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(71) Applicant: **Komori Corporation**
Tokyo 270-0213 (JP)

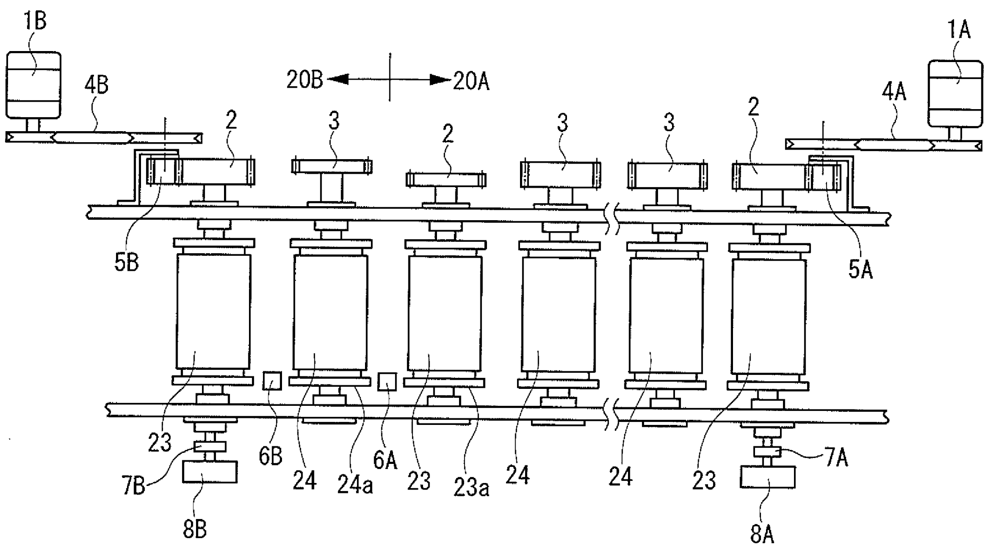
(72) Inventors:
- **Numauchi, Hiromitsu**
  Tsukuba-shi Ibaraki 300-1268 (JP)
- **Umetsu, Isao**
  Tsukuba-shi Ibaraki 300-1268 (JP)

(74) Representative: **UEXKÜLL & STOLBERG**
Patentanwälte
Beselerstraße 4
22607 Hamburg (DE)

(54) Method and device for controlling driving of processing machine

(57) This invention relates to a sheet-fed offset printing press including a gear (3) driven by an upstream drive motor (1A), a gear (2) rotationally driven by the upstream drive motor (1A) through the gear (3), an impression cylinder (23) of an upstream printing unit group (20A), and a transfer cylinder (24) of a downstream printing unit group (20B). The impression cylinder (23) is rotationally driven by the gear (2) and has a holding portion for holding a paper sheet W, The transfer cylinder (24) is rotationally driven by a downstream drive motor (1B) and has a holding portion for receiving the paper sheet W from the holding portion of the impression cylinder (23). The printing press further includes an impression-cylinder-side peripheral speed measuring device (6A) for measuring the peripheral speed of the impression cylinder (23) and a transfer-cylinder-side peripheral speed measuring device (6B) for measuring the peripheral speed of the transfer cylinder (24). The rotational phase difference between the impression and transfer cylinders (23, 24) is obtained from signals from the impression-cylinder-side and transfer-cylinder-side peripheral speed measuring devices (6A, 6B).

Fig.13



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Description

[Technical Field]

[0001] The present invention relates to a method and device for controlling the driving of a processing machine such as a sheet-fed offset printing press.

[Background Art]

[0002] In conventional convertible sheet-fed offset printing presses and latest sheet-fed offset printing presses which include a large number of processing units in order to deal with an increased number of colors for higher-quality printing or add other processing units (for coating, embossing, and the like) for high-value-added production, all the processing units have been driven by one drive motor.

[0003] Accordingly, there has been the following problem: since the load on the drive motor is heavy, a drive motor having a large capacity must be used; as a result, an expensive motor must be used, and a driving system having great rigidity is required, leading to a further increase in size; thus, a motor having an increasingly larger capacity must be used, and faster printing cannot be dealt with.

[Citation List]

[Patent Literature 1]

[0004] Japanese Patent Application Publication No. 2006-305903

[Summary of Invention]

[Technical Problem]

[0005] Accordingly, as described in Patent Literature 1, one possible configuration is as follows: a processing unit group (called a printing unit in Patent Literature 1) located on the upstream side in the paper flow direction and a processing unit group (called a machining unit in Patent Literature 1) located on the downstream side are driven by different drive motors, respectively; and the two drive motors are controlled so that the speeds and phases thereof may be synchronized with each other.

[0006] However, by taking as an example a sheet-fed offset printing press including a large number of processing units, due to non-uniformity in mass caused by the presence of a notched portion of an impression cylinder located at the rearmost position in an upstream printing unit group and non-uniformity in mass caused by the presence of a notched portion of a transfer cylinder located at the foremost position in a downstream printing unit group, non-uniform rotation is caused by a clearance between a gear of the impression cylinder of the upstream printing unit group and a gear of a transfer cylinder located adjacently upstream thereof, and non-uniform rotation is caused by a clearance between a gear of the transfer cylinder of the downstream printing unit group and a gear of an impression cylinder located adjacently downstream thereof.

[0007] Moreover, also in each printing unit, non-uniform rotation is caused by a clearance between gears due to load variations between a plate cylinder and a blanket cylinder (e.g., load variations between the state in which the peripheral surfaces of the plate and blanket cylinders are in contact with each other and subjected to the pressure of the contact therebetween and the state in which the notched portions of the plate and blanket cylinders face each other and are not subjected to contact pressure).

[0008] This may cause the following problem: when paper is passed from the upstream printing unit group to the downstream printing unit group, the paper cannot be passed to a correct position every time, and a printing trouble may occur; if variations in the rotational speeds become larger, there may occur a paper gripping error, a folded paper edge, or the like, and it may take an enormous time to resume the operation of the printing press.

[0009] Accordingly, an object of the present invention is to solve the above-described problems by measuring the respective peripheral speeds of rotating parts by which a workpiece is passed between processing unit groups driven by different driving means, obtaining the rotational phase difference between these rotating parts from the measured peripheral speeds, and thus enabling an instant determination as to whether or not there is a synchronization error.

[Solution to Problem]

[0010] To achieve the above-described object, a method for controlling the driving of a processing machine according to the present invention has the following characteristics:

(1) The processing machine includes first driven means driven by first driving means, second driven means rotationally driven by the first driving means through the first driven means, a first rotating part which is rotationally driven by the second driven means and which has a notched portion containing a first holding portion for holding a workpiece, a second rotating part which is rotationally driven by second driving means and which has a notched portion containing a second holding portion for receiving the workpiece from the first holding portion of the first rotating part, first peripheral speed measuring means for measuring a peripheral speed of the first rotating part, and second peripheral speed measuring means for measuring a peripheral speed of the second rotating part; and a rotational phase difference between the first and second rotating parts is obtained from respective signals from the first and

second peripheral speed measuring means.

[0011] (2) In the above-described characteristic (1), a speed deviation between the first and second rotating parts is obtained from the respective signals from the first and second peripheral speed measuring means, and the rotational phase difference is obtained by integrating the speed deviation.

[0012] (3) In the above-described characteristic (2), a speed variation of the first rotating part is obtained from the signal from the first peripheral speed measuring means, a speed variation of the second rotating part is obtained from the signal from the second peripheral speed measuring means, and the speed deviation is obtained from the difference between the speed variations of the first and second rotating parts.

[0013] (4) In the above-described characteristic (3), an average speed of the first rotating part is obtained from the signal from the first peripheral speed measuring means, the speed variation of the first rotating part is obtained from the difference between a peripheral speed of the first rotating part and the average speed of the first rotating part, the peripheral speed of the first rotating part being obtained from the signal from the first peripheral speed measuring means, an average speed of the second rotating part is obtained from the signal from the second peripheral speed measuring means, and the speed variation of the second rotating part is obtained from the difference between a peripheral speed of the second rotating part and the average speed of the second rotating part, the peripheral speed of the second rotating part being obtained from the signal from the second peripheral speed measuring means.

[0014] (5) In the above-described characteristic (4), the driving of the processing machine is stopped depending on the rotational phase difference.

[0015] To achieve the aforementioned object, a device for controlling the driving of a processing machine according to the present invention has the following characteristics:

(1) The processing machine includes first driven means driven by first driving means, second driven means rotationally driven by the first driving means through the first driven means, a first rotating part which is rotationally driven by the second driven means and which has a notched portion containing a first holding portion for holding a workpiece, and a second rotating part which is rotationally driven by second driving means and which has a notched portion containing a second holding portion for receiving the workpiece from the first holding portion of the first rotating part; and the device includes first peripheral speed measuring means for measuring a peripheral speed of the first rotating part, second peripheral speed measuring means for measuring a peripheral speed of the second rotating part, and controlling means for obtaining a rotational phase difference between the first and second rotating parts from respective signals from the first and second peripheral speed measuring means.

[0016] (7) In the above-described characteristic (6), the controlling means obtains a speed deviation between the first and second rotating parts from the respective signals from the first and second peripheral speed measuring means, and obtains the rotational phase difference by integrating the speed deviation.

[0017] (8) In the above-described characteristic (7), the controlling means obtains a speed variation of the first rotating part from the signal from the first peripheral speed measuring means, obtains a speed variation of the second rotating part from the signal from the second peripheral speed measuring means, and obtains the speed deviation from the difference between the speed variations of the first and second rotating parts.

[0018] (9) In the above-described characteristic (8), the controlling means obtains an average speed of the first rotating part from the signal from the first peripheral speed measuring means, obtains the speed variation of the first rotating part from the difference between a peripheral speed of the first rotating part and the average speed of the first rotating part, the peripheral speed of the first rotating part being obtained from the signal from the first peripheral speed measuring means, obtains an average speed of the second rotating part from the signal from the second peripheral speed measuring means, and obtains the speed variation of the second rotating part from the difference between a peripheral speed of the second rotating part and the average speed of the second rotating part, the peripheral speed of the second rotating part being obtained from the signal from the second peripheral speed measuring means.

[0019] (10) In the above-described characteristic (9), the controlling means stops the driving of the processing machine depending on the rotational phase difference.

[Advantageous Effects of Invention]

[0020] According to the present invention configured as described above, by obtaining the rotational phase difference (position deviation) between the first and second rotating parts separately rotationally driven, an instant and quantitative determination can be made as to whether or not there is a synchronization error. Thus, subsequent handling of the processing machine can immediately be performed, and the frequency of occurrence of printing troubles and the like can be reduced to the minimum. Further, the time from an abnormal stop of the machine to the resumption of the operation thereof can be reduced to improve the operation rate thereof.

[0021] Moreover, the actual peripheral speeds of the first and second rotating parts are measured by peripheral speed measuring means which are provided separately from and outside of a synchronization control system and which measure the actual peripheral speeds of the first and second rotating parts, the actual rotational phase difference (position deviation) between the first and second rotating parts is obtained from the difference between the measured peripheral speeds, and a determination is made based on the rotational phase difference as to whether or not paper or the like is being correctly conveyed. Accordingly, a correct determination can be made as to whether or not there is abnormal conveyance.

[Brief Description of Drawings]

[0022]

[Fig. 1A] Fig. 1A is a partial hardware block diagram of an upstream printing unit group drive control device, showing one example of the present invention.
[Fig. 1B] Fig. 1B is a partial hardware block diagram of the upstream printing unit group drive control device, showing one example of the present invention.
[Fig. 2] Fig. 2 is a hardware block diagram of a downstream printing unit group drive control device.
[Fig. 3A] Fig. 3A is a partial hardware block diagram of a synchronization error determination device.
[Fig. 3B] Fig. 3B is a partial hardware block diagram of the synchronization error determination device.
[Fig. 4A] Fig. 4A is a partial operation flow diagram of the upstream printing unit group drive control device.
[Fig. 4B] Fig. 4B is a partial operation flow diagram of the upstream printing unit group drive control device.
[Fig. 4C] Fig. 4C is a partial operation flow diagram of the upstream printing unit group drive control device.
[Fig. 4D] Fig. 4D is a partial operation flow diagram of the upstream printing unit group drive control device.
[Fig. 5A] Fig. 5A is a partial operation flow diagram of the upstream printing unit group drive control device.
[Fig. 5B] Fig. 5B is a partial operation flow diagram of the upstream printing unit group drive control device.
[Fig. 5C] Fig. 5C is a partial operation flow diagram of the upstream printing unit group drive control device.
[Fig. 6A] Fig. 6A is a partial operation flow diagram of the upstream printing unit group drive control device.
[Fig. 6B] Fig. 6B is a partial operation flow diagram of the upstream printing unit group drive control device.
[Fig. 6C] Fig. 6C is a partial operation flow diagram of the upstream printing unit group drive control device.
[Fig. 7A] Fig. 7A is a partial operation flow diagram of the upstream printing unit group drive control device.
[Fig. 7B] Fig. 7B is a partial operation flow diagram of the upstream printing unit group drive control device.
[Fig. 8A] Fig. 8A is a partial operation flow diagram of the downstream printing unit group drive control device.
[Fig. 8B] Fig. 8B is a partial operation flow diagram of the downstream printing unit group drive control device.
[Fig. 9A] Fig. 9A is a partial operation flow diagram of the downstream printing unit group drive control device.
[Fig. 9B] Fig. 9B is a partial operation flow diagram of the downstream printing unit group drive control device.
[Fig. 10A] Fig. 10A is a partial operation flow diagram of the downstream printing unit group drive control device.
[Fig. 10B] Fig. 10B is a partial operation flow diagram of the downstream printing unit group drive control device.
[Fig. 11A] Fig. 11A is a partial operation flow diagram of the synchronization error determination device.
[Fig. 11B] Fig. 11B is a partial operation flow diagram of the synchronization error determination device.
[Fig. 11C] Fig. 11C is a partial operation flow diagram of the synchronization error determination device.
[Fig. 11D] Fig. 11D is a partial operation flow diagram of the synchronization error determination device.
[Fig, 12] Fig. 12 is a schematic side view showing the configuration of a sheet-fed offset printing press.
[Fig. 13] Fig. 13 is a plan view showing a drive separation portion of the sheet-fed offset printing press.

[Description of Embodiments]

[0023] With reference to the drawings, a method and device for controlling the driving of a processing machine according to the present invention will be described in detail below using examples.

[Example]

[0024] Figs. 1A and 1B constitute a hardware block diagram of an upstream printing unit group drive control device, showing one example of the present invention. Fig. 2 is a hardware block diagram of a downstream printing unit group drive control device. Figs. 3A and 3B constitute a hardware block diagram of a synchronization error determination device.

[0025] Figs. 4A to 4D constitute an operation flow diagram of the upstream printing unit group drive control device. Figs. 5A to 5C constitute an operation flow diagram of the upstream printing unit group drive control device. Figs. 6A to 6C constitute an operation flow diagram of the upstream printing unit group drive control devices. Figs. 7A and 7B constitute an operation flow diagram of the upstream printing unit group drive control device.

[0026] Figs. 8A and 8B constitute an operation flow diagram of the downstream printing unit group drive control device. Figs. 9A and 9B constitute an operation flow diagram of the downstream printing unit group drive control device. Figs. 10A and 10B constitute an operation flow diagram of the downstream printing unit group drive control device.

[0027] Figs. 11A to 11D constitute an operation flow diagram of the synchronization error determination device.

[0028] Fig. 12 is a schematic side view showing the configuration of a sheet-fed offset printing press. Fig. 13 is a plan view showing a drive separation portion of the sheet-fed offset printing press.

[0029] As shown in Fig. 12, the sheet-fed offset printing press (processing machine) includes a feeder 10, a printing section 20, and a delivery unit 30. The printing section 20 includes an upstream printing unit group 20A and a downstream printing unit group 20B. The upstream printing unit group 20A includes offset printing units 20a to 20e for a first color to a fifth color. The downstream printing unit group 20B includes a sixth-color offset printing unit 20f, a coating unit 20g, a drying unit 20h, an embossing unit 20i, and a cooling unit 20j.

[0030] The feeder 10 has a feeder board 12 for feeding the printing section 20 with paper sheets (workpieces) W on a paper feed tray 11 one by one. At the end of the feeder board 12, a swing arm shaft pregripper 13 is provided which passes a paper sheet W to the first-color offset printing unit 20a through a transfer cylinder 24.

[0031] Each of the offset printing units 20a to 20f for the first to sixth colors includes a plate cylinder 21, a blanket cylinder 22, and an impression cylinder 23. Each of the offset printing units 20a to 20f performs printing on a paper sheet W passed through a transfer cylinder 24 and then transfers the paper sheet W to a subsequent unit.

[0032] The coating unit 20g includes an impression cylinder 23 and a bracket cylinder 25. The coating unit 20g performs coating on a paper sheet W passed through a transfer cylinder 24 and then transfers the paper sheet W to the drying unit 20h. The drying unit 20h includes a transport cylinder 26 and UV lamps 27. The drying unit 20h dries ink and a coating agent on the paper sheet W passed through a transfer cylinder 24, and then transfers the paper sheet W to the embossing unit 20i. The embossing unit 20i includes male and female embossing rolls 28a and 28b. The embossing unit 20i embosses the paper sheet W passed through a transfer cylinder 24 and then passes the paper sheet W to the cooling unit 20j. The cooling unit 20j includes a transport cylinder 26. The cooling unit 20j cools the paper sheet W passed through a transfer cylinder 24 with cooling water circulating through the transport cylinder 26, and then transfers the paper sheet W to the delivery unit 30.

[0033] In the delivery unit 30, the paper sheet W passed from the transport cylinder 26 of the cooling unit 20j is transported on a delivery chain 32 looped over a delivery cylinder 31 to be delivered onto an output tray 33.

[0034] It should be noted that each of the impression cylinders 23, the transfer cylinders 24, and the transport cylinders 26 has a notched portion, to the inside of which a holding portion including grippers or the like for holding a paper sheet W is attached, so that the paper sheet W being transported may be passed between the cylinders.

[0035] In this example, as shown in Fig. 13, the upstream printing unit group 20A and the downstream printing unit group 20B are separately driven: the upstream printing unit group 20A is driven by an upstream drive motor (first driving means; electric motor) 1A through a wound transmission device such as a belt 4A, and the downstream printing unit group 20B is driven by a downstream drive motor (second driving means; electric motor) 1B through a wound transmission device such as a belt 4B.

[0036] Specifically, a gear (second driven means) 2 of the rearmost impression cylinder (first rotating part) 23 of the upstream printing unit group 20A does not engage with a gear 3 of the foremost transfer cylinder (second rotating part) 24 of the downstream printing unit group 20B. The gear 2 of this impression cylinder 23 engages with a gear (first driven means) 3 of the rearmost transfer cylinder 24 of the upstream printing unit group 20A to constitute part of a gear train of the upstream printing unit group 20A, thus conveying the driving force of the upstream drive motor 1A. On the other hand, the gear 3 of the foremost transfer cylinder 24 of the downstream printing unit group 20B engages with a gear 2 of the foremost impression cylinder 23 of the downstream printing unit group 20B to constitute part of a gear train of the downstream printing unit group 20B, thus conveying the driving force of the downstream drive motor 1B. It should be noted that in Fig. 13, each of 5A and 5B denotes a drive pinion.

[0037] The cylinder shaft of the foremost impression cylinder 23 of the upstream printing unit group 20A has an upstream drive motor rotary encoder 8A attached to the end thereof opposite the gear 2 with a coupling 7A interposed therebetween. The cylinder shaft of the foremost impression cylinder 23 of the downstream printing unit group 20B has a downstream drive motor rotary encoder 8B attached to the end thereof opposite the gear 2 with a coupling 7B interposed therebetween.

[0038] At a position opposite the peripheral surface of a bearer 23a of the rearmost impression cylinder 23 of the upstream printing unit group 20A, an impression-cylinder-side peripheral speed measuring device (first peripheral speed measuring means) 6A such as a Doppler sensor which detects a moving object based on a frequency shift due to the Doppler effect is provided to measure the peripheral speed of this impression cylinder 23. Further, at a position opposite the peripheral surface of a bearer 24a of the foremost transfer cylinder 24 of the downstream printing unit group 20B, a transfer-cylinder-side peripheral speed measuring device (second peripheral speed measuring means) 6B such as a Doppler sensor which detects a moving object based on a frequency shift due to the Doppler effect is provided to measure the peripheral speed of this transfer cylinder 24.

[0039] It should be noted that the peripheral surfaces of the bearers 23a and 24a which are opposite the impression-cylinder-side peripheral speed measuring device 6A and the transfer-cylinder-side peripheral speed measuring device 6B are complete circumferential surfaces having the same radius so that the impression-cylinder-side peripheral speed measuring device 6A and the transfer-cylinder-side peripheral speed measuring device 6B can precisely measure the peripheral speeds of the rearmost impression cylinder 23 of the upstream printing unit group 20A and the foremost transfer cylinder 24 of the downstream printing unit group 20B, respectively.

