controller **130** causes the forward rotation of the conveying motor **102** in the conveyance processing to rotate the rollers **60**, **62**, **45** forwardly. It is noted that the forward rotation of the conveying motor **102** is transmitted from the conveying roller **60** to the output roller **62** and the reversible roller **45** via the first transmitter **74**. In the ejection processing, the controller **130** drives the carriage motor **103** to move the carriage **23** in the right and left directions **8**, **9** and controls the recording head **39** to eject the ink at predetermined timings.

The controller **130** at S**14** executes a front-side discharge processing for the sheet **12**. In this front-side discharge processing, at least one of the conveying unit **54**, the sheet discharger **55**, and the reversing device **56** conveys the sheet **12**, on which the image has been recorded on its front surface, in the first conveying direction **16**A such that the trailing end of the sheet **12**, i.e., the upstream end of the sheet **12** in the first conveying direction **16**A reaches the branch position **66**A. Specifically, the controller **130** causes the forward rotation of the conveying motor **102** to rotate the rollers **60**, **62**, **45** forwardly. In this rotation, the flap **49** is raised by the sheet **12** conveyed in the first conveying direction **16**A and thereby swung from the flip position to the discharge position. When the trailing end of the sheet **12** has reached the branch position **66**A, the flap **49** is swung from the discharge position to the flip position by its own weight. This operation turns the trailing end of the sheet **12** toward the second conveyance path **66**.

The controller **130** at S**15** switches the switching mechanism **170** from the first state to the second state. Specifically, the controller **130** controls the carriage **23** to move in the right direction **8** to bring the switching lever **176** into contact with the second stopper **181**. As a result, the switching gear **171** is moved to engage the switching gear **171** and the receiving gear **172**B with each other.

The controller **130** at S**16** executes a back-side supply processing. In this back-side supply processing, the sheet **12** on which the image has been recorded is turned upside down and conveyed to the conveying unit **54**. Specifically, the controller **130** causes the reverse rotation of the conveying motor **102** to rotate the reversible roller **45** reversely and rotate the re-conveying roller **68** forwardly. As a result, the sheet **12** is conveyed from the branch position **66**A into the second conveyance path **66**, with the upstream end of the sheet **12** in the first conveying direction **16**A as a leading end, and the sheet **12** is then conveyed to the conveying unit **54** via the merge position **66**B. It is noted that the reverse rotation of the conveying motor **102** is transmitted from the conveying roller **60** to the output roller **62** and the reversible roller **45** via the second transmitter **149** and from the conveying roller **60** to the re-conveying roller **68** via the fourth transmitter **140**.

The controller **130** at S**17** executes a back-side recording processing for image recording on a back surface of the sheet **12**. In this back-side recording processing, an image is recorded on the back surface of the sheet **12**. In this back-side recording processing, as in the front-side recording processing, the controller **130** alternately repeats the conveyance processing and the ejection processing.

The controller **130** causes the forward rotation of the conveying motor **102** in the conveyance processing of the back-side recording processing. As a result, the forward rotation of the conveying motor **102** is transmitted from the conveying roller **60** to the output roller **62** and the reversible roller **45** via the first transmitter **74** to rotate the rollers **60**, **62**, **45** forwardly. That is, the controller **130** switches the rotation of the conveying motor **102** from the reverse rotation performed in the back-side supply processing to the forward rotation in the conveyance processing. This switch of the rotation of the conveying motor **102** is performed before the sheet **12** reaches the conveying unit **54** via the merge position **66**B. Thus, the conveying unit **54** can convey the sheet **12** in the first conveying direction **16**A when the sheet **12** reaches the conveying unit **54**. Also, even when the rotation of the conveying motor **102** is switched from the reverse rotation to the forward rotation, the re-conveying roller **68** continues to be rotated forwardly. Thus, the sheet **12** is normally conveyed along the second conveyance path **66**.

In the above-described switch of the rotation of the conveying motor **102** from the reverse rotation to the forward rotation, the forward rotation of the conveying motor **102** is transmitted to the second transmitter **149**, whereby the planetary gear **152** is moved off and away from the gear **154**. When the rotation of the conveying motor **102** is switched from the reverse rotation to the forward rotation, the forward rotation of the conveying motor **102** is transmitted from the conveying roller **60** to the output roller **62** via the first transmitter **74**. In this transmission, the transmission delayer **160** delays the timing at which the forward rotation of the conveying motor **102** becomes transmittable from the conveying roller **60** to the output roller **62** via the first transmitter **74**. As a result, this timing can be set to a timing after the planetary gear **152** is moved off the gear **154**.

The controller **130** at S**18** executes a back-side discharge processing. In this back-side discharge processing, the sheet **12** is conveyed in the first conveying direction **16**A by the sheet discharger **55** and the reversing device **56** until the sheet **12** passes through the reversing device **56** (that is, until the sheet **12** is discharged onto the output tray **21**). Specifically, the controller **130** causes the forward rotation of the conveying motor **102** to rotate the rollers **60**, **62**, **45** forwardly.

Effects

In the above-described embodiment, when the rotation of the conveying motor **102** which is transmitted from the conveying motor **102** to the conveying roller **60** is changed from the reverse rotation to the forward rotation, the transmission delayer **160** delays the timing at which the forward rotation of the conveying motor **102** becomes transmittable from the conveying roller **60** to the output roller **62** via the first transmitter **74**. With this operation, the timing at which the forward rotation of the conveying motor **102** becomes transmittable to the gear **154** via the first transmitter **74** and the output roller **62** becomes later than the timing at which the planetary gear **152** is moved off the gear **154**. That is, it is possible to prevent the gear **154** from being rotated by the forward rotation of the conveying motor **102** in the state in which the gear **154** is in engagement with the planetary gear **152**. This configuration enables the planetary gear **152** to be moved off the gear **154**, thereby preventing occurrence of situation in which the conveying motor **102** cannot be rotated because the conveying motor **102** is locked.

In the above-described embodiment, the transmission delayer **160** is constituted by the pulley **77** and the gear **76**. Thus, the transmission delayer **160** can be constructed with a simple structure.

In the above-described embodiment, the first transmitter **74** includes the one-way clutch **83**, thereby simplifying the construction of the first transmitter **74**.

In the above-described embodiment, it is possible to stop the output roller **62** while rotating the conveying roller **60** by establishing the first state of the switching mechanism **170**. For example, it is possible to stop the output roller **62** while rotating the conveying roller **60** in the direction in which the sheet **12** is conveyed in the direction reverse to the first conveying direction **16**A. With this operation, the sheet **12** being conveyed toward the conveying roller **60** is brought into contact with the conveying roller **60** being rotated in the direction in which the sheet **12** is to be conveyed in the direction reverse to the first conveying direction **16**A. This contact can correct a skew of the sheet **12**. In this correction, the output roller **62** is at rest even in the state in which the sheet **12** supplied before the sheet **12** in question is in contact with the output roller **62**. Thus, the sheet **12** supplied before the sheet **12** in question is not conveyed by the output roller **62**.

In the above-described embodiment, the first state of the switching mechanism **170** is established, and the reverse rotation of the conveying motor **102** is transmitted to the conveying roller **60**, whereby the sheet **12** supported on the supply tray **20** can be supplied toward the conveying roller **60** by the supply roller **25**.

In the above-described embodiment, the second state of the switching mechanism **170** is established, and the rotation of the conveying motor **102** is transmitted from the conveying roller **60** to the re-conveying roller **68** via the fourth transmitter **140**, whereby the sheet **12** to be guided into the second conveyance path **66** can be conveyed along the second conveyance path **66** by the re-conveying roller **68**. Also, the supply of the sheet **12** by the supply roller **25** and the conveyance of the sheet **12** along the second conveyance path **66** by the re-conveying roller **68** can be performed separately depending upon the state of the switching mechanism **170**.