[0040] The driving of the upstream drive motor 1A is controlled by the undermentioned upstream printing unit group drive control device (controlling means) 40, and the driving of the downstream drive motor 1B is controlled by the undermentioned downstream printing unit group drive control device (controlling means) 60.

[0041] Further, the upstream and downstream drive motors 1A and 1B are controlled by the upstream printing unit group drive control device 40 so that the speeds and phases thereof may be synchronized with each other. The undermentioned synchronization error determination device (controlling means) 80 determines whether or not there is an error in this synchronization control. That is, the synchronization error determination device 80 is configured to obtain the rotational phase difference between the rearmost impression cylinder 23 of the upstream printing unit group 20A and the foremost transfer cylinder 24 of the downstream printing unit group 20B based on respective signals from the impression-cylinder-side peripheral speed measuring device 6A and the transfer-cylinder-side peripheral speed measuring device 6B and to determine from this rotational phase difference (position deviation) whether or not there is a synchronization error.

[0042] As shown in Figs, 1A and 1B, the upstream printing unit group drive control device 40 is configured by connecting between not only a CPU 41, ROM 42, and RAM 43, but also input/output devices 44a to 44f, an interface 46, and an internal clock counter 45 with a BUS (bus).

[0043] There are further components connected to the BUS: memory M1 for storing a slower operation rotational speed, memory M2 for storing the currently set rotational speed, memory M3 for storing a previously set rotational speed, memory M4 for storing the time interval at which the currently set rotational speed and an assumed current rotational phase of the downstream printing unit group are sent to the downstream printing unit group drive control device, memory M5 for storing the count value of a counter for detecting the current rotational phase of the upstream printing unit group, memory M6 for storing the current rotational phase of the upstream printing unit group, memory M7 for storing a correction value for the rotational phase of the downstream printing unit group, and memory M8 for storing an assumed current rotational phase of the downstream printing unit group.

[0044] There are still further components connected to the BUS: memory M9 for storing a commanded rotational speed, memory M10 for storing an adjustment value for a rotational speed during acceleration, memory M11 for storing an adjusted currently set rotational speed, memory M12 for storing an adjustment value for a rotational speed during deceleration, memory M13 for storing the output of an F/V converter, and memory M14 for storing the current rotational speeds of the upstream and downstream printing unit groups.

[0045] Connected to the input/output device 44a are a synchronized operation start switch 47, a synchronized operation stop switch 48, input devices 49 such as a keyboard and various switches and buttons, display devices 50 such as a CRT and a lamp, and output devices 51 such as a printer and a floppy disk (trademark) drive.

[0046] To the input/output device 44b, a rotational speed setter 52 is connected.

[0047] To the input/output device 44c, the upstream drive motor 1A is connected through a D/A converter 53 and an upstream drive motor driver 54.

[0048] To the input/output device 44d, the upstream drive motor rotary encoder 8A connected to and driven by the upstream drive motor 1A is connected through a counter 55 for detecting the current rotational phase of the upstream printing unit group. The upstream drive motor rotary encoder 8A is connected also to the above-described upstream drive motor driver 54.

[0049] To the input/output device 44e, the aforementioned upstream drive motor rotary encoder 8A is connected through an A/D converter 56 and an F/V converter 57.

[0050] To the input/output device 44f, the downstream drive motor rotary encoder 8B is connected through an A/D converter 58 and an F/V converter 59.

[0051] Moreover, connected to the interface 46 are a printing press control device 90, the downstream printing unit group drive control device 60, and the synchronization error determination device 80.

[0052] As shown in Fig. 2, the downstream printing unit group drive control device 60 is configured by connecting between not only a CPU 61, ROM 62, and RAM 63, but also input/output devices 64a to 64c and an interface 65 with a BUS (bus).

[0053] There are further components connected to this BUS: memory M15 for storing the currently set rotational speed, memory M16 for storing an assumed current rotational phase of the downstream printing unit group, memory M17 for storing the count value of a counter for detecting the current rotational phase of the downstream printing unit group, memory M18 for storing the current rotational phase of the downstream printing unit group, and memory M19 for storing the current rotational phase difference of the downstream printing unit group.

[0054] There are still further components connected to the above-described BUS: memory M20 for storing the absolute value of the current rotational phase difference of the downstream printing unit group, memory M21 for storing a tolerance for the current rotational phase difference of the downstream printing unit group, memory M22 for storing a commanded rotational speed, memory M23 for storing a conversion table between current rotational phase differences of the downstream printing unit group and correction values for set rotational speeds, and memory M24 for storing a correction value for a set rotational speed.

[0055] Connected to the input/output device 64a are input devices 66 such as a keyboard and various switches and buttons, display devices 67 such as a CRT and a lamp, and output devices 68 such as a printer and a floppy disk (trademark) drive.

[0056] To the input/output device 64b, the downstream drive motor 1B is connected through a D/A converter 69 and a downstream drive motor driver 70.

[0057] To the input/output device 64c, the downstream drive motor rotary encoder 8B connected to and driven by the downstream drive motor 1B is connected through a counter 71 for detecting the current rotational phase of the downstream printing unit group. The downstream drive motor rotary encoder 8B is connected also to the above-described downstream drive motor driver 70.

[0058] To the interface 65, the upstream printing unit group drive control device 40 is connected.

[0059] As shown in Figs. 3A and 3B, the synchronization error determination device 80 is configured by connecting between not only a CPU 81, ROM 82, and RAM 83, but also input/output devices 84a and 84b and an interface 85 with a BUS (bus).

[0060] There are further components connected to this BUS: memory M25 for storing a count value N, memory M26 for storing a peripheral speed measurement time interval, memory M27 for storing the output of the impression-cylinder-side peripheral speed measuring device, memory M28 for storing the output of the transfer-cylinder-side peripheral speed measuring device, memory M29 for storing the impression cylinder's current peripheral speed, memory M30 for storing an impression cylinder's average peripheral speed, memory M31 for storing the transfer cylinder's current peripheral speed, and memory M32 for storing a transfer cylinder's average peripheral speed. It should be noted that the peripheral speed measurement time interval stored on the memory M26 is set to a time interval shorter than the time intervals at which clock pulses are generated by the upstream and downstream drive motor rotary encoders 8A and 8B during the normal printing of the sheet-fed offset printing press.

[0061] There are still further components connected to the above-described BUS: memory M33 for storing an impression cylinder's speed variation, memory M34 for storing a transfer cylinder's speed variation, memory M35 for storing a speed deviation, memory M36 for storing a position deviation, memory M37 for storing the absolute value of the position deviation, memory M38 for storing a tolerance for the position deviation, memory M39 for storing the total of impression cylinder's peripheral speeds obtained previously, memory M40 for storing the current total of impression cylinder's peripheral speeds, memory M41 for storing a count value N+1, memory M42 for storing the total of transfer cylinder's peripheral speeds obtained previously, and memory M43 for storing the current total of transfer cylinder's peripheral speeds.

[0062] To the input/output device 84a, the impression-cylinder-side peripheral speed measuring device 6A is connected through an A/D converter 86.

[0063] To the input/output device 84b, the transfer-cylinder-side peripheral speed measuring device 6B is connected through an A/D converter 87.

[0064] To the interface 85, the upstream printing unit group drive control device 40 is connected.

[0065] The above-described configuration allows the upstream printing unit group drive control device 40 to operate according to the operation flow shown in Figs. 4A to 4D, 5A to 5C, 6A to 6C, and 7A and 7B.

[0066] Specifically, a determination is made in step P1 as to whether or not the synchronized operation start switch 47 is turned on. If the result of the determination is positive, the upstream printing unit group drive control device 40 goes to step P4 described later. On the other hand, if the result of the determination is negative, a determination is made in step P2 as to whether or not a set rotational speed has been inputted to the rotational speed setter 52.

[0067] Next, if the result of the determination in step P2 is positive, the set rotational speed is read from the rotational speed setter 52 and stored on the memory M2 for the currently set rotational speed in step P3, and then the upstream printing unit group drive control device 40 returns to step P1. On the other hand, the result of the determination in step P2 is negative, the upstream printing unit group drive control device 40 returns directly to step P1.

[0068] Next, in the aforementioned step P4, a synchronized operation start command is sent to the downstream printing unit group drive control device 60. Then, in step P5, a home positioning start command is sent to the downstream printing unit group drive control device 60.

[0069] Next, in step P6, the slower operation rotational speed is read from the memory M1. Then, in step P7, the slower operation rotational speed is written to the memory M2 for storing the currently set rotational speed and the memory M3 for storing a previously set rotational speed.

[0070] Next, in step P8, the internal clock counter (for counting elapsed time) 45 is started counting. Then, in step P9, the time interval at which the currently set rotational speed and an assumed current rotational phase of the downstream printing unit group are sent to the downstream printing unit group drive control device is read from the memory M4.

[0071] Next, in step P10, the count value of the internal clock counter 45 is read. Then, in step P11, a determination is made as to whether or not the count value of the internal clock counter is not less than the time interval at which the currently set rotational speed and an assumed current rotational phase of the downstream printing unit group are sent to the downstream printing unit group drive control device.

[0072] Next, if the result of the determination in the above-described step P11 is positive, a count value is read from the counter 55 for detecting the current rotational phase of the upstream printing unit group and stored on the memory M5 in step P12. Then, in step P13, the current rotational phase of the upstream printing unit group is calculated from the count value of the counter 55 for detecting the current rotational phase of the upstream printing unit group, and stored on the memory M6.

[0073] Next, in step P14, a correction value for the rotational phase of the downstream printing unit group is read from the memory M7. Then, in step P15, by adding the correction value for the rotational phase of the downstream printing unit group to the current rotational phase of the upstream printing unit group, an assumed current rotational phase of the downstream printing unit group is calculated to be stored on the memory M8.

[0074] Next, in step P16, the currently set rotational speed (slower operation rotational speed) is read from the memory M2. Then, in step P17, the currently set rotational speed (slower operation rotational speed) and the assumed current rotational phase of the downstream printing unit group are sent to the downstream printing unit group drive control device 60.

[0075] Next, in step P18, the memory M9 for storing a commanded rotational speed is overwritten with the currently set rotational speed (slower operation rotational speed). Then, in step P19, the commanded rotational speed is outputted to the upstream drive motor driver 54. Subsequently, in step P20, the currently set rotational speed (slower operation rotational speed) is stored on the memory M3 for storing a previously set rotational speed. Then, the upstream printing unit group drive control device 40 returns to step P8.

[0076] On the other hand, if the result of the determination in step P11 is negative, a determination is made in step P21 as to whether or not a home positioning completion signal has been sent from the downstream printing unit group drive control unit 60. If the result of this determination is positive, the upstream printing unit group drive control device 40 goes to step P22 described later. On the other hand, if the result of the determination is negative, the upstream printing unit group drive control device 40 returns to step P9.

[0077] Next, in the above-described step P22, the time interval at which the currently set rotational speed and an assumed current rotational phase of the downstream printing unit group are sent to the downstream printing unit group drive control device is read from the memory M4. Then, in step P23, the count value of the internal clock counter 45 is read.

[0078] Next, in step P24, a determination is made as to whether or not the count value of the internal clock counter 45 is not less than the time interval at which the currently set rotational speed and an assumed current rotational phase of the downstream printing unit group are sent to the downstream printing unit group drive control device. If the result of the determination is positive, a count value is read from the counter 55 for detecting the current rotational phase of the upstream printing unit group and stored on the memory M5 in step P25. On the other hand, if the result of the determination is negative, the upstream printing unit group drive control device 40 returns to step P22.

[0079] Next, in step P26, the current rotational phase of the upstream printing unit group is calculated from the count value of the counter 55 for detecting the current rotational phase of the upstream printing unit group, and stored on the memory M6. Then, in step P27, the correction value for the rotational phase of the downstream printing unit group is read from the memory M7.

[0080] Next, in step P28, by adding the correction value for the rotational phase of the downstream printing unit group to the current rotational phase of the upstream printing unit group, an assumed current rotational phase of the downstream printing unit group is calculated to be stored on the memory M8. Then, in step P29, the currently set rotational speed (slower operation rotational speed) is read from the memory M2.

[0081] Next, in step P30, the currently set rotational speed (slower operation rotational speed) and the assumed current rotational phase of the downstream printing unit group are sent to the downstream printing unit group drive control device 60. Then, in step P31, the memory M9 for storing a commanded rotational speed is overwritten with the currently set rotational speed (slower operation rotational speed).

[0082] Next, in step P32, the commanded rotational speed is outputted to the upstream drive motor driver 54. Then, in step P33, the currently set rotational speed (slower operation rotational speed) is stored on the memory M3 for storing a previously set rotational speed.

[0083] Next, in step P34, a print start command is sent to the printing press control device 90. Then, in step P35, a measurement start command is sent to the synchronization error determination device 80.

[0084] Next, in step P36, the internal clock counter (for counting elapsed time) 45 is started counting. Then, in step P37, the time interval at which the currently set rotational speed and an assumed current rotational phase of the downstream printing unit group are sent to the downstream printing unit group drive control device is read from the memory M4.

[0085] Next, in step P38, the count value of the internal clock counter 45 is read. Then, in step P39, a determination is made as to whether or not the count value of the internal clock counter is not less than the time interval at which the currently set rotational speed and an assumed current rotational phase of the downstream printing unit group are sent to the downstream printing unit group drive control device.

[0086] Next, if the result of the determination in the above-described step P40 is positive, the upstream printing unit group drive control device 40 goes to step P41 described later. On the other hand, if the result of the determination is negative, a determination is made in step P40 as to whether or not an error signal has been sent from the synchronization error determination device 80. If the result of this determination is positive, the upstream printing unit group drive control device 40 goes to step P79. On the other hand, if the result of the determination is negative, the upstream printing unit group drive control device 40 returns to step P37.

[0087] Next, in the above-described step P41, the previously set rotational speed is read from the memory M3. Then, in step P42, an adjustment value for a rotational speed during acceleration is read from the memory M10.

[0088] Next, in step P43, by adding the adj ustment value for a rotational speed during acceleration to the previously set rotational speed, an adjusted currently set rotational speed is calculated to be stored on the memory M11. Then, in step P44, the set rotational speed is read from the rotational speed setter 52 and stored on the memory M2 for storing the currently set rotational speed.

[0089] Next, in step P45, a determination is made as to whether or not the adjusted currently set rotational speed is less than the currently set rotational speed. If the result of the determination is positive, a count value is read from the counter 55 for detecting the current rotational phase of the upstream printing unit group and stored on the memory M5 in step P46. On the other hand, if the result of the determination is negative, the upstream printing unit group drive control device 40 goes to step P55 described later.

[0090] Next, in step P47, the current rotational phase of the upstream printing unit group is calculated from the count value of the counter 55 for detecting the current rotational phase of the upstream printing unit group, and stored on the memory M6. Then, in step P48, the correction value for the rotational phase of the downstream printing unit group is read from the memory M7.

[0091] Next, in step P49, by adding the correction value for the rotational phase of the downstream printing unit group to the current rotational phase of the upstream printing unit group, an assumed current rotational phase of the downstream printing unit group is calculated to be stored on the memory M8. Then, in step P50, the adjusted currently set rotational speed is stored on the memory M2 for storing the currently set rotational speed.

[0092] Next, in step P51, the currently set rotational speed and the assumed current rotational phase of the downstream printing unit group are sent to the downstream printing unit group drive control device 60. Then, in step P52, the memory M9 for storing a commanded rotational speed is overwritten with the currently set rotational speed.

[0093] Next, in step P53, the commanded rotational speed is outputted to the upstream drive motor driver 54. Then, in step P54, the currently set rotational speed is stored on the memory M3 for storing a previously set rotational speed. Subsequently, the upstream printing unit group drive control device 40 returns to step P36.

[0094] Next, in the aforementioned step P55, a count value is read from the counter 55 for detecting the current rotational phase of the upstream printing unit group and stored on the memory M5. Then, in step P56, the current rotational phase of the upstream printing unit group is calculated from the count value of the counter 55 for detecting the current rotational phase of the upstream printing unit group, and stored on the memory M6.

[0095] Next, in step P57, the correction value for the rotational phase of the downstream printing unit group is read from the memory M7. Then, in step P58, by adding the correction value for the rotational phase of the downstream printing unit group to the current rotational phase of the upstream printing unit group, an assumed current rotational phase of the downstream printing unit group is calculated to be stored on the memory M8.

[0096] Next, in step P59, the set rotational speed is read from the rotational speed setter 52 and stored on the memory M2 for storing the currently set rotational speed. Then, in step P60, the currently set rotational speed and the assumed current rotational phase of the downstream printing unit group are sent to the downstream printing unit group drive control device 60.

[0097] Next, in step P61, the memory M9 for storing a commanded rotational speed is overwritten with the currently set rotational speed. Then, in step P62, the commanded rotational speed is outputted to the upstream drive motor driver 54. Subsequently, in step P63, the currently set rotational speed is stored on the memory M3 for storing a previously set rotational speed.

[0098] Next, in step P64, the internal clock counter (for counting elapsed time) is started counting. Then, in step P65, the time interval at which the currently set rotational speed and an assumed current rotational phase of the downstream printing unit group are sent to the downstream printing unit group drive control device is read from the memory M4.

[0099] Next, in step P66, the count value of the internal clock counter 45 is read. Then, in step P67, a determination is made as to whether or not the count value of the internal clock counter is not less than the time interval at which the currently set rotational speed and an assumed current rotational phase of the downstream printing unit group are sent to the downstream printing unit group drive control device.

[0100] Next, if the result of the determination in the above-described step P67 is positive, the upstream printing unit group drive control device 40 goes to step P68 described later. On the other hand, if the result of the determination is negative, a determination is made in step P77 as to whether or not an error signal has been sent from the synchronization error determination device 80.

[0101] Next, if the result of the determination in the above-described step P77 is positive, the upstream printing unit group drive control device 40 goes to step P79 described later. On the other hand, if the result of the determination is negative, a determination is made in step P78 as to whether or not the synchronized operation stop switch 48 is turned on. If the result of this determination is positive, the upstream printing unit group drive control device 40 goes to step P79 described later. On the other hand, if the result of the determination is negative, the upstream printing unit group drive control device 40 returns to step P65.

[0102] Next, in step P68, a count value is read from the counter 55 for detecting the current rotational phase of the upstream printing unit group and stored on the memory M5. Then, in step P69, the current rotational phase of the upstream printing unit group is calculated from the count value of the counter 55 for detecting the current rotational phase of the upstream printing unit group, and stored on the memory M6.

[0103] Next, in step P70, the correction value for the rotational phase of the downstream printing unit group is read from the memory M7. Then, in step P71, by adding the correction value for the rotational phase of the downstream printing unit group to the current rotational phase of the upstream printing unit group, an assumed current rotational phase of the downstream printing unit group is calculated to be stored on the memory M8.

[0104] Next, in step P72, the set rotational speed is read from the rotational speed setter 52 and stored on the memory M2 for storing the currently set rotational speed. Then, in step P73, the currently set rotational speed and the assumed current rotational phase of the downstream printing unit group are sent to the downstream printing unit group drive control device 60. Subsequently, in step P74, the memory M9 for storing a commanded rotational speed is overwritten with the currently set rotational speed.

[0105] Next, in step P75, the commanded rotational speed is outputted to the upstream drive motor driver 54. Then, in step P76, the currently set rotational speed is stored on the memory M3 for storing a previously set rotational speed. Then, the upstream printing unit group drive control device 40 returns to step P64.

[0106] On the other hand, in the aforementioned step P79, a count value is read from the counter 55 for detecting the current rotational phase of the upstream printing unit group, and stored on the memory M5. Then, in step P80, the current rotational phase of the upstream printing unit group is calculated from the count value of the counter 55 for detecting the current rotational phase of the upstream printing unit group, and stored on the memory M6.

[0107] Next, in step P81, the correction value for the rotational phase of the downstream printing unit group is read from the memory M7. Then, in step P82, by adding the correction value for the rotational phase of the downstream printing unit group to the current rotational phase of the upstream printing unit group, an assumed current rotational phase of the downstream printing unit group is calculated to be stored on the memory M8.

[0108] Next, in step P83, the set rotational speed is read from the rotational speed setter 52 and stored on the memory M2 for storing the currently set rotational speed. Then, in step P84, the currently set rotational speed and the assumed current rotational phase of the downstream printing unit group are sent to the downstream printing unit group drive control device 60.

[0109] Next, in step P85, the memory M9 for storing a commanded rotational speed is overwritten with the currently set rotational speed. Then, in step P86, the commanded rotational speed is outputted to the upstream drive motor driver 54. Subsequently, in step P87, the currently set rotational speed is stored on the memory M3 for storing a previously set rotational speed.

[0110] Next, in step P88, a print stop command is sent to the printing press control device 90. Then, in step P89, a measurement stop command is sent to the synchronization error determination device 80.

[0111] Next, in step P90, the internal clock counter (for counting elapsed time) 45 is started counting. Then, in step P91, the time interval at which the currently set rotational speed and an assumed current rotational phase of the downstream printing unit group are sent to the downstream printing unit group drive control device is read from the memory M4.

[0112] Next, in step P92, a count value is read from the internal clock counter 45. Then, in step P93, a determination is made as to whether or not the count value of the internal clock counter is not less than the time interval at which the currently set rotational speed and an assumed current rotational phase of the downstream printing unit group are sent to the downstream printing unit group drive control device.

[0113] Next, if the result of the determination in the above-described step P93 is positive, a count value is read from the counter 55 for detecting the current rotational phase of the upstream printing unit group and stored on the memory M5 in step P94. Then, in step P95, the current rotational phase of the upstream printing unit group is calculated from the count value of the counter 55 for detecting the current rotational phase of the upstream printing unit group, and stored on the memory M6.

[0114] Next, in step P96, the correction value for the rotational phase of the downstream printing unit group is read from the memory M7. Then, in step P97, by adding the correction value for the rotational phase of the downstream printing unit group to the current rotational phase of the upstream printing unit group, an assumed current rotational phase of the downstream printing unit group is calculated to be stored on the memory M8.

[0115] Next, in step P98, the previously set rotational speed is read from the memory M3. Then, in step P99, an adjustment value for a rotational speed during deceleration is read from the memory M12. Subsequently, in step P100, by subtracting the adjustment value for a rotational speed during deceleration from the previously set rotational speed, an adjusted currently set rotational speed is calculated to be stored on the memory M11.

[0116] Next, in step P101, a determination is made as to whether or not the adjusted currently set rotational speed is less than zero, If the result of the determination is positive, the adjusted currently set rotational speed is replaced by zero in step P102, and then the upstream printing unit group drive control device 40 goes to step P103 described later. On the other hand, if the result of the determination is negative, the upstream printing unit group drive control device 40 goes directly to step P103. Next, in step P103, the adjusted currently set rotational speed is stored on the memory M2 for storing the currently set rotational speed.

[0117] Next, in step P104, the currently set rotational speed and the assumed current rotational phase of the downstream printing unit group are sent to the downstream printing unit group drive control device 60. Then, in step P105, the memory M9 for storing a commanded rotational speed is overwritten with the currently set rotational speed.

[0118] Next, in step P106, the commanded rotational speed is outputted to the upstream drive motor driver 54. Then, in step P107, the currently set rotational speed is stored on the memory M3 for storing a previously set rotational speed. Subsequently, the upstream printing unit group drive control device 40 returns to step P90.

[0119] On the other hand, if the result of the determination in the aforementioned step P93 is negative, the outputs of the F/V converters 57 and 59 connected to the drive motor rotary encoders 8A and 8B of the upstream and downstream printing unit groups 20A and 20B are read through the A/D converters 56 and 58 and stored on the memory M13 in step P108. Then, in step P109, the current rotational speeds of the upstream and downstream printing unit groups are calculated from the outputs of the F/V converters 57 and 59 connected to the drive motor rotary encoders 8A and 8B of the upstream and downstream printing unit groups 20A and 20B, and stored on the memory M14.

[0120] Next, in step P110, a determination is made as to whether or not the current rotational speeds of the upstream and downstream printing unit groups are zero. If the result of the determination is positive, a synchronized operation stop command is sent to the downstream printing unit group drive control device 60 in step P111, and then the upstream printing unit group drive control device 40 returns to step P1. On the other hand, if the result of the determination is negative, the upstream printing unit group drive control device 40 returns to step P91. This operation is then repeated.

[0121] According to the above-described operation flow, the upstream printing unit group drive control device 40 sends a synchronized operation start command and a synchronized operation stop command to the downstream printing unit group drive control device 60, sends a measurement start command and a measurement stop command to the synchronization error determination device 80, and sends a print start command and a print stop command to the printing press control device 90.

[0122] The downstream printing unit group drive control device 60 operates according to the operation flow shown in Figs. 8A and 8B, 9A and 9B, and 10A and 10B.

[0123] Specifically, in step P1, a synchronized operation start command is sent from the upstream printing unit group drive control device 40. In step P2, a home positioning start command is sent from the upstream printing unit group drive control device 40. Subsequently, if the currently set rotational speed (slower operation rotational speed) and an assumed current rotational phase of the downstream printing unit group are sent from the upstream printing unit group drive control device 40 in step P3, the currently set rotational speed (slower operation rotational speed) and the assumed current rotational phase of the downstream printing unit group are received from the upstream printing unit group drive control device 40, and stored on the memory M15 and M16, respectively, in step P4.

[0124] Next, in step P5, a count value is read from the counter 71 for detecting the current rotational phase of the downstream printing unit group, and stored on the memory M17. Then, in step P6, the current rotational phase of the downstream printing unit group is calculated from the count value of the counter 71 for detecting the current rotational phase of the downstream printing unit group, and stored on the memory M18.

[0125] Next, in step P7, by subtracting the current rotational phase of the downstream printing unit group from the assumed current rotational phase of the downstream printing unit group, the current rotational phase difference of the downstream printing unit group is calculated to be stored on the memory M19. Then, in step P8, the absolute value of the current rotational phase difference of the downstream printing unit group is calculated from the current rotational phase difference of the downstream printing unit group, and stored on the memory M20.

[0126] Next, in step P9, a tolerance for the current rotational phase difference of the downstream printing unit group is read from the memory M21. Then, in step P10, a determination is made as to whether or not the absolute value of the current rotational phase difference of the downstream printing unit group is not more than the tolerance for the current rotational phase difference of the downstream printing unit group.

[0127] Next, if the result of the determination in step P10 is positive, the downstream printing unit group drive control device 60 goes to step P17 described later. On the other hand, if the result of the determination is negative, a conversion table between current rotational phase differences of the downstream printing unit group and correction values for set rotational speeds is read from the memory M23 in step P11.

[0128] Next, in step P12, the current rotational phase difference of the downstream printing unit group is read from the memory M19. Then, in step P13, using the conversion table between current rotational phase differences of the downstream printing unit group and correction values for set rotational speeds, a correction value for the set rotational speed is obtained from the current rotational phase difference of the downstream printing unit group to be stored on the memory M24.

[0129] Next, in step P14, the currently set rotational speed (slower operation rotational speed) is read from the memory M15. Then, in step P15, by adding the correction value for the set rotational speed to the currently set rotational speed (slower operation rotational speed), a commanded rotational speed is calculated to be stored on the memory M22. Subsequently, in step P16, the commanded rotational speed is outputted to the downstream drive motor driver 70. After that, the downstream printing unit group drive control device 60 returns to step P3.

[0130] Next, in the aforementioned step P17, the currently set rotational speed (slower operation rotational speed) is read from the memory M15. Then, in step P18, the memory M22 for storing a commanded rotational speed is overwritten with the currently set rotational speed (slower operation rotational speed).

[0131] Next, in step P19, the commanded rotational speed is outputted to the downstream drive motor driver 70. Then, in step P20, a home positioning completion signal is sent to the upstream printing unit group drive control device 40.

[0132] Next, if the currently set rotational speed (slower operation rotational speed) and an assumed current rotational phase of the downstream printing unit group are sent from the upstream printing unit group drive control device 40 in step P21, the currently set rotational speed (slower operation rotational speed) and the assumed current rotational phase of the downstream printing unit group are received from the upstream printing unit group drive control device 40, and stored on the memory M15 and M16, respectively, in step P22.

[0133] Next, in step P23, a count value is read from the counter 71 for detecting the current rotational phase of the downstream printing unit group, and stored on the memory M17. Then, in step P24, the current rotational phase of the downstream printing unit group is calculated from the count value of the counter 71 for detecting the current rotational phase of the downstream printing unit group, and stored on the memory M18.

[0134] Next, in step P25, by subtracting the current rotational phase of the downstream printing unit group from the assumed current rotational phase of the downstream printing unit group, the current rotational phase difference of the downstream printing unit group is calculated to be stored on the memory M19. Then, in step P26, the absolute value of the current rotational phase difference of the downstream printing unit group is calculated from the current rotational phase difference of the downstream printing unit group, and stored on the memory M20.

[0135] Next, in step P27, the tolerance for the current rotational phase difference of the downstream printing unit group is read from the memory M21. Then, in step P28, a determination is made as to whether or not the absolute value of the current rotational phase difference of the downstream printing unit group is not more than the tolerance for the current rotational phase difference of the downstream printing unit group.

[0136] Next, if the result of the determination in the above-described step P28 is positive, the currently set rotational speed (slower operation rotational speed) is read from the memory M15 in step P29. Then, in step P30, the memory M22 for storing a commanded rotational speed is overwritten with the currently set rotational speed (slower operation rotational speed). Subsequently, in step P31, the commanded rotational speed is outputted to the downstream drive motor driver 70. After that, the downstream printing unit group drive control device 60 goes to step P38 described later.

[0137] On the other hand, if the result of the determination in the above-described step P28 is negative, the conversion table between current rotational phase differences of the downstream printing unit group and correction values for set rotational speeds is read from the memory M23 in step P32. Then, in step P33, the current rotational phase difference of the downstream printing unit group is read from the memory M19.

[0138] Next, in step P34, using the conversion table between current rotational phase differences of the downstream printing unit group and correction values for set rotational speeds, a correction value for the set rotational speed is obtained from the current rotational phase difference of the downstream printing unit group to be stored on the memory M24. Then, in step P35, the currently set rotational speed (slower operation rotational speed) is read from the memory M15.

[0139] Next, in step P36, by adding the correction value for the set rotational speed to the currently set rotational speed (slower operation rotational speed), a commanded rotational speed is calculated to be stored on the memory M22. Then, in step P37, the commanded rotational speed is outputted to the downstream drive motor driver 70.

[0140] Next, in the aforementioned step P38, a determination is made as to whether or not the currently set rotational speed and an assumed current rotational phase of the downstream printing unit group have been sent from the upstream printing unit group drive control device 40. If the result of the determination is positive, the downstream printing unit group drive control device 60 goes to step P40 described later. On the other hand, if the result of the determination is negative, a determination is made in step P39 as to whether or not a synchronized operation stop command has been sent from the upstream printing unit group drive control device 40. If the result of this determination is positive, the downstream printing unit group drive control device 60 returns to step P1. On the other hand, if the result of the determination is negative, the downstream printing unit group drive control device 60 returns to step P38.

[0141] Next, in the above-described step P40, the currently set rotational speed and an assumed current rotational phase of the downstream printing unit group are received from the upstream printing unit group drive control device 40, and stored on the memory M15 and M16, respectively. Then, in step P41, a count value is read from the counter 71 for detecting the current rotational phase of the downstream printing unit group, and stored on the memory M17.

[0142] Next, in step P42, the current rotational phase of the downstream printing unit group is calculated from the count value of the counter 71 for detecting the current rotational phase of the downstream printing unit group, and stored on the memory M18. Then, in step P43, by subtracting the current rotational phase of the downstream printing unit group from the assumed current rotational phase of the downstream printing unit group, the current rotational phase difference of the downstream printing unit group is calculated to be stored on the memory M19.

[0143] Next, in step P44, the absolute value of the current rotational phase difference of the downstream printing unit group is calculated from the current rotational phase difference of the downstream printing unit group, and stored on the memory M20. Then, in step P45, the tolerance for the current rotational phase difference of the downstream printing unit group is read from the memory M21.

[0144] Next, in step P46, a determination is made as to whether or not the absolute value of the current rotational phase difference of the downstream printing unit group is not more than the tolerance for the current rotational phase difference of the downstream printing unit group. If the result of the determination is positive, the currently set rotational speed is read from the memory M15 in step P47. On the other hand, if the result of the determination is negative, the downstream printing unit group drive control device 60 goes to step P50.

[0145] Next, in step P48, the memory M22 for storing a commanded rotational speed is overwritten with the currently set rotational speed. Then, in step P49, the commanded rotational speed is outputted to the downstream drive motor driver 70. After that, the downstream printing unit group drive control device 60 returns to step P38.

[0146] Next, in the aforementioned step P50, the conversion table between current rotational phase differences of the downstream printing unit group and correction values for set rotational speeds is read from the memory M23. Then, in step P51, the current rotational phase difference of the downstream printing unit group is read from the memory M19.

[0147] Next, in step P52, using the conversion table between current rotational phase differences of the downstream printing unit group and correction values for set rotational speeds, a correction value for the set rotational speed is obtained from the current rotational phase difference of the downstream printing unit group to be stored on the memory M24. Then, in step P53, the currently set rotational speed is read from the memory M15.

[0148] Next, in step P54, by adding the correction value for the set rotational speed to the currently set rotational speed, a commanded rotational speed is calculated to be stored on the memory M22. Then, in step P55, the commanded rotational speed is outputted to the downstream drive motor driver 70. After that, the downstream printing unit group drive control device 60 returns to step P38. This operation is then repeated.

[0149] According to the above-described operation flow, in response to a synchronized operation start command and a synchronized operation stop command from the upstream printing unit group drive control device 40, the downstream printing unit group drive control device 60 controls the downstream drive motor 1B so that the downstream drive motor 1B may be synchronized with the upstream drive motor 1A.

[0150] The synchronization error determination device 80 operates according to the operation flow shown in Figs. 11A to 11D.

[0151] Specifically, in step P1, zero is stored on the memory M25 for storing a count value N. Then, if a measurement start command is sent from the upstream printing unit group drive control device 40 in step P2, the internal clock counter (for counting elapsed time) 88 is started counting in step P3.

[0152] Next, in step P4, the peripheral speed measurement time interval is read from the memory M26. Then, in step P5, the count value of the internal clock counter 88 is read.

[0153] Next, in step P6, a determination is made as to whether or not the count value of the internal clock counter is equal to the peripheral speed measurement time interval. If the result of the determination is positive, an output is read from the impression-cylinder-side peripheral speed measuring device 6A and stored on the memory M27 in step P7. On the other hand, if the result of the determination is negative, the synchronization error determination device 80 returns to step P4.

[0154] Next, in step P8, an output is read from the transfer-cylinder-side peripheral speed measuring device 6B, and stored on the memory M28. Then, in step p9, the output of the impression-cylinder-side peripheral speed measuring device 6A is read from the memory M27.

[0155] Next, in step P10, the current peripheral speed of the impression cylinder 23 (i.e., the rearmost impression cylinder of the upstream printing unit group 20A, hereinafter used in the same meaning) is calculated from the output of the impression-cylinder-side peripheral speed measuring device 6A, and stored on the memory M29. Then, in step P11, the current peripheral speed of the impression cylinder 23 is stored on the memory M30 for an impression cylinder's average peripheral speed.

[0156] Next, in step P12, the output of the transfer-cylinder-side peripheral speed measuring device 6B is read from the memory M28. Then, in step P13, the current peripheral speed of the transfer cylinder 24 (i.e., the foremost transfer cylinder of the downstream printing unit group 20B, hereinafter used in the same meaning) is calculated from the output of the transfer-cylinder-side peripheral speed measuring device 6B, and stored on the memory M31.

[0157] Next, in step P14, the current peripheral speed of the transfer cylinder 24 is stored on the memory M32 for storing a transfer cylinder's average peripheral speed. Then, in step P15, a count value N is read from the memory M25.

[0158] Next, in step P16, one is added to the count value N, and the memory M25 is overwritten with the resultant count value N. Then, in step P17, the internal clock counter (for counting elapsed time) 88 is started counting.

[0159] Next, in step P18, the peripheral speed measurement time interval is read from the memory M26. Then, in step P19, the count value of the internal clock counter 88 is read.

[0160] Next, in step P20, a determination is made as to whether or not the count value of the internal clock counter is equal to the peripheral speed measurement time interval. If the result of the determination is positive, the synchronization error determination device 80 goes to step P22 described later. On the other hand, if the result of the determination is negative, a determination is made in step P21 as to whether or not a measurement stop command has been sent from the upstream printing unit group drive control device 40. If the result of this determination is positive, the synchronization error determination device 80 returns to step P1. On the other hand, if the result of this determination is negative, the synchronization error determination device 80 returns to step P18.

[0161] Next, in the above-described step P22, an output is read from the impression-cylinder-side peripheral speed measuring device 6A, and stored on the memory M27. Then, in step P23, an output is read from the transfer-cylinder-side peripheral speed measuring device 6B, and stored on the memory M28.

[0162] Next, in step P24, the output of the impression-cylinder-side peripheral speed measuring device 6A is read from the memory M27. Then, in step P25, the current peripheral speed of the impression cylinder 23 is calculated from the output of the impression-cylinder-side peripheral speed measuring device 6A, and stored on the memory M29.

[0163] Next, in step P26, the average peripheral speed of the impression cylinder 23 is read from the memory M30. Then, in step P27, by subtracting the average peripheral speed of the impression cylinder 23 from the current peripheral speed of the impression cylinder 23, the speed variation of the impression cylinder 23 is calculated to be stored on the memory M33.

[0164] Next, in step P28, the output of the transfer-cylinder-side peripheral speed measuring device 6B is read from the memory M28. Then, in step P29, the current peripheral speed of the transfer cylinder 24 is calculated from the output of the transfer-cylinder-side peripheral speed measuring device 6B, and stored on the memory M31.

[0165] Next, in step P30, the average peripheral speed of the transfer cylinder 24 is read from the memory M32. Then, in step P31, by subtracting the average peripheral speed of the transfer cylinder 24 from the current peripheral speed of the transfer cylinder 24, the speed variation of the transfer cylinder 24 is calculated to be stored on the memory M34.

[0166] Next, in step P32, by subtracting the speed variation of the transfer cylinder 24 from the speed variation of the impression cylinder 23, a speed deviation is calculated to be stored on the memory M35. Then, in step P33, the peripheral speed measurement time interval is read from the memory M26.

[0167] Next, in step P34, by multiplying the speed deviation by the peripheral speed measurement time interval, a position deviation is calculated to be stored on the memory M36. Then, in step P35, the absolute value of the position deviation is calculated from the position deviation, and stored on the memory M37.

[0168] Next, in step P36, a tolerance for the position deviation is read from the memory M38. Then, in step P37, a determination is made as to whether or not the absolute value of the position deviation is not more than the tolerance for the position deviation.

[0169] Next, if the result of the determination in the above-described step P37 is positive, the synchronization error determination device 80 goes to step P39 described later. On the other hand, if the result of the determination is negative, an error signal is sent to the upstream printing unit group drive control device 40 in step P38. After that, the synchronization error determination device 80 returns to step P1.

[0170] Next, in the above-described step P39, the average peripheral speed of the impression cylinder 23 is read from the memory M30. Then, in step P40, the count value N is read from the memory M25.

[0171] Next, in step P41, by multiplying the average peripheral speed of the impression cylinder 23 by the count value, the total of previously obtained peripheral speeds of the impression cylinder 23 is calculated to be stored on the memory M39. Then, in step P42, the current peripheral speed of the impression cylinder 23 is read from the memory M29.

[0172] Next, in step P43, by adding the current peripheral speed of the impression cylinder 23 to the total of previously obtained peripheral speeds of the impression cylinder 23, the current total of peripheral speeds of the impression cylinder 23 is calculated to be stored on the memory M40. Then, in step P44, the count value N is read from the memory M25.

[0173] Next, in step P45, by adding one to the count value N, a count value N+1 is calculated to be stored on the memory M41. Then, in step P4 6, the average peripheral speed of the impression cylinder 23 is calculated by dividing the current total of peripheral speeds of the impression cylinder 23 by the count value N+1, and the memory M30 is overwritten with the average peripheral speed of the impression cylinder 23.

[0174] Next, in step P47, the average peripheral speed of the transfer cylinder 24 is read from the memory M32. Then, in step P48, the count value N is read from the memory M25.

[0175] Next, in step P49, by multiplying the average peripheral speed of the transfer cylinder 24 by the count value, the total of previously obtained peripheral speeds of the transfer cylinder 24 is calculated to be stored on the memory 42. Then, in step P50, the current peripheral speed of the transfer cylinder 24 is read from the memory M31.

[0176] Next, in step P51, by adding the current peripheral speed of the transfer cylinder 24 to the total of the previously obtained peripheral speeds of the transfer cylinder 24, the current total of peripheral speeds of the transfer cylinder 24 is calculated to be stored on the memory M43. Then, in step P52, the count value N+1 is read from the memory M41.

[0177] Next, in step P53, the average peripheral speed of the transfer cylinder 24 is calculated by dividing the current total of peripheral speeds of the transfer cylinder 24 by the count value N+1, and the memory M32 is overwritten with the average peripheral speed of the transfer cylinder 24. Then, in step P54, the count value N is read from the memory M25. Subsequently, in step P55, one is added to the count value N, and the memory M25 is overwritten with the resultant count value N. After that, the synchronization error determination device 80 returns to step P17. This operation is then repeated.