In the above-described embodiment, the drive-power transmitting path of the first transmitter **74** and the drive-power transmitting path of the second transmitter **149** share a path from the output roller **62** to the reversible roller **45**. This configuration reduces the size of a space occupied by the first transmitter **74** and the second transmitter **149**.

The speed of the rotation of the conveying roller **60** is reduced by the second transmitter **149**, and the rotation is transmitted to the output roller **62**. Thus, there is a possibility that the timing at which the rotation of the conveying motor **102** becomes transmittable from the conveying roller **60** to the output roller **62** via the first transmitter **74** is earlier than the timing at which the planetary gear **152** is moved off the gear **154**. In the above-described embodiment, in contrast, the first transmitter **74** includes the transmission delayer **160**. With this construction, the timing at which the rotation of the conveying motor **102** becomes transmittable from the conveying roller **60** to the output roller **62** via the first transmitter **74** is later than the timing at which the planetary gear **152** is moved off the gear **154**.

In the above-described embodiment, the first transmitter **74** is provided to the left of the first conveyance path **65**, and the second transmitter **149** is provided to the right of the first conveyance path **65**. With this construction, the first transmitter **74** and the second transmitter **149** do not interfere with each other, thereby simplifying the constructions of the transmitters **74**, **149**.

Modifications

In the above-described embodiment, the rollers **60**, **62**, **45** are rotated forwardly by receiving the forward rotation of the conveying motor **102** via the first transmitter **74** and are rotated reversely by receiving the reverse rotation of the conveying motor **102** via the second transmitter **149**. However, the directions of the rotation of the rollers **60**, **62**, **45** are not limited to the rotations in the above-described embodiment. For example, each of the rollers **60**, **62**, **45** may be rotated in the same direction in any of the case where the forward rotation of the conveying motor **102** is transmitted via the first transmitter **74** and the case where the reverse rotation of the conveying motor **102** is transmitted via the second transmitter **149**.

The conveying roller **60** serves as the driven member in the above-described embodiment, but the present disclosure is not limited to this configuration. For example, the driven member may be a pump, not illustrated, which is driven when the ink is sucked from the nozzles **40**. The pump is

disposed on a tube, not illustrated, which is connected to the nozzles when the ink is sucked from the nozzles **40**. The tube is connected at one end to the nozzles **40** and at the other end to a waste ink tank, not illustrated. When the pump is driven, the tube is squeezed. As a result, the ink is sucked from the nozzles **40** into the tube and transferred into the waste ink tank. In the case where the driven member is the pump, the rotation of the conveying motor **102** is transmitted from the pump to the output roller **62** by gears provided on the pump, for example.

The directions of the rotation (i.e., the forward rotation and the reverse rotation) transmitted from the conveying motor **102** to each of the rollers **25**, **60**, **62**, **45**, **68** may be reverse to those in the above-described embodiment. For example, in the above-described embodiment, the rollers **60**, **62**, **45** are rotated forwardly by receiving the forward rotation of the conveying motor **102** via the first transmitter **74** and are rotated reversely by receiving the reverse rotation of the conveying motor **102** via the second transmitter **149**. However, the rollers **60**, **62**, **45** may be rotated forwardly by receiving the reverse rotation of the conveying motor **102** via the first transmitter **74** and are rotated reversely by receiving the forward rotation of the conveying motor **102** via the second transmitter **149**.

The second conveyance path **66** may have a construction different from that illustrated in FIG. **2** as long as the sheet **12** on which an image has been recorded by the image recorder **24** can be turned upside down and conveyed to the image recorder **24** again. For example, the second conveyance path **66** may be defined such that the branch position **66**A is located upstream of the image recorder **24** in the first conveying direction **16**A, and the merge position **66**B is located upstream of the branch position **66**A in the first conveying direction **16**A.