[0178] According to the above-described operation flow, in response to a measurement start command and a measurement stop command from the upstream printing unit group drive control device 40, the synchronization error determination device 80 obtains the rotational phase difference (position deviation) between the rearmost impression cylinder 23 of the upstream printing unit group 20A and the foremost transfer cylinder 24 of the downstream printing unit group 20B from signals sent from the impression-cylinder-side peripheral speed measuring device 6A and the transfer-cylinder-side peripheral speed measuring device 6B. When the synchronization error determination device 80 determines, based on this rotational phase difference, that there is a synchronization error, the synchronization error determination device 80 sends an error signal to the upstream printing unit group drive control device 40. As a result, the upstream printing unit group drive control device 40 sends a print stop command to the printing press control device 90 to stop the driving of the printing press.

[0179] As described above, in this example, by obtaining the rotational phase difference (position deviation) between the rearmost impression cylinder 23 of the upstream printing unit group 20A rotationally driven by the upstream drive motor 1A and the foremost transfer cylinder 24 of the downstream printing unit group 20B rotationally driven by the downstream drive motor 1B, an instant and quantitative determination can be made as to whether or not there is a synchronization error between the impression cylinder 23 and the transfer cylinder 24. Thus, subsequent handling (the stopping of the printing press, cylinder disengagement, or the like) of the printing press can immediately be performed, and the frequency of occurrence of printing troubles can be reduced to the minimum. Further, the time from an abnormal stop of the printing press to the resumption of the operation thereof can be reduced to improve the operation rate thereof.

[0180] Moreover, the impression-cylinder-side peripheral speed measuring device 6A and the transfer-cylinder-side peripheral speed measuring device 6B for measuring the peripheral speeds of the impression cylinder 23 and the transfer cylinder 24 are provided to face the peripheral surfaces of the bearers 23a and 24a of the impression cylinder 23 and the transfer cylinder 24, and measure the peripheral speeds at the peripheral surfaces of the bearers 23a and 24a. Accordingly, unlike the measurement of the peripheral speeds at gapped peripheral surfaces of the impression cylinder 23 and the transfer cylinder 24, the peripheral speeds can precisely be measured.

[0181] It should of course be noted that the present invention is not limited to the above-described example, and that various modifications can be made thereto without departing from the spirit of the present invention. For example, though in the shown example the sheet-fed offset printing press including the coating unit 20g and the embossing unit 20i is taken as an example of a processing machine, the present invention can also be applied to a sheet-fed offset printing press including other processing unit and a convertible sheet-fed printing press.

[Reference Signs List]

[0182]

1A	UPSTREAM DRIVE MOTOR
1B	DOWNSTREAM DRIVE MOTOR
2	GEAR OF IMPRESSION CYLINDER
3	GEAR OF TRANSFER CYLINDER
6A	IMPRESSION-CYLINDER-SIDE PERIPHERAL SPEED MEASURING DEVICE
6B	TRANSFER-CYLINDER-SIDE PERIPHERAL SPEED MEASURING DEVICE
8A	UPSTREAM DRIVE MOTOR ROTARY ENCOD-

ER

8B DOWNSTREAM DRIVE MOTOR ROTARY ENCODER

10 FEEDER

20 PRINTING UNIT

20A UPSTREAM PRINTING UNIT GROUP

20B DOWNSTREAM PRINTING UNIT GROUP

23 IMPRESSION CYLINDER

24 TRANSFER CYLINDER

30 DELIVERY UNIT

40 UPSTREAM PRINTING UNIT GROUP DRIVE CONTROL DEVICE

60 DOWNSTREAM PRINTING UNIT GROUP DRIVE CONTROL DEVICE

80 SYNCHRONIZATION ERROR DETERMINATION DEVICE

90 PRINTING PRESS CONTROL DEVICE

Claims

1. A method for controlling the driving of a processing machine, the processing machine including:

first driven means (3) driven by first driving means (1A);
second driven means (2) rotationally driven by the first driving means (1A) through the first driven means (3);
a first rotating part (23) being rotationally driven by the second driven means (2) and having a notched portion provided with a first holding portion for holding a workpiece; and
a second rotating part (24) being rotationally driven by second driving means (1B) and having a notched portion provided with a second holding portion for receiving the workpiece from the first holding portion of the first rotating part (23),

the method **characterized in that**
the processing machine further comprises:

first peripheral speed measuring means (6A) for measuring a peripheral speed of the first rotating part (23); and
second peripheral speed measuring means (6B) for measuring a peripheral speed of the second rotating part (24), and
a rotational phase difference between the first and second rotating parts (23, 24) is obtained from respective signals from the first and second peripheral speed measuring means (6A, 6B).

2. The method according to claim 1, **characterized in that**
a speed deviation between the first and second rotating parts (23, 24) is obtained from the respective signals from the first and second peripheral speed measuring means (6A, 6B), and
the rotational phase difference is obtained by integrating the speed deviation.

3. The method according to claim 2, **characterized in that**
a speed variation of the first rotating part (23) is obtained from the signal from the first peripheral speed measuring means (6A),
a speed variation of the second rotating part (24) is obtained from the signal from the second peripheral speed measuring means (6B), and
the speed deviation is obtained from the difference between the speed variations of the first and second rotating parts (23, 24).

4. The method according to claim 3, **characterized in that**
an average speed of the first rotating part (23) is obtained from the signal from the first peripheral speed measuring means (6A),
the speed variation of the first rotating part (23) is obtained from the difference between a peripheral speed of the first rotating part (23) and the average speed of the first rotating part (23), the peripheral speed of the first rotating part (23) being obtained from the signal from the first peripheral speed measuring means (6A),
an average speed of the second rotating part (24) is obtained from the signal from the second peripheral speed measuring means (6B), and
the speed variation of the second rotating part (24) is obtained from the difference between a peripheral speed of the second rotating part (24) and the average speed of the second rotating part (24), the peripheral speed of the second rotating part (24) being obtained from the signal from the second peripheral speed measuring means (6B).

5. The method according to claim 1, **characterized in that** the driving of the processing machine is stopped depending on the rotational phase difference.

6. A device for controlling the driving of a processing machine,
the processing machine including:

first driven means (3) driven by first driving means (1A);
second driven means (2) rotationally driven by the first driving means (1A) through the first driven means (3);
a first rotating part (23) being rotationally driven by the second driven means (2) and having a notched portion containing a first holding portion for holding a workpiece; and
a second rotating part (24) being rotationally driven by second driving means (1B) and having a notched portion containing a second holding portion for receiving the workpiece from the first holding portion of the first rotating part (23),

the device being **characterized by** comprising:

first peripheral speed measuring means (6A) for measuring a peripheral speed of the first rotating part (23);
second peripheral speed measuring means (6B) for measuring a peripheral speed of the second rotating part (24); and
controlling means (40, 60, 80) for obtaining a rotational phase difference between the first and second rotating parts (23, 24) from respective signals from the first and second peripheral speed measuring means (6A, 6B).

7. The device according to claim 6, **characterized in that**
the controlling means (40, 60, 80)
obtains a speed deviation between the first and second rotating parts (23, 24) from the respective signals from the first and second peripheral speed measuring means (6A, 6B), and
obtains the rotational phase difference by integrating the speed deviation.

8. The device according to claim 7, **characterized in that**
the controlling means (40, 60, 80)
obtains a speed variation of the first rotating part (23) from the signal from the first peripheral speed measuring means (6A),
obtains a speed variation of the second rotating part (24) from the signal from the second peripheral speed measuring means (6B), and
obtains the speed deviation from the difference between the speed variations of the first and second rotating parts (23, 24).

9. The device according to claim 8, **characterized in that**
the controlling means (40, 60, 80)
obtains an average speed of the first rotating part (23) from the signal from the first peripheral speed measuring means (6A),
obtains the speed variation of the first rotating part (23) from the difference between a peripheral speed of the first rotating part (23) and the average speed of the first rotating part (23), the peripheral speed of the first rotating part (23) being obtained from the signal from the first peripheral speed measuring means (6A),
obtains an average speed of the second rotating part (24) from the signal from the second peripheral speed measuring means (6B), and
obtains the speed variation of the second rotating part (24) from the difference between a peripheral speed of the second rotating part (24) and the average speed of the second rotating part (24), the peripheral speed of the second rotating part (24) being obtained from the signal from the second peripheral speed measuring means (6B).

10. The device according to claim 6, **characterized in that** the controlling means (40, 60, 80) stops the driving of the processing machine depending on the rotational phase difference.

Fig.1A

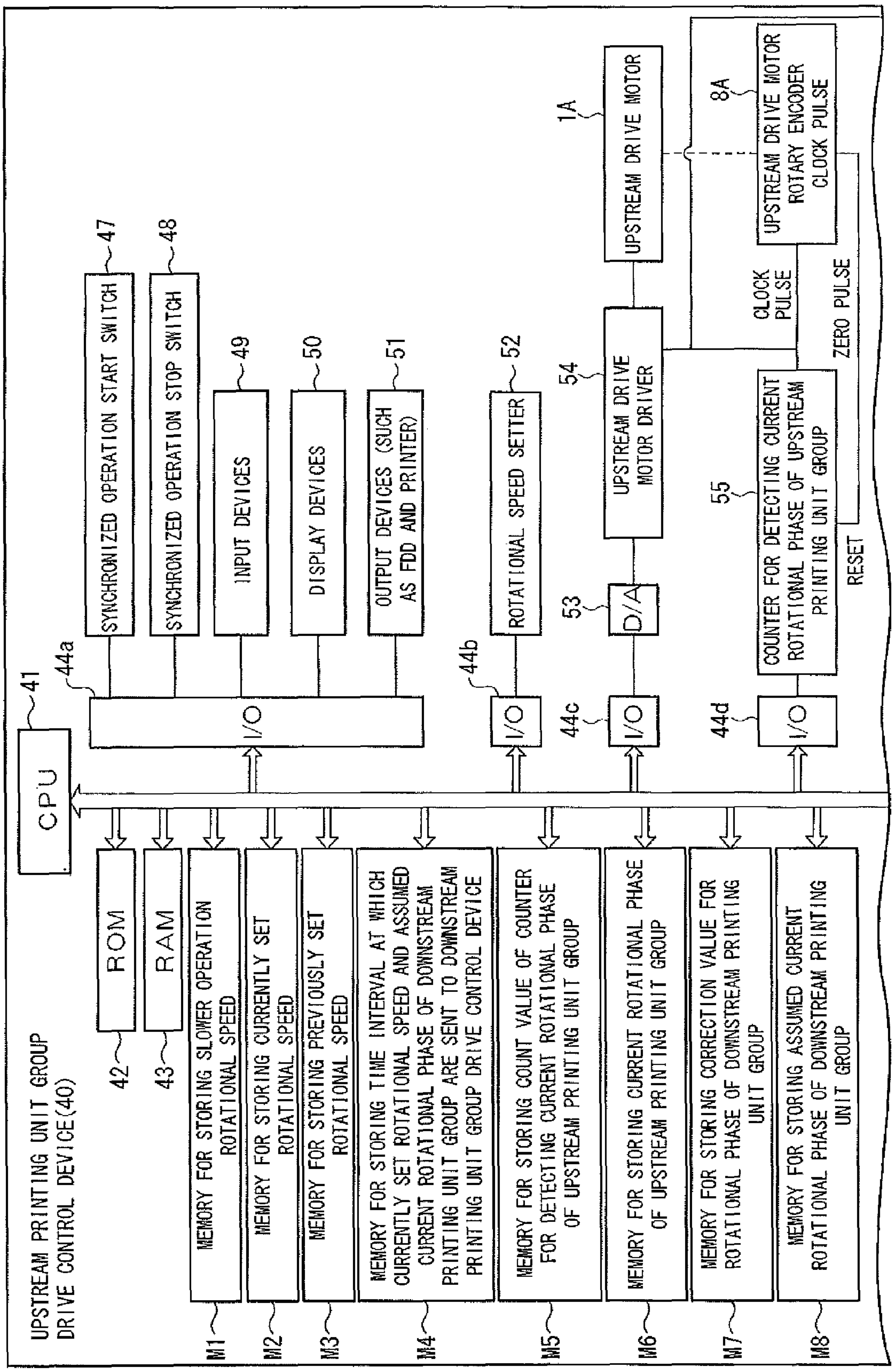

UPSTREAM PRINTING UNIT GROUP DRIVE CONTROL DEVICE(40)
CPU
41
42
ROM
43
RAM
I/O
44a
44b
44c
44d
SYNCHRONIZED OPERATION START SWITCH
47
SYNCHRONIZED OPERATION STOP SWITCH
48
INPUT DEVICES
49
DISPLAY DEVICES
50
OUTPUT DEVICES (SUCH AS FDD AND PRINTER)
51
ROTATIONAL SPEED SETTER
52
D/A
53
UPSTREAM DRIVE MOTOR DRIVER
54
UPSTREAM DRIVE MOTOR
1A
UPSTREAM DRIVE MOTOR ROTARY ENCODER CLOCK PULSE
8A
CLOCK PULSE
ZERO PULSE
RESET
COUNTER FOR DETECTING CURRENT ROTATIONAL PHASE OF UPSTREAM PRINTING UNIT GROUP
55
M1
MEMORY FOR STORING SLOWER OPERATION ROTATIONAL SPEED
M2
MEMORY FOR STORING CURRENTLY SET ROTATIONAL SPEED
M3
MEMORY FOR STORING PREVIOUSLY SET ROTATIONAL SPEED
M4
MEMORY FOR STORING TIME INTERVAL AT WHICH CURRENTLY SET ROTATIONAL SPEED AND ASSUMED CURRENT ROTATIONAL PHASE OF DOWNSTREAM PRINTING UNIT GROUP ARE SENT TO DOWNSTREAM PRINTING UNIT GROUP DRIVE CONTROL DEVICE
M5
MEMORY FOR STORING COUNT VALUE OF COUNTER FOR DETECTING CURRENT ROTATIONAL PHASE OF UPSTREAM PRINTING UNIT GROUP
M6
MEMORY FOR STORING CURRENT ROTATIONAL PHASE OF UPSTREAM PRINTING UNIT GROUP
M7
MEMORY FOR STORING CORRECTION VALUE FOR ROTATIONAL PHASE OF DOWNSTREAM PRINTING UNIT GROUP
M8
MEMORY FOR STORING ASSUMED CURRENT ROTATIONAL PHASE OF DOWNSTREAM PRINTING UNIT GROUP

Fig.1B

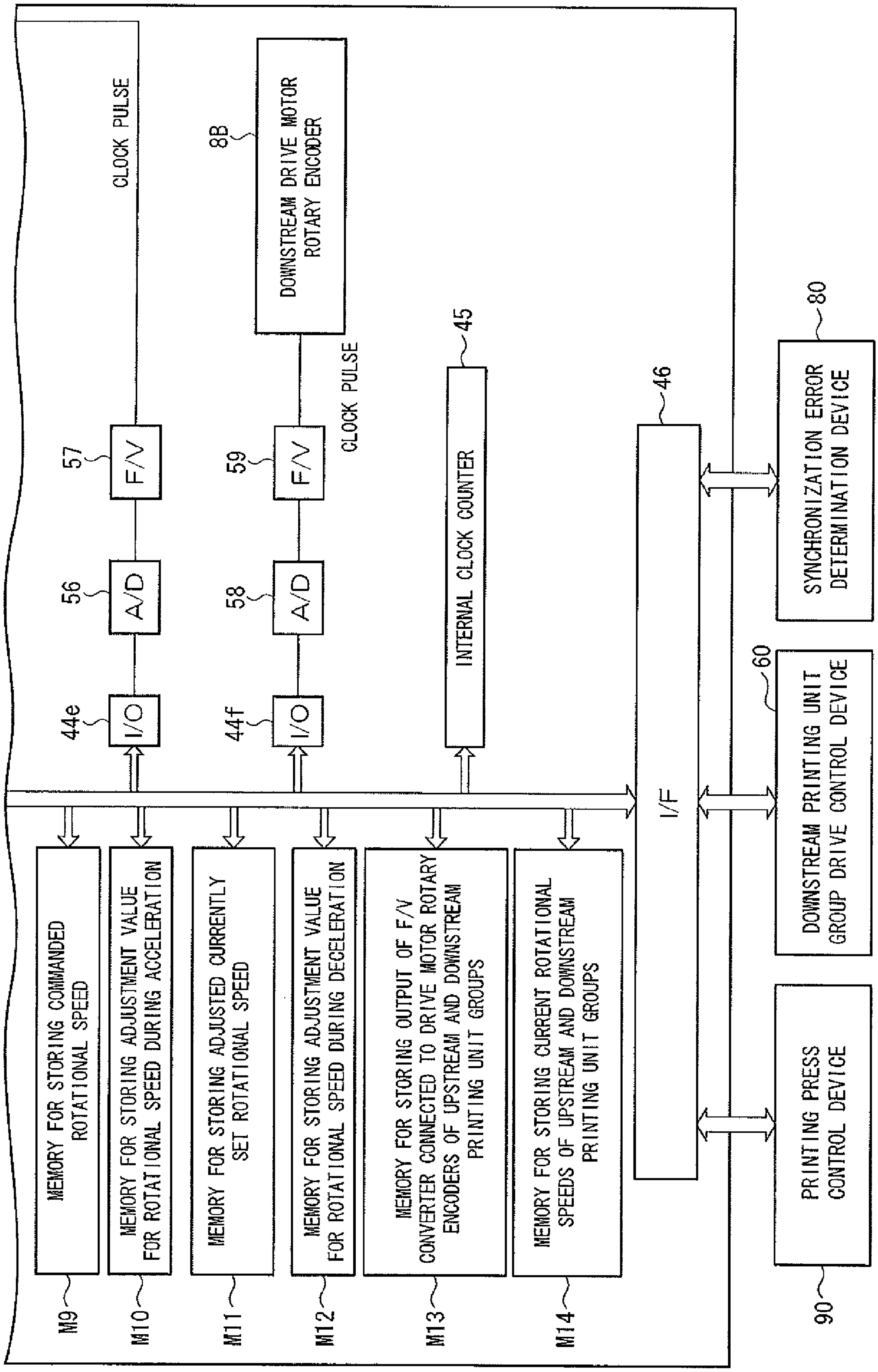

CLOCK PULSE
8B
DOWNSTREAM DRIVE MOTOR ROTARY ENCODER
CLOCK PULSE
57
F/V
59
F/V
56
A/D
58
A/D
44e
I/O
44f
I/O
45
INTERNAL CLOCK COUNTER
46
I/F
80
SYNCHRONIZATION ERROR DETERMINATION DEVICE
60
DOWNSTREAM PRINTING UNIT GROUP DRIVE CONTROL DEVICE
90
PRINTING PRESS CONTROL DEVICE
M9
MEMORY FOR STORING COMMANDED ROTATIONAL SPEED
M10
MEMORY FOR STORING ADJUSTMENT VALUE FOR ROTATIONAL SPEED DURING ACCELERATION
M11
MEMORY FOR STORING ADJUSTED CURRENTLY SET ROTATIONAL SPEED
M12
MEMORY FOR STORING ADJUSTMENT VALUE FOR ROTATIONAL SPEED DURING DECELERATION
M13
MEMORY FOR STORING OUTPUT OF F/V CONVERTER CONNECTED TO DRIVE MOTOR ROTARY ENCODERS OF UPSTREAM AND DOWNSTREAM PRINTING UNIT GROUPS
M14
MEMORY FOR STORING CURRENT ROTATIONAL SPEEDS OF UPSTREAM AND DOWNSTREAM PRINTING UNIT GROUPS