In the image recording process in the above-described embodiment, the transmission delayer **160** delays the transmission of the forward rotation of the conveying motor **102** via the first transmitter **74** in the conveyance processing of the back-side recording processing in the case of the both-side image recording on the sheet **12**. However, the transmission of the forward rotation of the conveying motor **102** via the first transmitter **74** may not be delayed in the conveyance processing of the back-side recording processing and may be delayed in any time in the switch of the rotation of the conveying motor **102** from the forward rotation to the reverse rotation or from the reverse rotation to the forward rotation.

For example, the transmission delayer **160** may delay the transmission of the forward rotation of the conveying motor **102** via the first transmitter **74** in the case where the MFP **10** has a function for recording an image on a surface of a plate-like or disc-like recording medium such as a CD and a DVD. In this case, the recording medium is inserted from the opening **13** in the direction reverse to the first conveying direction **16**A, then conveyed in the first conveying direction **16**A for image recording, and finally discharged through the opening **13**. The conveying motor **102** is rotated reversely when the recording medium is inserted in the direction reverse to the first conveying direction **16**A, and the conveying motor **102** is rotated forwardly when the recording medium is conveyed in the first conveying direction **16**A. That is, the rotation of the conveying motor **102** is switched from the reverse rotation to the forward rotation when the direction of the conveyance of the recording medium is switched. The timing of this switch is delayed by the transmission delayer **160**.

What is claimed is:

1. A conveyor, comprising:

a motor that is rotated forwardly and reversely;

a driven member that is driven by rotation caused by at least one of forward rotation and reverse rotation of the motor, the caused rotation being transmitted from the motor;

a first roller provided on a first conveyance path through which a sheet is to be conveyed;

a first power transmitting mechanism configured to transmit rotation caused by one of the forward rotation and the reverse rotation of the motor to the first roller and not to transmit rotation caused by the other of the forward rotation and the reverse rotation of the motor from the driven member to the first roller; and

a second power transmitting mechanism configured to transmit the rotation caused by the other of the forward rotation and the reverse rotation of the motor to the first roller and not to transmit the rotation caused by the one of the forward rotation and the reverse rotation of the motor to the first roller,

the second power transmitting mechanism comprising:

a sun gear that is rotated in a first rotational direction by receiving the rotation caused by the one of the forward rotation and the reverse rotation of the motor from the driven member and that is rotated in a second rotational direction by receiving the rotation caused by the other of the forward rotation and the reverse rotation of the motor from the driven member, the second rotational direction being reverse to the first rotational direction;

an arm pivotably supported by the sun gear;

a planetary gear rotatably supported by the arm in a state in which the planetary gear is engaged with the sun gear, the planetary gear being configured to be revolved around the sun gear; and

a transmission gear engageable with the planetary gear and configured to transmit, to the first roller, rotation of the motor which is transmitted from the planetary gear,

the planetary gear being configured to be revolved, in a direction in which the planetary gear is moved away from the transmission gear, by rotation of the sun gear in the first rotational direction, the planetary gear being configured to be revolved, in a direction in which the planetary gear is to be engaged with the transmission gear, by rotation of the sun gear in the second rotational direction,

the first power transmitting mechanism comprising a transmission delayer that does not transmit the rotation of the motor from the driven member to the first roller until the motor is rotated by a particular amount from a time point at which the motor starts to be rotated in a rotational direction of the one of the forward rotation and the reverse rotation when rotation transmitted from the motor to the driven member is changed from the other of the forward rotation and the reverse rotation to the one of the forward rotation and the reverse rotation.