Fig.2

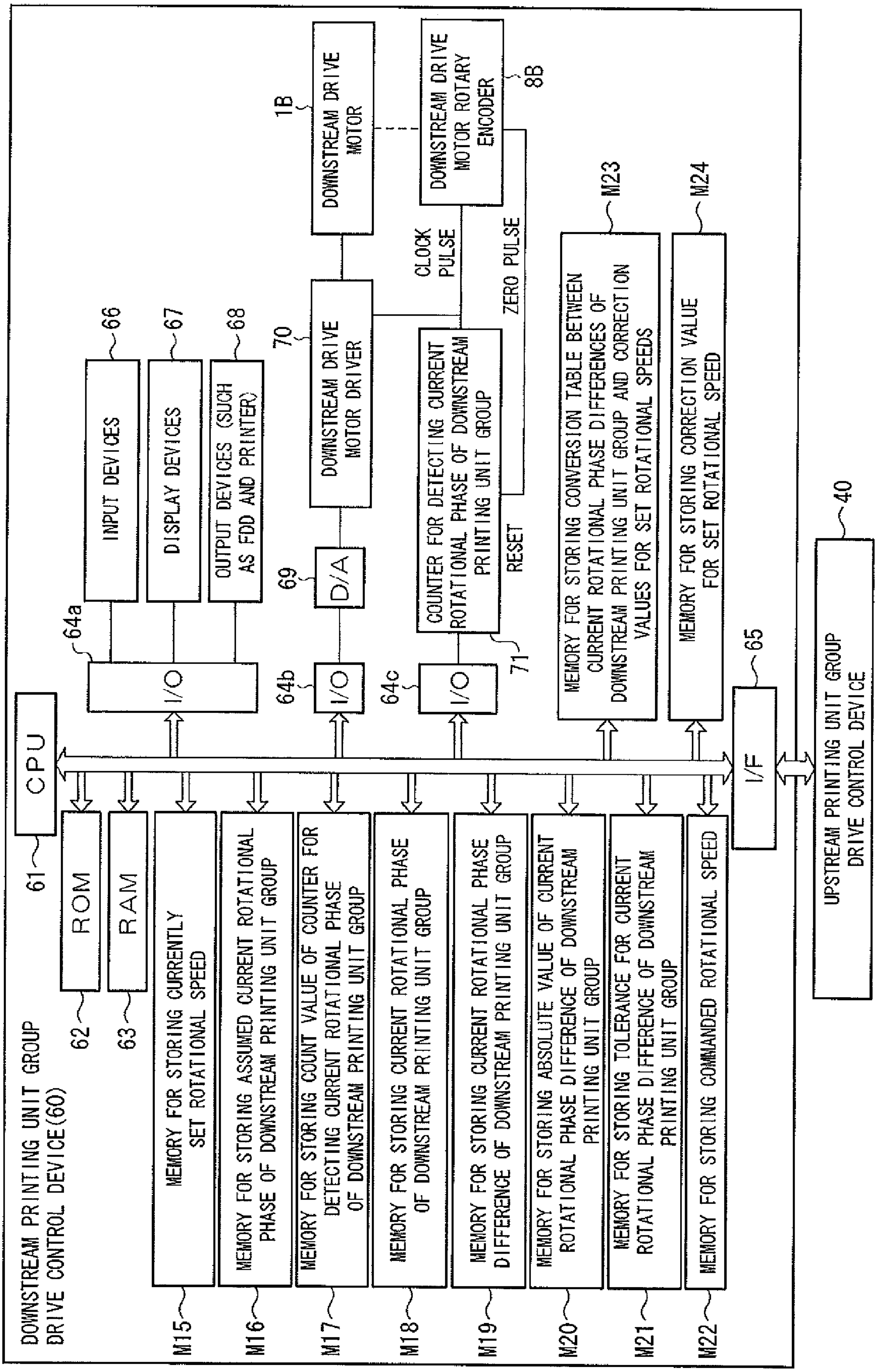

DOWNSTREAM PRINTING UNIT GROUP DRIVE CONTROL DEVICE(60)
CPU
61
ROM
62
RAM
63
I/O
64a
INPUT DEVICES
66
DISPLAY DEVICES
67
OUTPUT DEVICES (SUCH AS FDD AND PRINTER)
68
I/O
64b
D/A
69
DOWNSTREAM DRIVE MOTOR DRIVER
70
DOWNSTREAM DRIVE MOTOR
1B
DOWNSTREAM DRIVE MOTOR ROTARY ENCODER
8B
CLOCK PULSE
ZERO PULSE
I/O
64c
COUNTER FOR DETECTING CURRENT ROTATIONAL PHASE OF DOWNSTREAM PRINTING UNIT GROUP
RESET
71
MEMORY FOR STORING CONVERSION TABLE BETWEEN CURRENT ROTATIONAL PHASE DIFFERENCES OF DOWNSTREAM PRINTING UNIT GROUP AND CORRECTION VALUES FOR SET ROTATIONAL SPEEDS
M23
MEMORY FOR STORING CORRECTION VALUE FOR SET ROTATIONAL SPEED
M24
I/F
65
UPSTREAM PRINTING UNIT GROUP DRIVE CONTROL DEVICE
40
MEMORY FOR STORING CURRENTLY SET ROTATIONAL SPEED
M15
MEMORY FOR STORING ASSUMED CURRENT ROTATIONAL PHASE OF DOWNSTREAM PRINTING UNIT GROUP
M16
MEMORY FOR STORING COUNT VALUE OF COUNTER FOR DETECTING CURRENT ROTATIONAL PHASE OF DOWNSTREAM PRINTING UNIT GROUP
M17
MEMORY FOR STORING CURRENT ROTATIONAL PHASE OF DOWNSTREAM PRINTING UNIT GROUP
M18
MEMORY FOR STORING CURRENT ROTATIONAL PHASE DIFFERENCE OF DOWNSTREAM PRINTING UNIT GROUP
M19
MEMORY FOR STORING ABSOLUTE VALUE OF CURRENT ROTATIONAL PHASE DIFFERENCE OF DOWNSTREAM PRINTING UNIT GROUP
M20
MEMORY FOR STORING TOLERANCE FOR CURRENT ROTATIONAL PHASE DIFFERENCE OF DOWNSTREAM PRINTING UNIT GROUP
M21
MEMORY FOR STORING COMMANDED ROTATIONAL SPEED
M22

Fig.3A

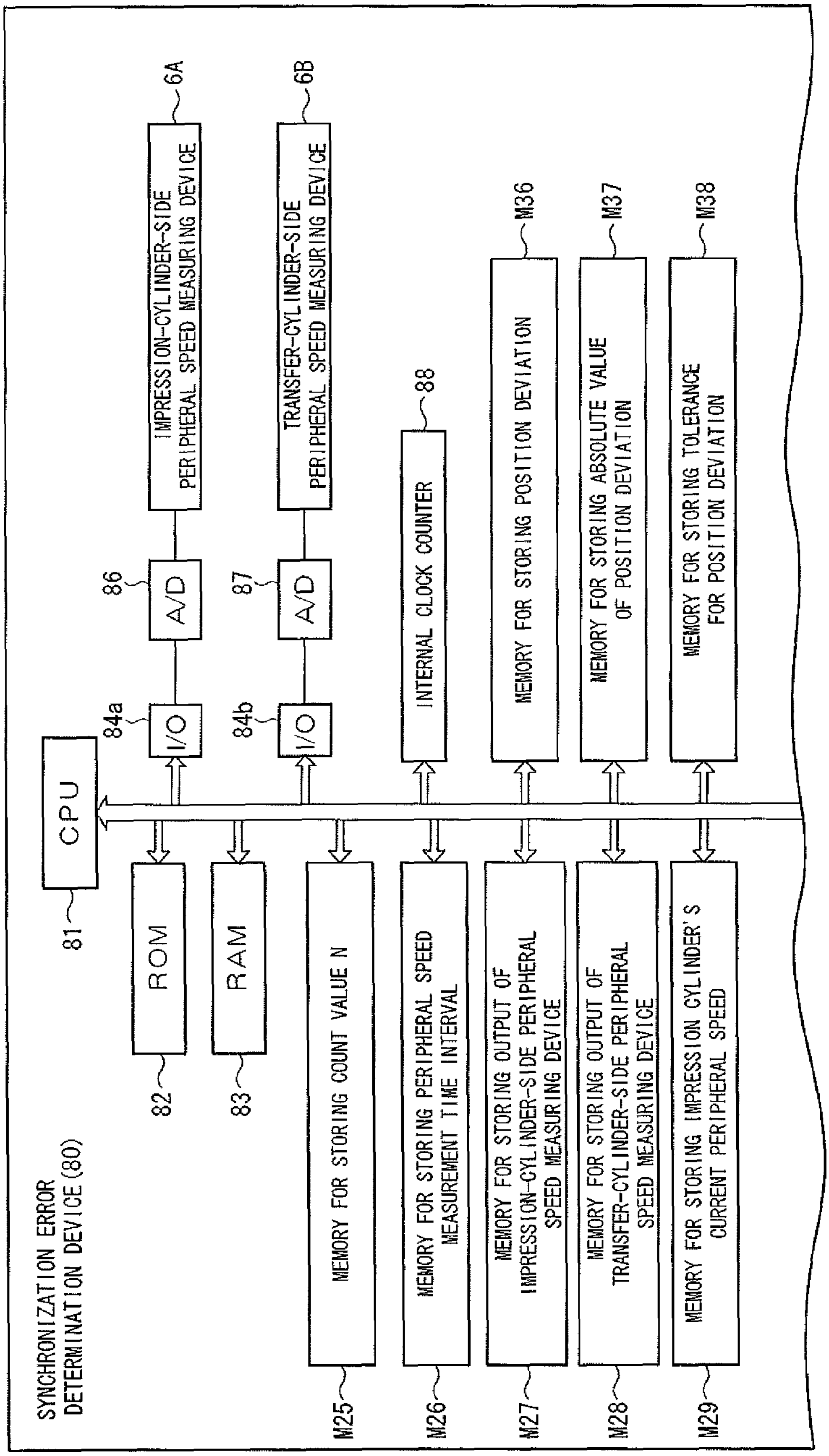

SYNCHRONIZATION ERROR DETERMINATION DEVICE (80)
CPU
81
ROM
82
RAM
83
I/O
84a
I/O
84b
A/D
86
A/D
87
IMPRESSION-CYLINDER-SIDE PERIPHERAL SPEED MEASURING DEVICE
6A
TRANSFER-CYLINDER-SIDE PERIPHERAL SPEED MEASURING DEVICE
6B
INTERNAL CLOCK COUNTER
88
MEMORY FOR STORING POSITION DEVIATION
M36
MEMORY FOR STORING ABSOLUTE VALUE OF POSITION DEVIATION
M37
MEMORY FOR STORING TOLERANCE FOR POSITION DEVIATION
M38
MEMORY FOR STORING COUNT VALUE N
M25
MEMORY FOR STORING PERIPHERAL SPEED MEASUREMENT TIME INTERVAL
M26
MEMORY FOR STORING OUTPUT OF IMPRESSION-CYLINDER-SIDE PERIPHERAL SPEED MEASURING DEVICE
M27
MEMORY FOR STORING OUTPUT OF TRANSFER-CYLINDER-SIDE PERIPHERAL SPEED MEASURING DEVICE
M28
MEMORY FOR STORING IMPRESSION CYLINDER'S CURRENT PERIPHERAL SPEED
M29

Fig.3B

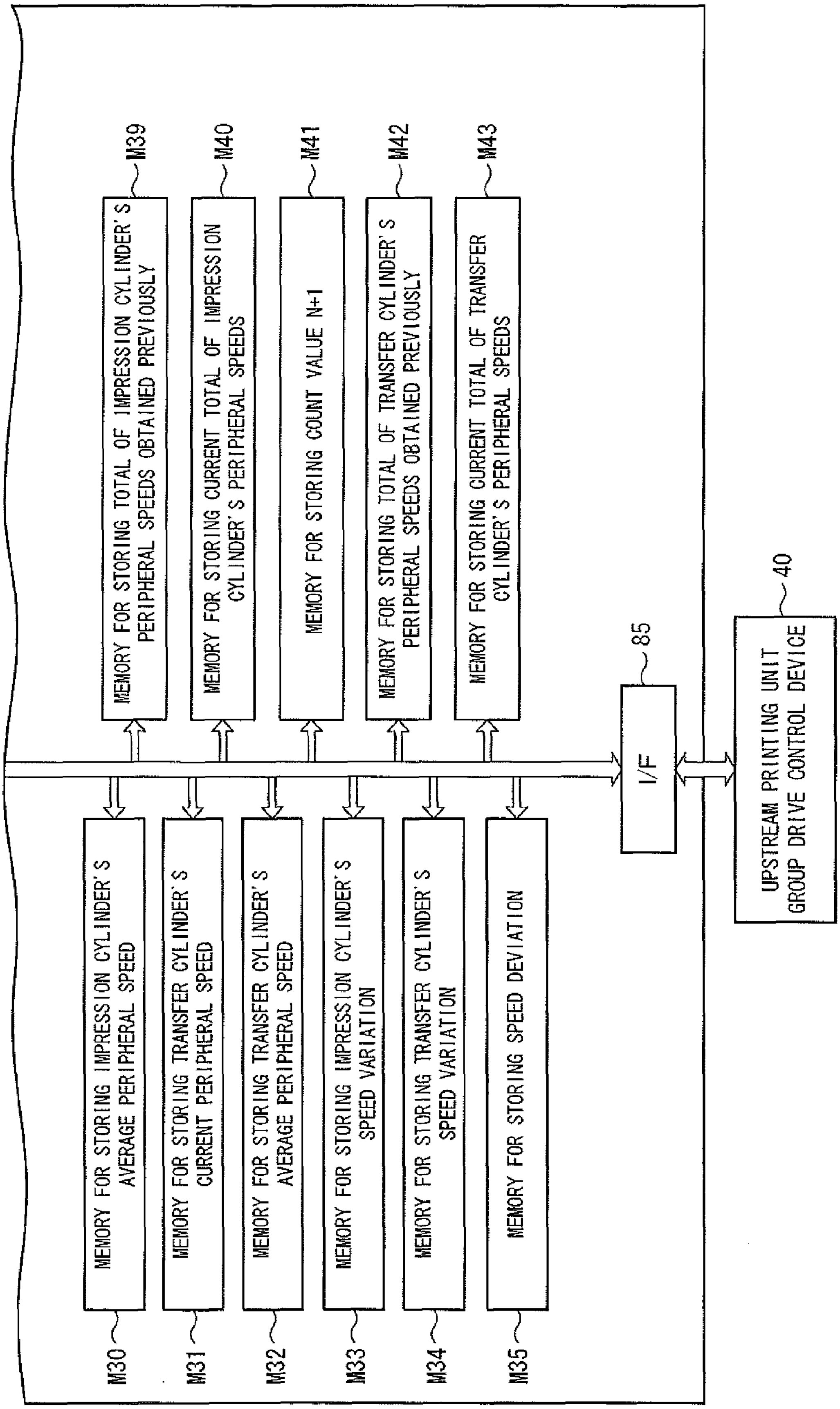

MEMORY FOR STORING TOTAL OF IMPRESSION CYLINDER'S PERIPHERAL SPEEDS OBTAINED PREVIOUSLY
M39
MEMORY FOR STORING CURRENT TOTAL OF IMPRESSION CYLINDER'S PERIPHERAL SPEEDS
M40
MEMORY FOR STORING COUNT VALUE N+1
M41
MEMORY FOR STORING TOTAL OF TRANSFER CYLINDER'S PERIPHERAL SPEEDS OBTAINED PREVIOUSLY
M42
MEMORY FOR STORING CURRENT TOTAL OF TRANSFER CYLINDER'S PERIPHERAL SPEEDS
M43
MEMORY FOR STORING IMPRESSION CYLINDER'S AVERAGE PERIPHERAL SPEED
M30
MEMORY FOR STORING TRANSFER CYLINDER'S CURRENT PERIPHERAL SPEED
M31
MEMORY FOR STORING TRANSFER CYLINDER'S AVERAGE PERIPHERAL SPEED
M32
MEMORY FOR STORING IMPRESSION CYLINDER'S SPEED VARIATION
M33
MEMORY FOR STORING TRANSFER CYLINDER'S SPEED VARIATION
M34
MEMORY FOR STORING SPEED DEVIATION
M35
I/F
85
UPSTREAM PRINTING UNIT GROUP DRIVE CONTROL DEVICE
40

Fig.4A

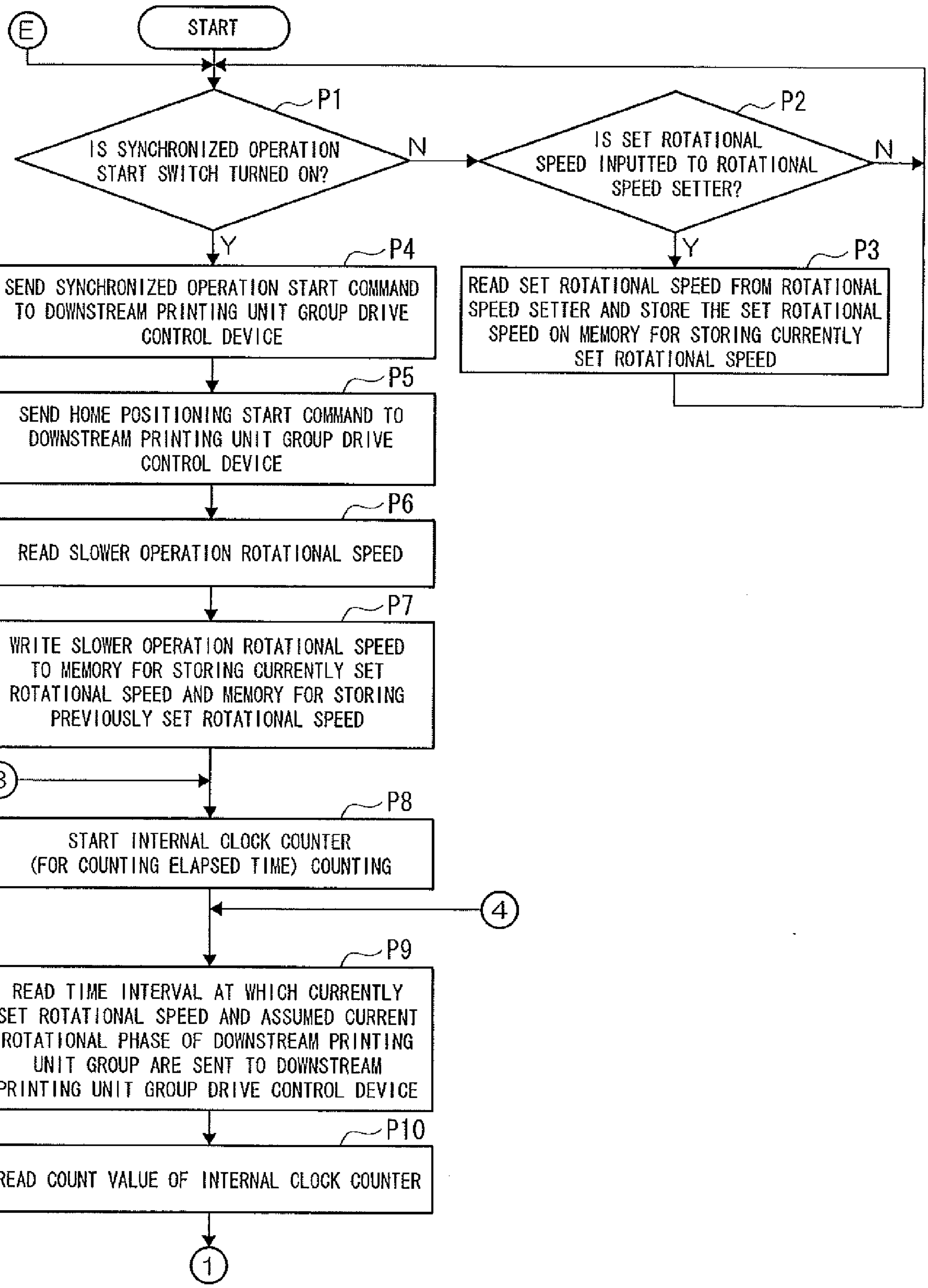

E
START
P1
IS SYNCHRONIZED OPERATION START SWITCH TURNED ON?
N
Y
P2
IS SET ROTATIONAL SPEED INPUTTED TO ROTATIONAL SPEED SETTER?
N
Y
P4
SEND SYNCHRONIZED OPERATION START COMMAND TO DOWNSTREAM PRINTING UNIT GROUP DRIVE CONTROL DEVICE
P3
READ SET ROTATIONAL SPEED FROM ROTATIONAL SPEED SETTER AND STORE THE SET ROTATIONAL SPEED ON MEMORY FOR STORING CURRENTLY SET ROTATIONAL SPEED
P5
SEND HOME POSITIONING START COMMAND TO DOWNSTREAM PRINTING UNIT GROUP DRIVE CONTROL DEVICE
P6
READ SLOWER OPERATION ROTATIONAL SPEED
P7
WRITE SLOWER OPERATION ROTATIONAL SPEED TO MEMORY FOR STORING CURRENTLY SET ROTATIONAL SPEED AND MEMORY FOR STORING PREVIOUSLY SET ROTATIONAL SPEED
3
P8
START INTERNAL CLOCK COUNTER (FOR COUNTING ELAPSED TIME) COUNTING
4
P9
READ TIME INTERVAL AT WHICH CURRENTLY SET ROTATIONAL SPEED AND ASSUMED CURRENT ROTATIONAL PHASE OF DOWNSTREAM PRINTING UNIT GROUP ARE SENT TO DOWNSTREAM PRINTING UNIT GROUP DRIVE CONTROL DEVICE
P10
READ COUNT VALUE OF INTERNAL CLOCK COUNTER
1

Fig.4B

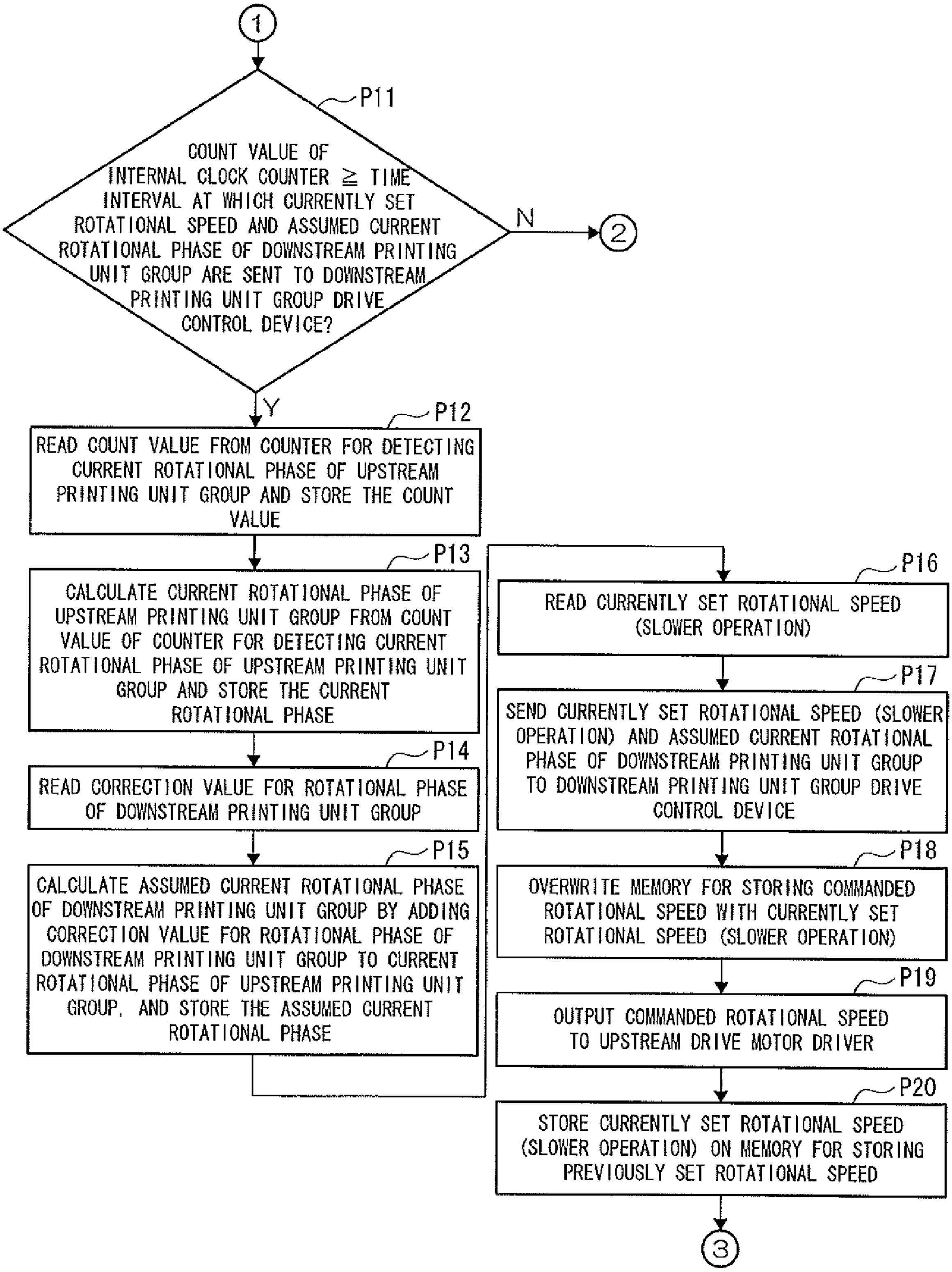

1
P11
COUNT VALUE OF INTERNAL CLOCK COUNTER ≧ TIME INTERVAL AT WHICH CURRENTLY SET ROTATIONAL SPEED AND ASSUMED CURRENT ROTATIONAL PHASE OF DOWNSTREAM PRINTING UNIT GROUP ARE SENT TO DOWNSTREAM PRINTING UNIT GROUP DRIVE CONTROL DEVICE?
N
2
Y
P12
READ COUNT VALUE FROM COUNTER FOR DETECTING CURRENT ROTATIONAL PHASE OF UPSTREAM PRINTING UNIT GROUP AND STORE THE COUNT VALUE
P13
CALCULATE CURRENT ROTATIONAL PHASE OF UPSTREAM PRINTING UNIT GROUP FROM COUNT VALUE OF COUNTER FOR DETECTING CURRENT ROTATIONAL PHASE OF UPSTREAM PRINTING UNIT GROUP AND STORE THE CURRENT ROTATIONAL PHASE
P14
READ CORRECTION VALUE FOR ROTATIONAL PHASE OF DOWNSTREAM PRINTING UNIT GROUP
P15
CALCULATE ASSUMED CURRENT ROTATIONAL PHASE OF DOWNSTREAM PRINTING UNIT GROUP BY ADDING CORRECTION VALUE FOR ROTATIONAL PHASE OF DOWNSTREAM PRINTING UNIT GROUP TO CURRENT ROTATIONAL PHASE OF UPSTREAM PRINTING UNIT GROUP, AND STORE THE ASSUMED CURRENT ROTATIONAL PHASE
P16
READ CURRENTLY SET ROTATIONAL SPEED (SLOWER OPERATION)
P17
SEND CURRENTLY SET ROTATIONAL SPEED (SLOWER OPERATION) AND ASSUMED CURRENT ROTATIONAL PHASE OF DOWNSTREAM PRINTING UNIT GROUP TO DOWNSTREAM PRINTING UNIT GROUP DRIVE CONTROL DEVICE
P18
OVERWRITE MEMORY FOR STORING COMMANDED ROTATIONAL SPEED WITH CURRENTLY SET ROTATIONAL SPEED (SLOWER OPERATION)
P19
OUTPUT COMMANDED ROTATIONAL SPEED TO UPSTREAM DRIVE MOTOR DRIVER
P20
STORE CURRENTLY SET ROTATIONAL SPEED (SLOWER OPERATION) ON MEMORY FOR STORING PREVIOUSLY SET ROTATIONAL SPEED
3

Fig.4C

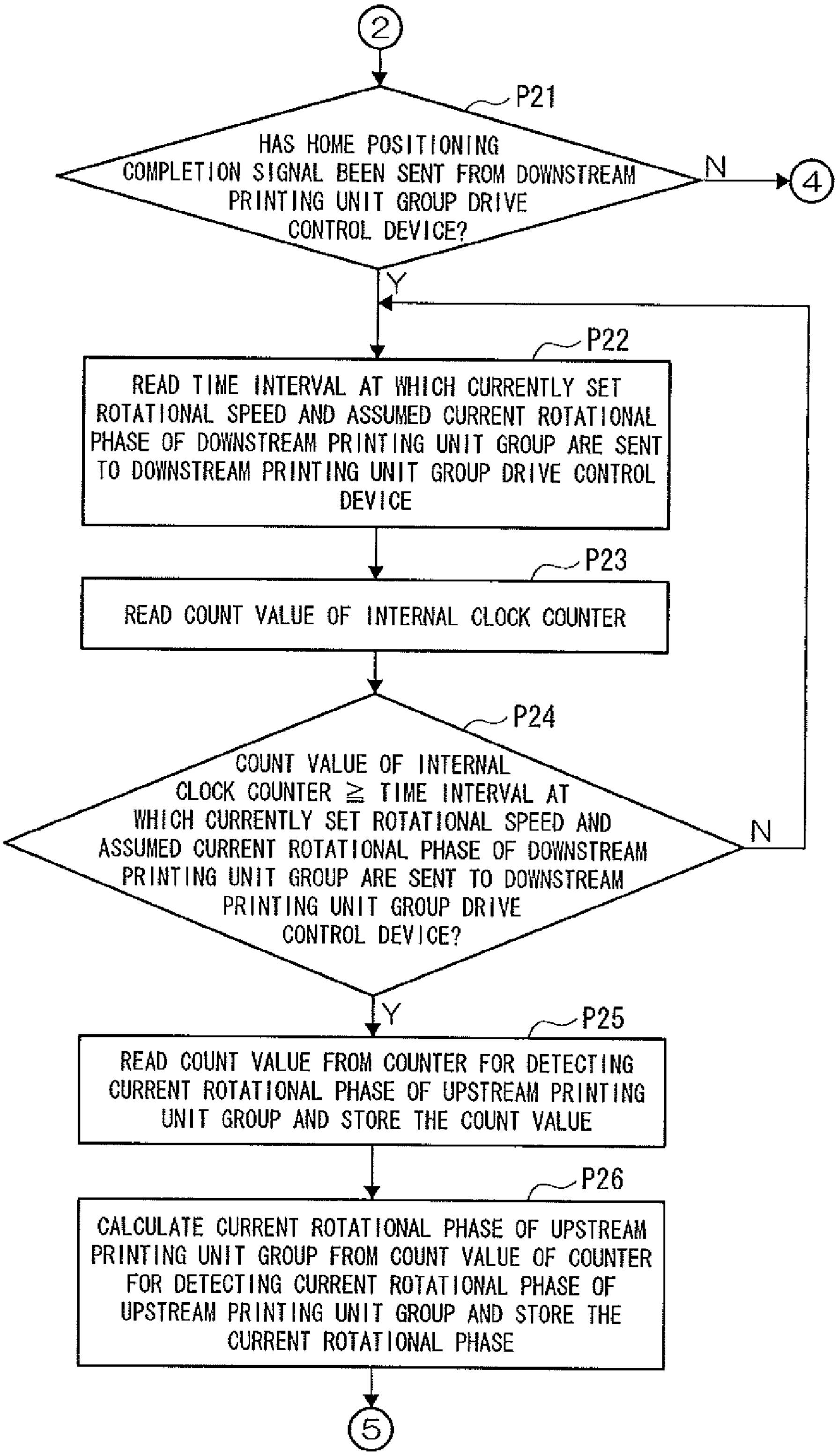

2
P21
HAS HOME POSITIONING COMPLETION SIGNAL BEEN SENT FROM DOWNSTREAM PRINTING UNIT GROUP DRIVE CONTROL DEVICE?
N
4
Y
P22
READ TIME INTERVAL AT WHICH CURRENTLY SET ROTATIONAL SPEED AND ASSUMED CURRENT ROTATIONAL PHASE OF DOWNSTREAM PRINTING UNIT GROUP ARE SENT TO DOWNSTREAM PRINTING UNIT GROUP DRIVE CONTROL DEVICE
P23
READ COUNT VALUE OF INTERNAL CLOCK COUNTER
P24
COUNT VALUE OF INTERNAL CLOCK COUNTER ≧ TIME INTERVAL AT WHICH CURRENTLY SET ROTATIONAL SPEED AND ASSUMED CURRENT ROTATIONAL PHASE OF DOWNSTREAM PRINTING UNIT GROUP ARE SENT TO DOWNSTREAM PRINTING UNIT GROUP DRIVE CONTROL DEVICE?
N
Y
P25
READ COUNT VALUE FROM COUNTER FOR DETECTING CURRENT ROTATIONAL PHASE OF UPSTREAM PRINTING UNIT GROUP AND STORE THE COUNT VALUE
P26
CALCULATE CURRENT ROTATIONAL PHASE OF UPSTREAM PRINTING UNIT GROUP FROM COUNT VALUE OF COUNTER FOR DETECTING CURRENT ROTATIONAL PHASE OF UPSTREAM PRINTING UNIT GROUP AND STORE THE CURRENT ROTATIONAL PHASE
5

Fig.4D

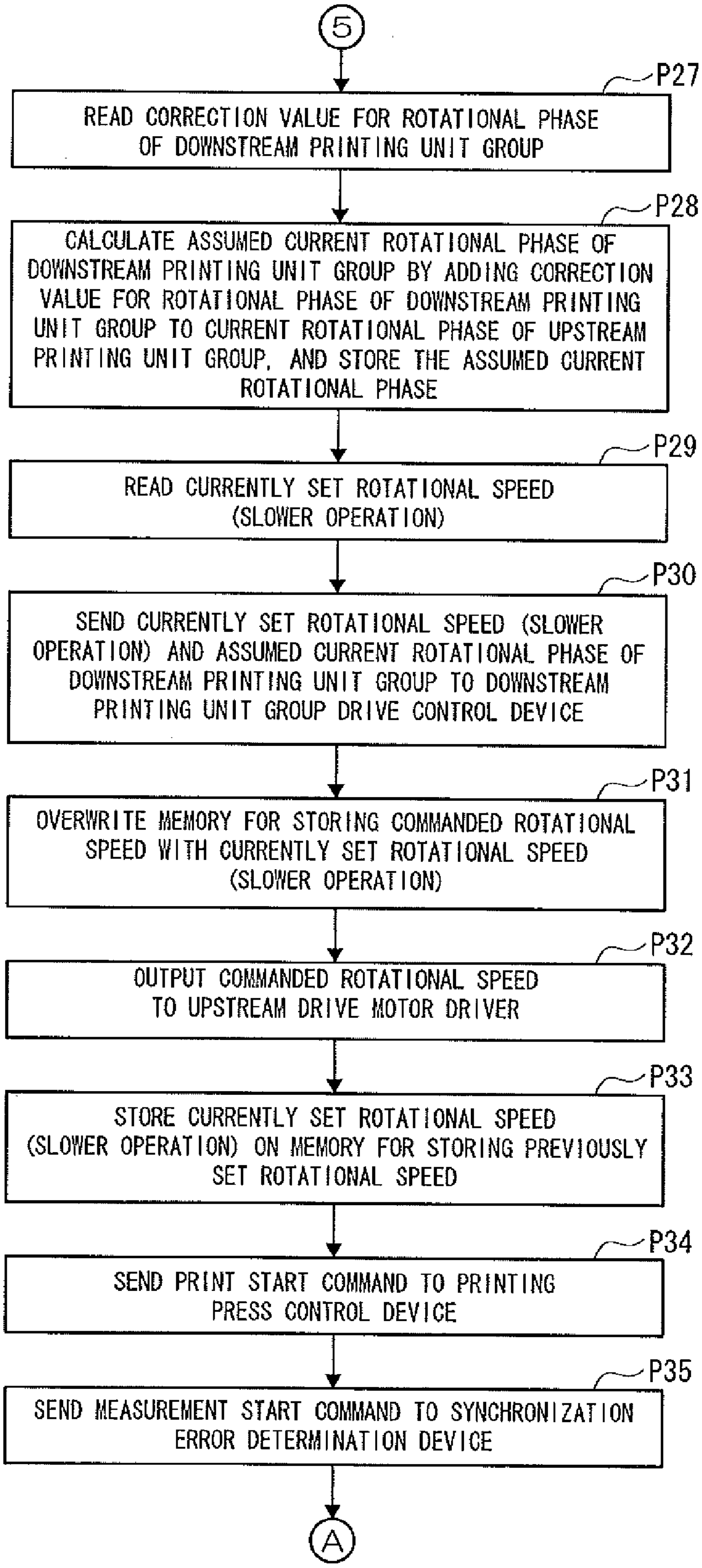

5
P27
READ CORRECTION VALUE FOR ROTATIONAL PHASE OF DOWNSTREAM PRINTING UNIT GROUP
P28
CALCULATE ASSUMED CURRENT ROTATIONAL PHASE OF DOWNSTREAM PRINTING UNIT GROUP BY ADDING CORRECTION VALUE FOR ROTATIONAL PHASE OF DOWNSTREAM PRINTING UNIT GROUP TO CURRENT ROTATIONAL PHASE OF UPSTREAM PRINTING UNIT GROUP, AND STORE THE ASSUMED CURRENT ROTATIONAL PHASE
P29
READ CURRENTLY SET ROTATIONAL SPEED (SLOWER OPERATION)
P30
SEND CURRENTLY SET ROTATIONAL SPEED (SLOWER OPERATION) AND ASSUMED CURRENT ROTATIONAL PHASE OF DOWNSTREAM PRINTING UNIT GROUP TO DOWNSTREAM PRINTING UNIT GROUP DRIVE CONTROL DEVICE
P31
OVERWRITE MEMORY FOR STORING COMMANDED ROTATIONAL SPEED WITH CURRENTLY SET ROTATIONAL SPEED (SLOWER OPERATION)
P32
OUTPUT COMMANDED ROTATIONAL SPEED TO UPSTREAM DRIVE MOTOR DRIVER
P33
STORE CURRENTLY SET ROTATIONAL SPEED (SLOWER OPERATION) ON MEMORY FOR STORING PREVIOUSLY SET ROTATIONAL SPEED
P34
SEND PRINT START COMMAND TO PRINTING PRESS CONTROL DEVICE
P35
SEND MEASUREMENT START COMMAND TO SYNCHRONIZATION ERROR DETERMINATION DEVICE
A

Fig.5A

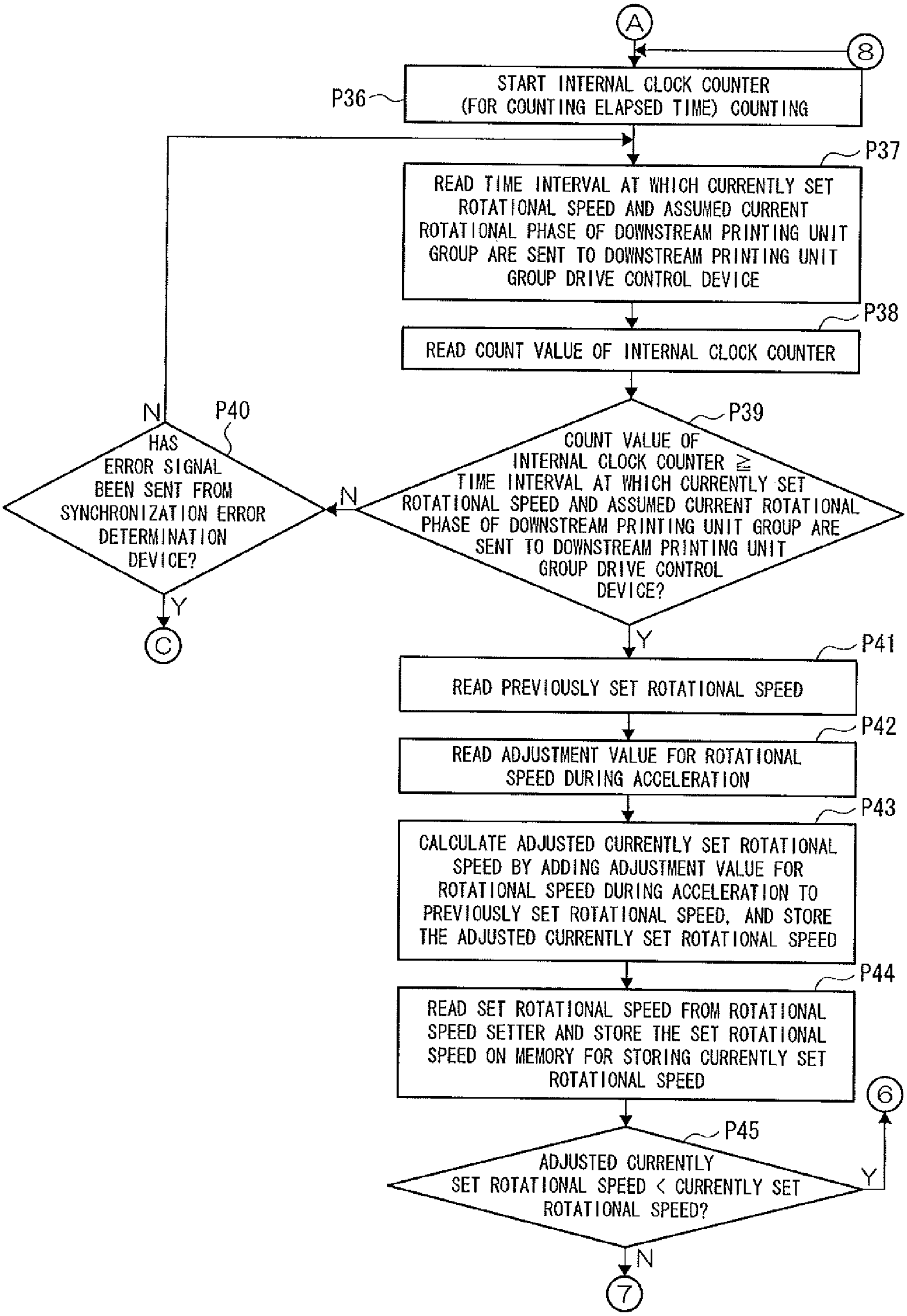

A
8
P36
START INTERNAL CLOCK COUNTER (FOR COUNTING ELAPSED TIME) COUNTING
P37
READ TIME INTERVAL AT WHICH CURRENTLY SET ROTATIONAL SPEED AND ASSUMED CURRENT ROTATIONAL PHASE OF DOWNSTREAM PRINTING UNIT GROUP ARE SENT TO DOWNSTREAM PRINTING UNIT GROUP DRIVE CONTROL DEVICE
P38
READ COUNT VALUE OF INTERNAL CLOCK COUNTER
P39
COUNT VALUE OF INTERNAL CLOCK COUNTER ≧ TIME INTERVAL AT WHICH CURRENTLY SET ROTATIONAL SPEED AND ASSUMED CURRENT ROTATIONAL PHASE OF DOWNSTREAM PRINTING UNIT GROUP ARE SENT TO DOWNSTREAM PRINTING UNIT GROUP DRIVE CONTROL DEVICE?
N
P40
HAS ERROR SIGNAL BEEN SENT FROM SYNCHRONIZATION ERROR DETERMINATION DEVICE?
N
Y
C
Y
P41
READ PREVIOUSLY SET ROTATIONAL SPEED
P42
READ ADJUSTMENT VALUE FOR ROTATIONAL SPEED DURING ACCELERATION
P43
CALCULATE ADJUSTED CURRENTLY SET ROTATIONAL SPEED BY ADDING ADJUSTMENT VALUE FOR ROTATIONAL SPEED DURING ACCELERATION TO PREVIOUSLY SET ROTATIONAL SPEED, AND STORE THE ADJUSTED CURRENTLY SET ROTATIONAL SPEED
P44
READ SET ROTATIONAL SPEED FROM ROTATIONAL SPEED SETTER AND STORE THE SET ROTATIONAL SPEED ON MEMORY FOR STORING CURRENTLY SET ROTATIONAL SPEED
6
P45
ADJUSTED CURRENTLY SET ROTATIONAL SPEED < CURRENTLY SET ROTATIONAL SPEED?
Y
N
7