2. The conveyor according to claim **1**,

wherein the transmission delayer comprises a first rotary member and a second rotary member that is rotated coaxially with the first rotary member,

wherein the first rotary member comprises a first surface and a second surface spaced apart from each other in a circumferential direction of the first rotary member,

wherein the second rotary member comprises a contact portion located between the first surface and the second

surface in the circumferential direction and contactable with the first surface and the second surface, and

wherein a distance between a portion of the contact portion which is to contact the first surface and a portion of the contact portion which is to contact the second surface is less than a distance between the first surface and the second surface in the circumferential direction.

3. The conveyor according to claim **1**, wherein the first power transmitting mechanism comprises a one-way clutch that is rotated together with the first roller by the rotation caused by the one of the forward rotation and the reverse rotation of the motor and that is idled with respect to the first roller by the rotation caused by the other of the forward rotation and the reverse rotation of the motor.

4. The conveyor according to claim **1**,

wherein the driven member is a second roller that is rotated, in a direction in which the sheet is to be conveyed in a conveying direction, by receiving from the motor the rotation caused by the one of the forward rotation and the reverse rotation of the motor and that is rotated, in a direction in which the sheet is to be conveyed in a direction reverse to the conveying direction, by receiving from the motor the rotation caused by the other of the forward rotation and the reverse rotation of the motor,

wherein the first roller is configured to be rotated, in the direction in which the sheet is to be conveyed in the conveying direction, by receiving the rotation caused by the one of the forward rotation and the reverse rotation of the motor from the second roller via the first power transmitting mechanism, and the first roller is configured to be rotated, in the direction in which the sheet is to be conveyed in the direction reverse to the conveying direction, by receiving the rotation caused by the other of the forward rotation and the reverse rotation of the motor from the second roller via the second power transmitting mechanism, and

wherein the second roller is provided on the first conveyance path at a position located upstream of the first roller in the conveying direction.

5. The conveyor according to claim **4**, further comprising a switching mechanism that is switchable between (i) a first state in which transmission of the rotation of the motor from the second roller to the first roller via the second power transmitting mechanism is interrupted and (ii) a second state in which the transmission of the rotation of the motor from the second roller to the first roller via the second power transmitting mechanism is allowed.

6. The conveyor according to claim **5**, further comprising:

a tray that supports the sheet;

a supply roller that supplies the sheet from the tray toward the second roller in the conveying direction; and

a third power transmitting mechanism configured to transmit the rotation caused by the other of the forward rotation and the reverse rotation of the motor from the second roller to the supply roller and not to transmit the rotation caused by the one of the forward rotation and the reverse rotation of the motor from the second roller to the supply roller,

wherein the switching mechanism is configured to allow transmission of the rotation of the motor from the second roller to the supply roller via the third power transmitting mechanism when the switching mechanism is in the first state, and

wherein the switching mechanism is configured to interrupt the transmission of the rotation of the motor from the second roller to the supply roller via the third power transmitting mechanism when the switching mechanism is in the second state.

7. The conveyor according to claim **6**, further comprising:

a third roller provided on a second conveyance path connected to the first conveyance path; and

a fourth power transmitting mechanism configured to transmit the forward rotation and the reverse rotation of the motor from the second roller to the third roller as rotation in a direction in which the sheet to be guided into the second conveyance path is allowed to be conveyed,

wherein the switching mechanism is configured to interrupt transmission of the rotation of the motor from the second roller to the third roller via the fourth power transmitting mechanism when the switching mechanism is in the first state, and

wherein the switching mechanism is configured to allow the transmission of the rotation of the motor from the second roller to the third roller via the fourth power transmitting mechanism when the switching mechanism is in the second state.

8. The conveyor according to claim **7**, further comprising a fourth roller provided on the first conveyance path at a position located downstream of the first roller in the conveying direction,

wherein the second conveyance path is connected to the first conveyance path at (i) a first connecting position located between the first roller and the fourth roller and (ii) a second connecting position located upstream of the second roller in the conveying direction,

wherein the first power transmitting mechanism is configured to transmit the rotation caused by the one of the forward rotation and the reverse rotation of the motor from the second roller to the fourth roller via the first roller, and

wherein the second power transmitting mechanism is configured to transmit the rotation caused by the other of the forward rotation and the reverse rotation of the motor from the second roller to the fourth roller via the first roller.

9. The conveyor according to claim **8**,

wherein the first power transmitting mechanism comprises:

a first pulley that is rotated in conjunction with rotation of the second roller;

a second pulley that is rotated to rotate the first roller in conjunction with rotation of the second pulley;

a third pulley that is rotated in conjunction with rotation of the second pulley;

a fourth pulley that is rotated to rotate the fourth roller in conjunction with rotation of the fourth pulley;

a first belt looped over the first pulley and the second pulley; and

a second belt looped over the third pulley and the fourth pulley, and

wherein the second power transmitting mechanism comprises the third pulley, the fourth pulley, and the second belt.

10. The conveyor according to claim **4**, wherein the second power transmitting mechanism comprises a speed reducer configured to reduce a speed of rotation of the first roller rotated by receiving the rotation caused by the other of the forward rotation and the reverse rotation of the motor via the second power transmitting mechanism, such that the speed of rotation of the first roller is less than a speed of rotation of the second roller.

11. The conveyor according to claim 1,

wherein the first power transmitting mechanism is configured to transmit the rotation of the motor to the first roller from one of opposite sides of the first roller in an axial direction thereof, and

wherein the second power transmitting mechanism is configured to transmit the rotation of the motor to the first roller from the other of the opposite sides of the first roller in the axial direction thereof.

12. An image recording apparatus, comprising:

a conveyor comprising (i) a motor that is rotated forwardly and reversely, (ii) a driven member that is driven by rotation caused by at least one of forward rotation and reverse rotation of the motor, the caused rotation being transmitted from the motor, (iii) a first roller provided on a first conveyance path through which a sheet is to be conveyed, (iv) a first power transmitting mechanism configured to transmit rotation caused by one of the forward rotation and the reverse rotation of the motor to the first roller and not to transmit rotation caused by the other of the forward rotation and the reverse rotation of the motor from the driven member to the first roller, and (v) a second power transmitting mechanism configured to transmit the rotation caused by the other of the forward rotation and the reverse rotation of the motor to the first roller and not to transmit the rotation caused by the one of the forward rotation and the reverse rotation of the motor to the first roller; and

an image recorder provided on the first conveyance path and configured to record an image on the sheet,

the second power transmitting mechanism comprising:

a sun gear that is rotated in a first rotational direction by receiving the rotation caused by the one of the forward rotation and the reverse rotation of the motor from the driven member and that is rotated in a second rotational direction by receiving the rotation caused by the other of the forward rotation and the reverse rotation of the motor from the driven member, the second rotational direction being reverse to the first rotational direction;

an arm pivotably supported by the sun gear;

a planetary gear rotatably supported by the arm in a state in which the planetary gear is engaged with the sun gear, the planetary gear being configured to be revolved around the sun gear; and

a transmission gear engageable with the planetary gear and configured to transmit, to the first roller, rotation of the motor which is transmitted from the planetary gear,

the planetary gear being configured to be revolved, in a direction in which the planetary gear is moved away from the transmission gear, by rotation of the sun gear in the first rotational direction, the planetary gear being configured to be revolved, in a direction in which the planetary gear is to be engaged with the transmission gear, by rotation of the sun gear in the second rotational direction,

the first power transmitting mechanism comprising a transmission delayer that does not transmit the rotation of the motor from the driven member to the first roller until the motor is rotated by a particular amount from a time point at which the motor starts to be rotated in a rotational direction of the one of the forward rotation and the reverse rotation when rotation transmitted from the motor to the driven member is changed from the other of the forward rotation and the reverse rotation to the one of the forward rotation and the reverse rotation.

13. The image recording apparatus according to claim 12, wherein the image recorder is provided upstream of the first roller in the conveying direction.

* * * * *