Fig.5B

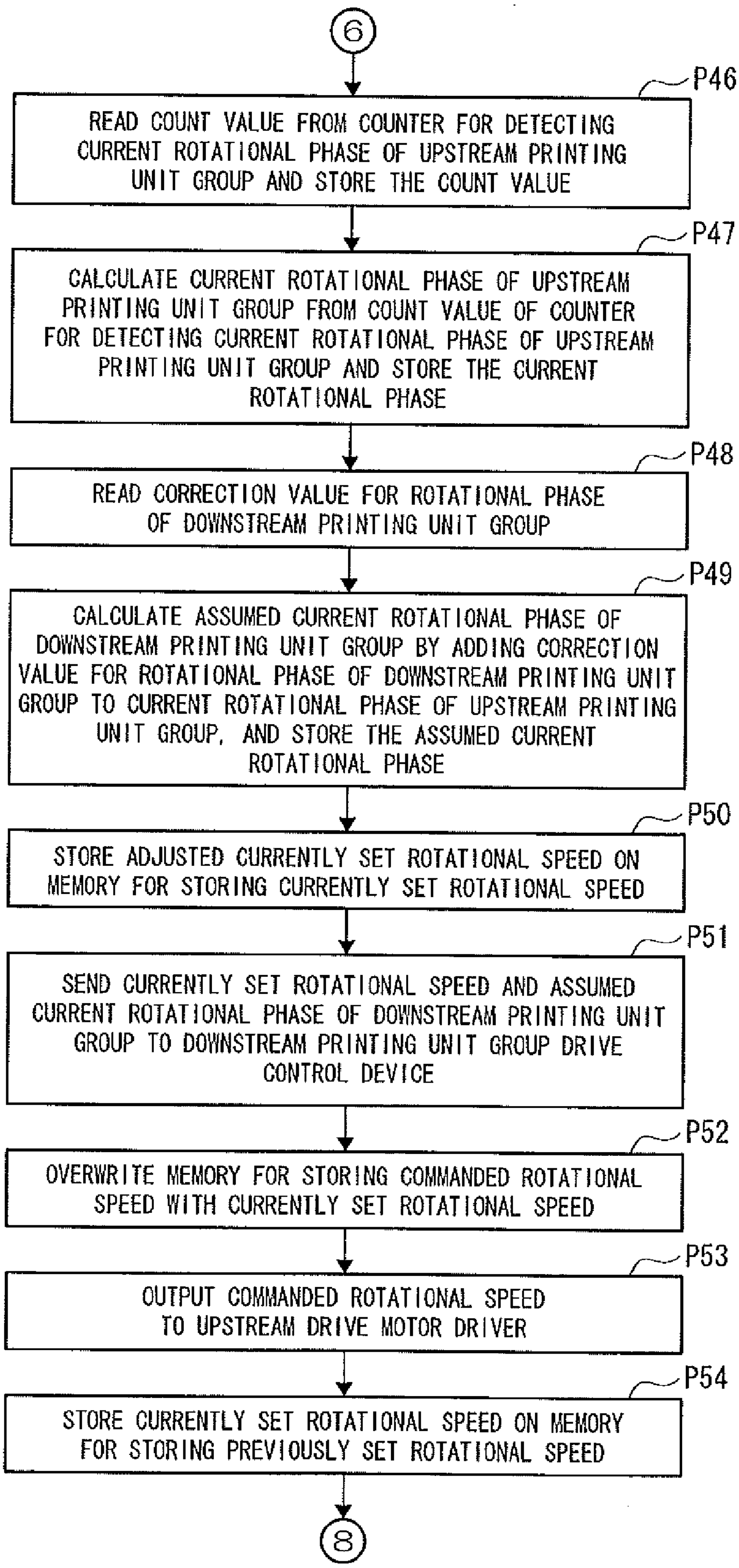

6
P46
READ COUNT VALUE FROM COUNTER FOR DETECTING CURRENT ROTATIONAL PHASE OF UPSTREAM PRINTING UNIT GROUP AND STORE THE COUNT VALUE
P47
CALCULATE CURRENT ROTATIONAL PHASE OF UPSTREAM PRINTING UNIT GROUP FROM COUNT VALUE OF COUNTER FOR DETECTING CURRENT ROTATIONAL PHASE OF UPSTREAM PRINTING UNIT GROUP AND STORE THE CURRENT ROTATIONAL PHASE
P48
READ CORRECTION VALUE FOR ROTATIONAL PHASE OF DOWNSTREAM PRINTING UNIT GROUP
P49
CALCULATE ASSUMED CURRENT ROTATIONAL PHASE OF DOWNSTREAM PRINTING UNIT GROUP BY ADDING CORRECTION VALUE FOR ROTATIONAL PHASE OF DOWNSTREAM PRINTING UNIT GROUP TO CURRENT ROTATIONAL PHASE OF UPSTREAM PRINTING UNIT GROUP, AND STORE THE ASSUMED CURRENT ROTATIONAL PHASE
P50
STORE ADJUSTED CURRENTLY SET ROTATIONAL SPEED ON MEMORY FOR STORING CURRENTLY SET ROTATIONAL SPEED
P51
SEND CURRENTLY SET ROTATIONAL SPEED AND ASSUMED CURRENT ROTATIONAL PHASE OF DOWNSTREAM PRINTING UNIT GROUP TO DOWNSTREAM PRINTING UNIT GROUP DRIVE CONTROL DEVICE
P52
OVERWRITE MEMORY FOR STORING COMMANDED ROTATIONAL SPEED WITH CURRENTLY SET ROTATIONAL SPEED
P53
OUTPUT COMMANDED ROTATIONAL SPEED TO UPSTREAM DRIVE MOTOR DRIVER
P54
STORE CURRENTLY SET ROTATIONAL SPEED ON MEMORY FOR STORING PREVIOUSLY SET ROTATIONAL SPEED
8

Fig.5C

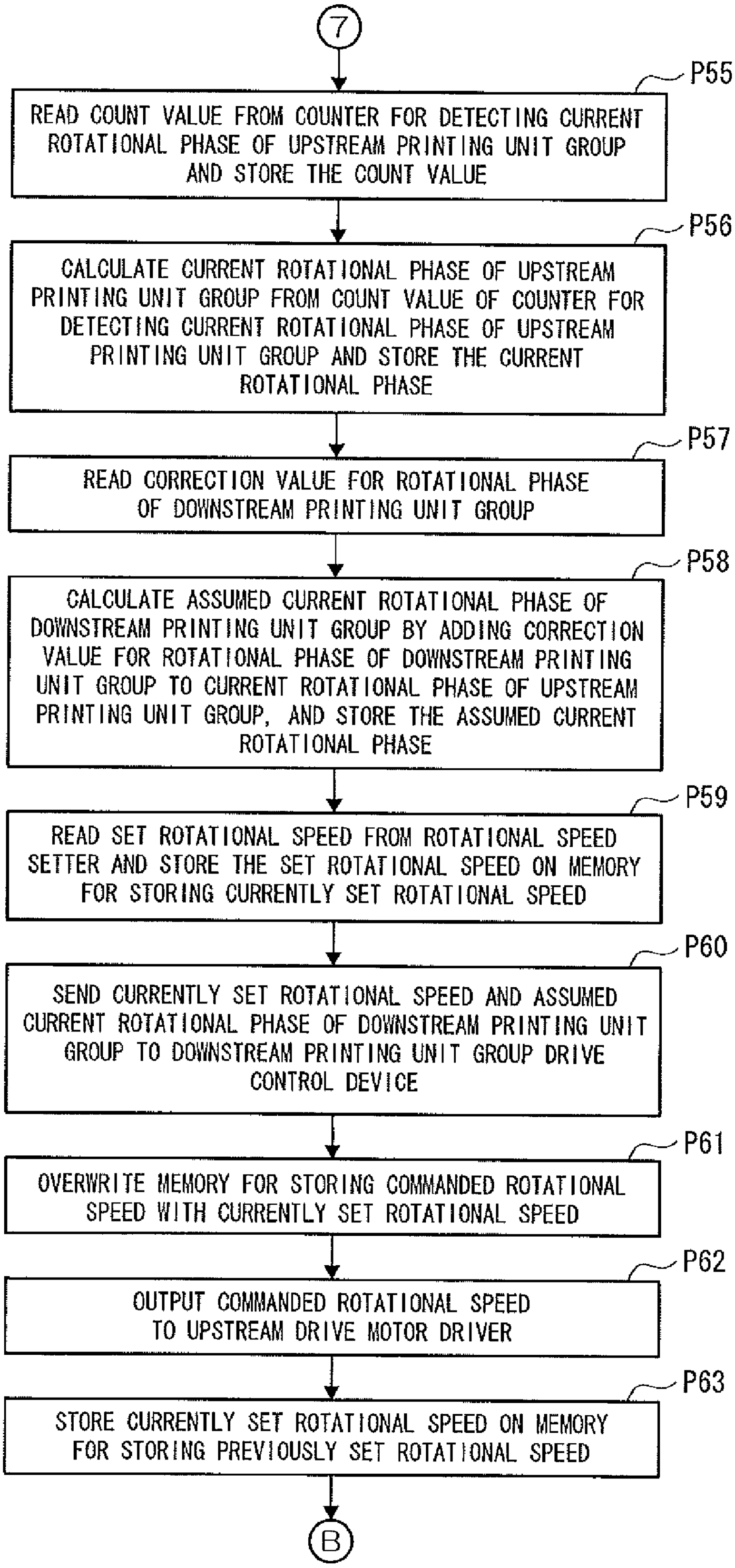

7
P55
READ COUNT VALUE FROM COUNTER FOR DETECTING CURRENT ROTATIONAL PHASE OF UPSTREAM PRINTING UNIT GROUP AND STORE THE COUNT VALUE
P56
CALCULATE CURRENT ROTATIONAL PHASE OF UPSTREAM PRINTING UNIT GROUP FROM COUNT VALUE OF COUNTER FOR DETECTING CURRENT ROTATIONAL PHASE OF UPSTREAM PRINTING UNIT GROUP AND STORE THE CURRENT ROTATIONAL PHASE
P57
READ CORRECTION VALUE FOR ROTATIONAL PHASE OF DOWNSTREAM PRINTING UNIT GROUP
P58
CALCULATE ASSUMED CURRENT ROTATIONAL PHASE OF DOWNSTREAM PRINTING UNIT GROUP BY ADDING CORRECTION VALUE FOR ROTATIONAL PHASE OF DOWNSTREAM PRINTING UNIT GROUP TO CURRENT ROTATIONAL PHASE OF UPSTREAM PRINTING UNIT GROUP, AND STORE THE ASSUMED CURRENT ROTATIONAL PHASE
P59
READ SET ROTATIONAL SPEED FROM ROTATIONAL SPEED SETTER AND STORE THE SET ROTATIONAL SPEED ON MEMORY FOR STORING CURRENTLY SET ROTATIONAL SPEED
P60
SEND CURRENTLY SET ROTATIONAL SPEED AND ASSUMED CURRENT ROTATIONAL PHASE OF DOWNSTREAM PRINTING UNIT GROUP TO DOWNSTREAM PRINTING UNIT GROUP DRIVE CONTROL DEVICE
P61
OVERWRITE MEMORY FOR STORING COMMANDED ROTATIONAL SPEED WITH CURRENTLY SET ROTATIONAL SPEED
P62
OUTPUT COMMANDED ROTATIONAL SPEED TO UPSTREAM DRIVE MOTOR DRIVER
P63
STORE CURRENTLY SET ROTATIONAL SPEED ON MEMORY FOR STORING PREVIOUSLY SET ROTATIONAL SPEED
B

Fig.6A

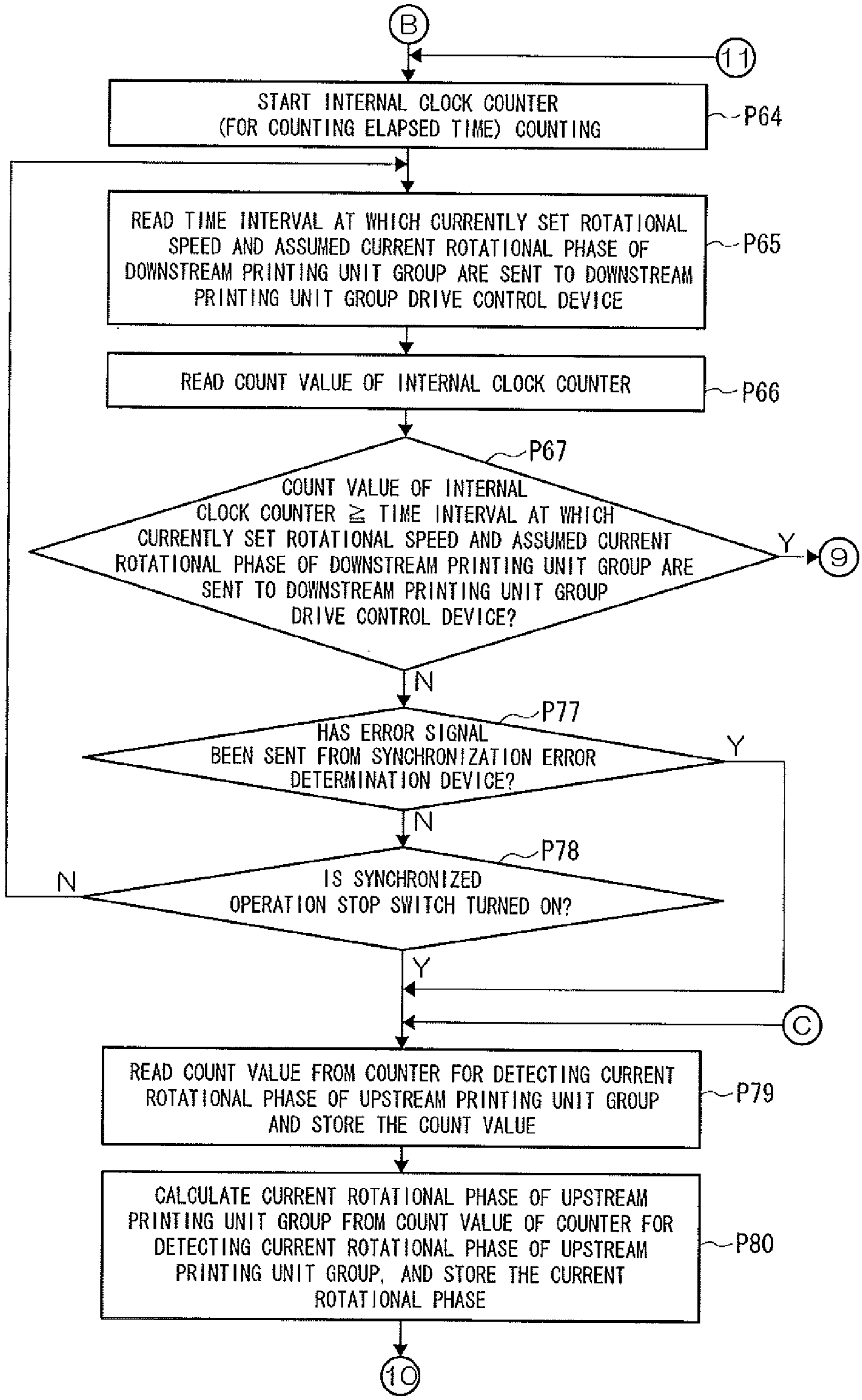

B
11
START INTERNAL CLOCK COUNTER (FOR COUNTING ELAPSED TIME) COUNTING
P64
READ TIME INTERVAL AT WHICH CURRENTLY SET ROTATIONAL SPEED AND ASSUMED CURRENT ROTATIONAL PHASE OF DOWNSTREAM PRINTING UNIT GROUP ARE SENT TO DOWNSTREAM PRINTING UNIT GROUP DRIVE CONTROL DEVICE
P65
READ COUNT VALUE OF INTERNAL CLOCK COUNTER
P66
P67
COUNT VALUE OF INTERNAL CLOCK COUNTER ≧ TIME INTERVAL AT WHICH CURRENTLY SET ROTATIONAL SPEED AND ASSUMED CURRENT ROTATIONAL PHASE OF DOWNSTREAM PRINTING UNIT GROUP ARE SENT TO DOWNSTREAM PRINTING UNIT GROUP DRIVE CONTROL DEVICE?
Y
9
N
P77
HAS ERROR SIGNAL BEEN SENT FROM SYNCHRONIZATION ERROR DETERMINATION DEVICE?
Y
N
P78
N
IS SYNCHRONIZED OPERATION STOP SWITCH TURNED ON?
Y
C
READ COUNT VALUE FROM COUNTER FOR DETECTING CURRENT ROTATIONAL PHASE OF UPSTREAM PRINTING UNIT GROUP AND STORE THE COUNT VALUE
P79
CALCULATE CURRENT ROTATIONAL PHASE OF UPSTREAM PRINTING UNIT GROUP FROM COUNT VALUE OF COUNTER FOR DETECTING CURRENT ROTATIONAL PHASE OF UPSTREAM PRINTING UNIT GROUP, AND STORE THE CURRENT ROTATIONAL PHASE
P80
10

Fig.6B

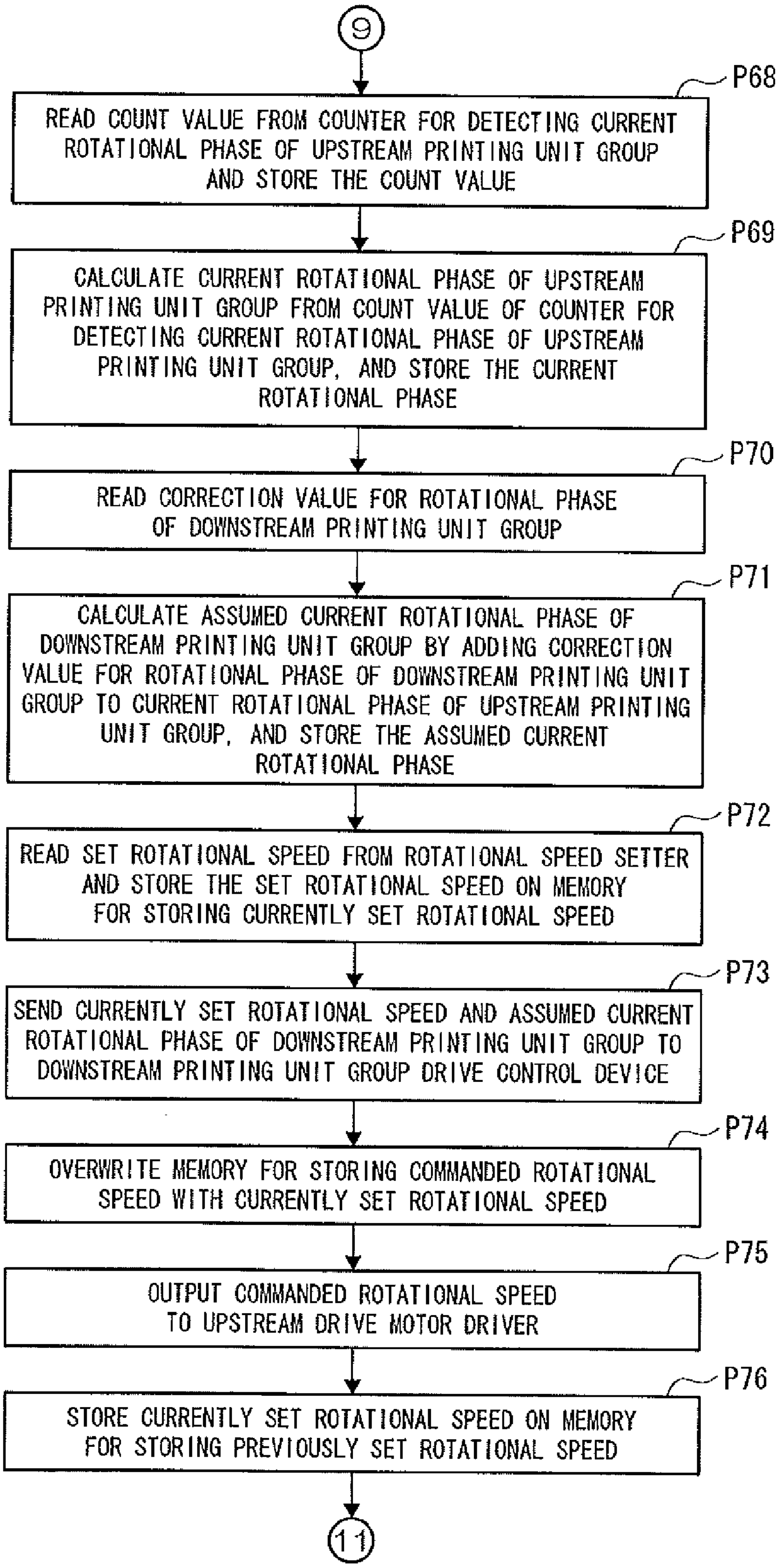

9
P68
READ COUNT VALUE FROM COUNTER FOR DETECTING CURRENT ROTATIONAL PHASE OF UPSTREAM PRINTING UNIT GROUP AND STORE THE COUNT VALUE
P69
CALCULATE CURRENT ROTATIONAL PHASE OF UPSTREAM PRINTING UNIT GROUP FROM COUNT VALUE OF COUNTER FOR DETECTING CURRENT ROTATIONAL PHASE OF UPSTREAM PRINTING UNIT GROUP, AND STORE THE CURRENT ROTATIONAL PHASE
P70
READ CORRECTION VALUE FOR ROTATIONAL PHASE OF DOWNSTREAM PRINTING UNIT GROUP
P71
CALCULATE ASSUMED CURRENT ROTATIONAL PHASE OF DOWNSTREAM PRINTING UNIT GROUP BY ADDING CORRECTION VALUE FOR ROTATIONAL PHASE OF DOWNSTREAM PRINTING UNIT GROUP TO CURRENT ROTATIONAL PHASE OF UPSTREAM PRINTING UNIT GROUP, AND STORE THE ASSUMED CURRENT ROTATIONAL PHASE
P72
READ SET ROTATIONAL SPEED FROM ROTATIONAL SPEED SETTER AND STORE THE SET ROTATIONAL SPEED ON MEMORY FOR STORING CURRENTLY SET ROTATIONAL SPEED
P73
SEND CURRENTLY SET ROTATIONAL SPEED AND ASSUMED CURRENT ROTATIONAL PHASE OF DOWNSTREAM PRINTING UNIT GROUP TO DOWNSTREAM PRINTING UNIT GROUP DRIVE CONTROL DEVICE
P74
OVERWRITE MEMORY FOR STORING COMMANDED ROTATIONAL SPEED WITH CURRENTLY SET ROTATIONAL SPEED
P75
OUTPUT COMMANDED ROTATIONAL SPEED TO UPSTREAM DRIVE MOTOR DRIVER
P76
STORE CURRENTLY SET ROTATIONAL SPEED ON MEMORY FOR STORING PREVIOUSLY SET ROTATIONAL SPEED
11

Fig.6C

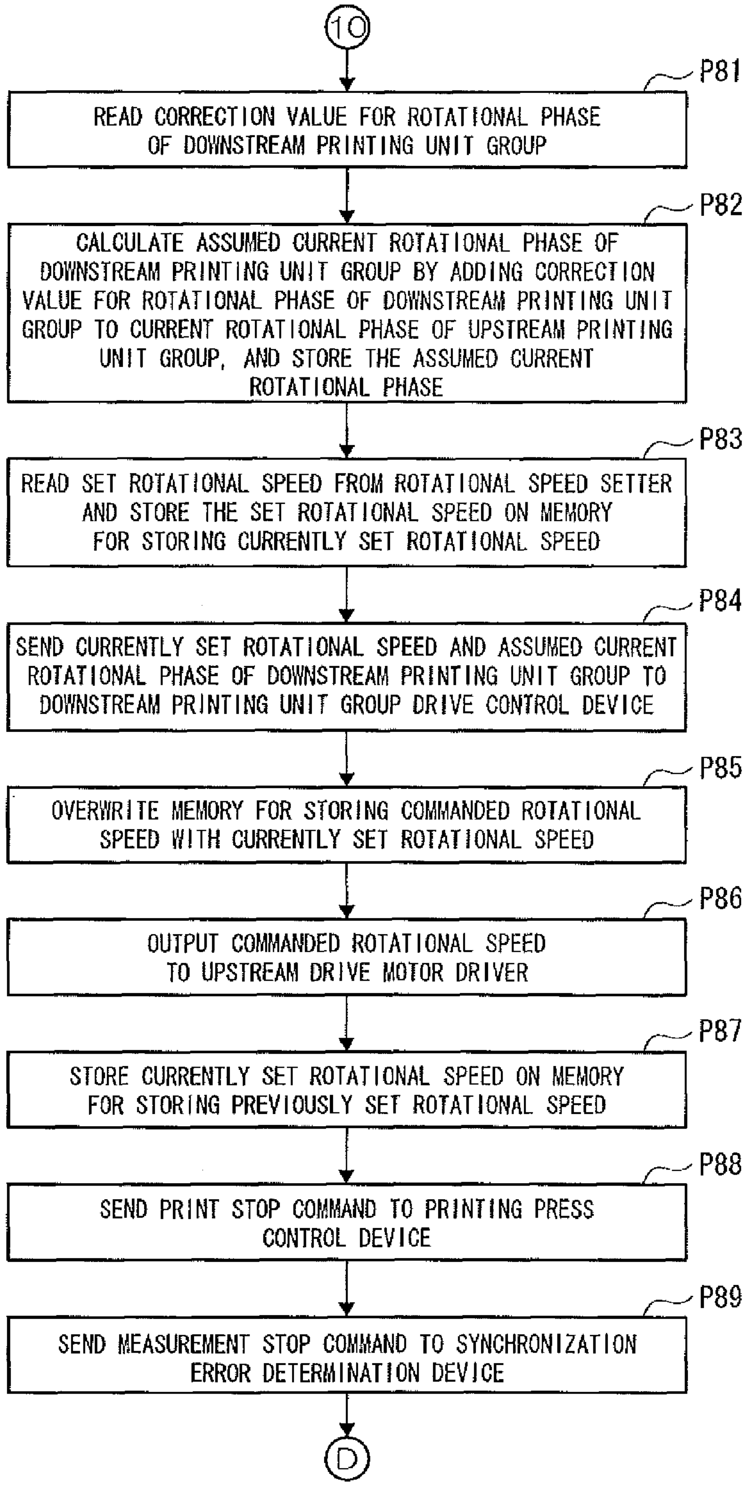

10
P81
READ CORRECTION VALUE FOR ROTATIONAL PHASE OF DOWNSTREAM PRINTING UNIT GROUP
P82
CALCULATE ASSUMED CURRENT ROTATIONAL PHASE OF DOWNSTREAM PRINTING UNIT GROUP BY ADDING CORRECTION VALUE FOR ROTATIONAL PHASE OF DOWNSTREAM PRINTING UNIT GROUP TO CURRENT ROTATIONAL PHASE OF UPSTREAM PRINTING UNIT GROUP, AND STORE THE ASSUMED CURRENT ROTATIONAL PHASE
P83
READ SET ROTATIONAL SPEED FROM ROTATIONAL SPEED SETTER AND STORE THE SET ROTATIONAL SPEED ON MEMORY FOR STORING CURRENTLY SET ROTATIONAL SPEED
P84
SEND CURRENTLY SET ROTATIONAL SPEED AND ASSUMED CURRENT ROTATIONAL PHASE OF DOWNSTREAM PRINTING UNIT GROUP TO DOWNSTREAM PRINTING UNIT GROUP DRIVE CONTROL DEVICE
P85
OVERWRITE MEMORY FOR STORING COMMANDED ROTATIONAL SPEED WITH CURRENTLY SET ROTATIONAL SPEED
P86
OUTPUT COMMANDED ROTATIONAL SPEED TO UPSTREAM DRIVE MOTOR DRIVER
P87
STORE CURRENTLY SET ROTATIONAL SPEED ON MEMORY FOR STORING PREVIOUSLY SET ROTATIONAL SPEED
P88
SEND PRINT STOP COMMAND TO PRINTING PRESS CONTROL DEVICE
P89
SEND MEASUREMENT STOP COMMAND TO SYNCHRONIZATION ERROR DETERMINATION DEVICE
D

Fig.7A

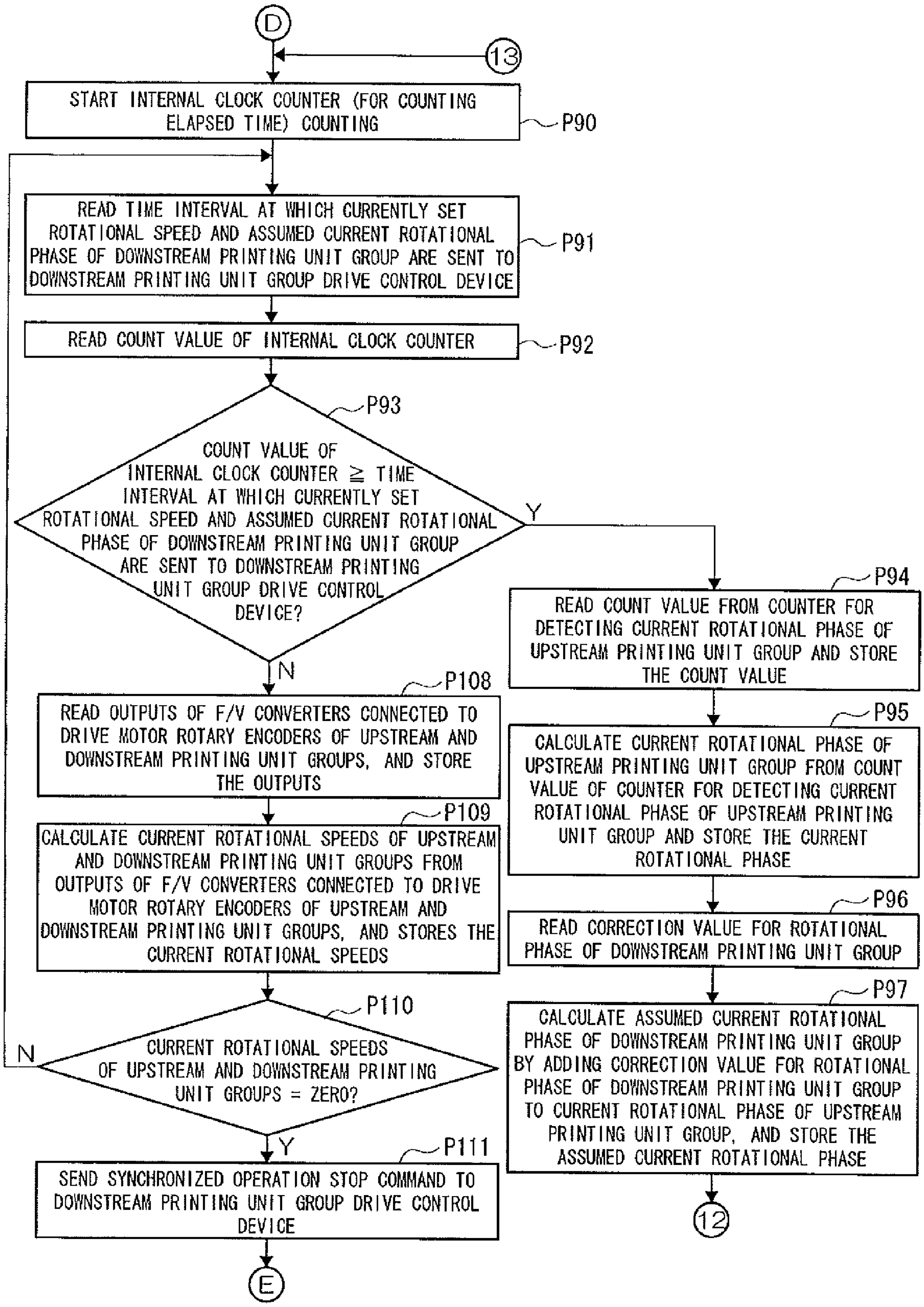

D
13
START INTERNAL CLOCK COUNTER (FOR COUNTING ELAPSED TIME) COUNTING
P90
READ TIME INTERVAL AT WHICH CURRENTLY SET ROTATIONAL SPEED AND ASSUMED CURRENT ROTATIONAL PHASE OF DOWNSTREAM PRINTING UNIT GROUP ARE SENT TO DOWNSTREAM PRINTING UNIT GROUP DRIVE CONTROL DEVICE
P91
READ COUNT VALUE OF INTERNAL CLOCK COUNTER
P92
P93
COUNT VALUE OF INTERNAL CLOCK COUNTER ≧ TIME INTERVAL AT WHICH CURRENTLY SET ROTATIONAL SPEED AND ASSUMED CURRENT ROTATIONAL PHASE OF DOWNSTREAM PRINTING UNIT GROUP ARE SENT TO DOWNSTREAM PRINTING UNIT GROUP DRIVE CONTROL DEVICE?
Y
N
P94
READ COUNT VALUE FROM COUNTER FOR DETECTING CURRENT ROTATIONAL PHASE OF UPSTREAM PRINTING UNIT GROUP AND STORE THE COUNT VALUE
P95
CALCULATE CURRENT ROTATIONAL PHASE OF UPSTREAM PRINTING UNIT GROUP FROM COUNT VALUE OF COUNTER FOR DETECTING CURRENT ROTATIONAL PHASE OF UPSTREAM PRINTING UNIT GROUP AND STORE THE CURRENT ROTATIONAL PHASE
P96
READ CORRECTION VALUE FOR ROTATIONAL PHASE OF DOWNSTREAM PRINTING UNIT GROUP
P97
CALCULATE ASSUMED CURRENT ROTATIONAL PHASE OF DOWNSTREAM PRINTING UNIT GROUP BY ADDING CORRECTION VALUE FOR ROTATIONAL PHASE OF DOWNSTREAM PRINTING UNIT GROUP TO CURRENT ROTATIONAL PHASE OF UPSTREAM PRINTING UNIT GROUP, AND STORE THE ASSUMED CURRENT ROTATIONAL PHASE
12
P108
READ OUTPUTS OF F/V CONVERTERS CONNECTED TO DRIVE MOTOR ROTARY ENCODERS OF UPSTREAM AND DOWNSTREAM PRINTING UNIT GROUPS, AND STORE THE OUTPUTS
P109
CALCULATE CURRENT ROTATIONAL SPEEDS OF UPSTREAM AND DOWNSTREAM PRINTING UNIT GROUPS FROM OUTPUTS OF F/V CONVERTERS CONNECTED TO DRIVE MOTOR ROTARY ENCODERS OF UPSTREAM AND DOWNSTREAM PRINTING UNIT GROUPS, AND STORES THE CURRENT ROTATIONAL SPEEDS
P110
CURRENT ROTATIONAL SPEEDS OF UPSTREAM AND DOWNSTREAM PRINTING UNIT GROUPS = ZERO?
N
Y
P111
SEND SYNCHRONIZED OPERATION STOP COMMAND TO DOWNSTREAM PRINTING UNIT GROUP DRIVE CONTROL DEVICE
E

Fig.7B

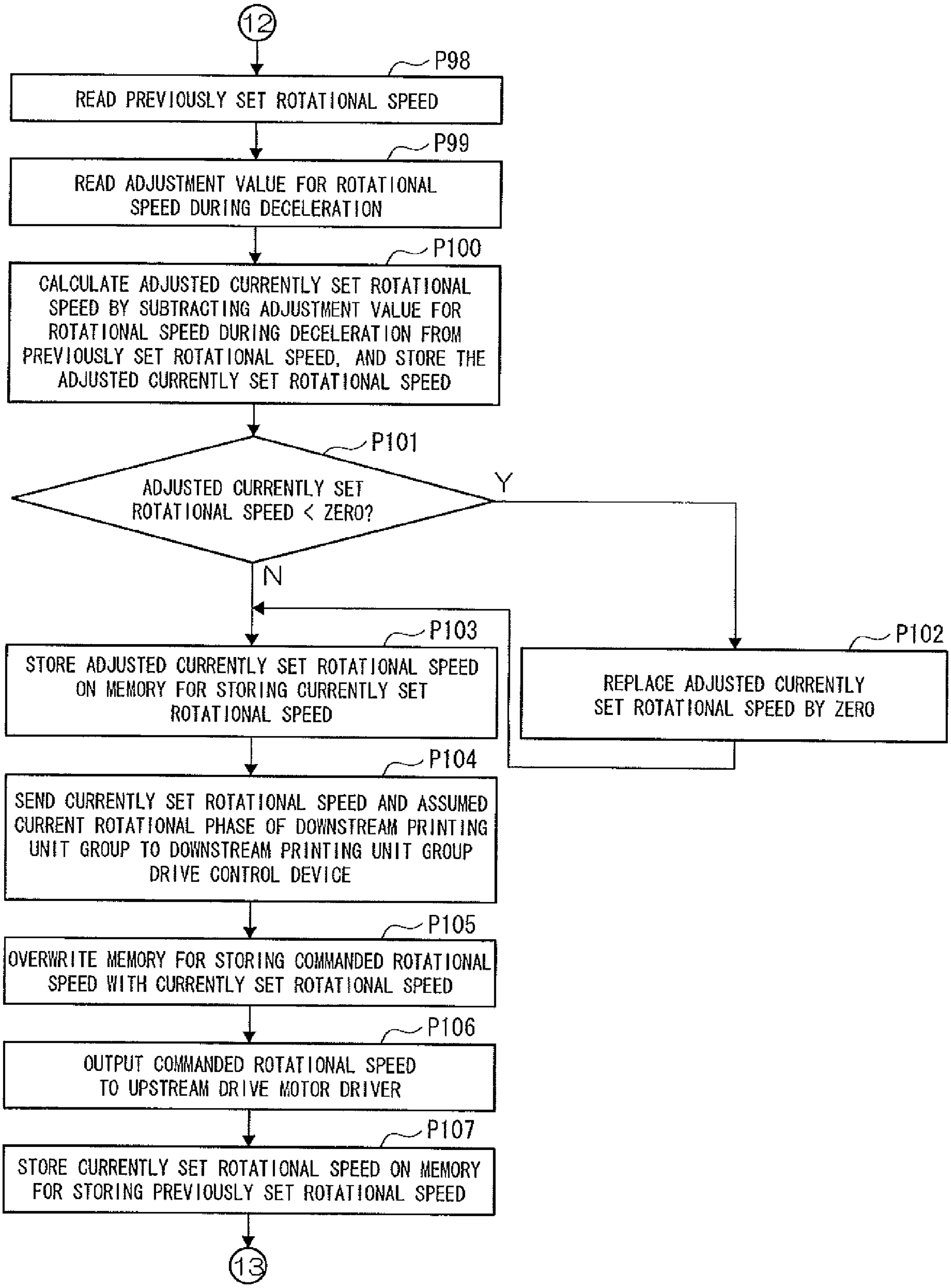

12
P98
READ PREVIOUSLY SET ROTATIONAL SPEED
P99
READ ADJUSTMENT VALUE FOR ROTATIONAL SPEED DURING DECELERATION
P100
CALCULATE ADJUSTED CURRENTLY SET ROTATIONAL SPEED BY SUBTRACTING ADJUSTMENT VALUE FOR ROTATIONAL SPEED DURING DECELERATION FROM PREVIOUSLY SET ROTATIONAL SPEED, AND STORE THE ADJUSTED CURRENTLY SET ROTATIONAL SPEED
P101
ADJUSTED CURRENTLY SET ROTATIONAL SPEED < ZERO?
Y
N
P102
REPLACE ADJUSTED CURRENTLY SET ROTATIONAL SPEED BY ZERO
P103
STORE ADJUSTED CURRENTLY SET ROTATIONAL SPEED ON MEMORY FOR STORING CURRENTLY SET ROTATIONAL SPEED
P104
SEND CURRENTLY SET ROTATIONAL SPEED AND ASSUMED CURRENT ROTATIONAL PHASE OF DOWNSTREAM PRINTING UNIT GROUP TO DOWNSTREAM PRINTING UNIT GROUP DRIVE CONTROL DEVICE
P105
OVERWRITE MEMORY FOR STORING COMMANDED ROTATIONAL SPEED WITH CURRENTLY SET ROTATIONAL SPEED
P106
OUTPUT COMMANDED ROTATIONAL SPEED TO UPSTREAM DRIVE MOTOR DRIVER
P107
STORE CURRENTLY SET ROTATIONAL SPEED ON MEMORY FOR STORING PREVIOUSLY SET ROTATIONAL SPEED
13

Fig.8A

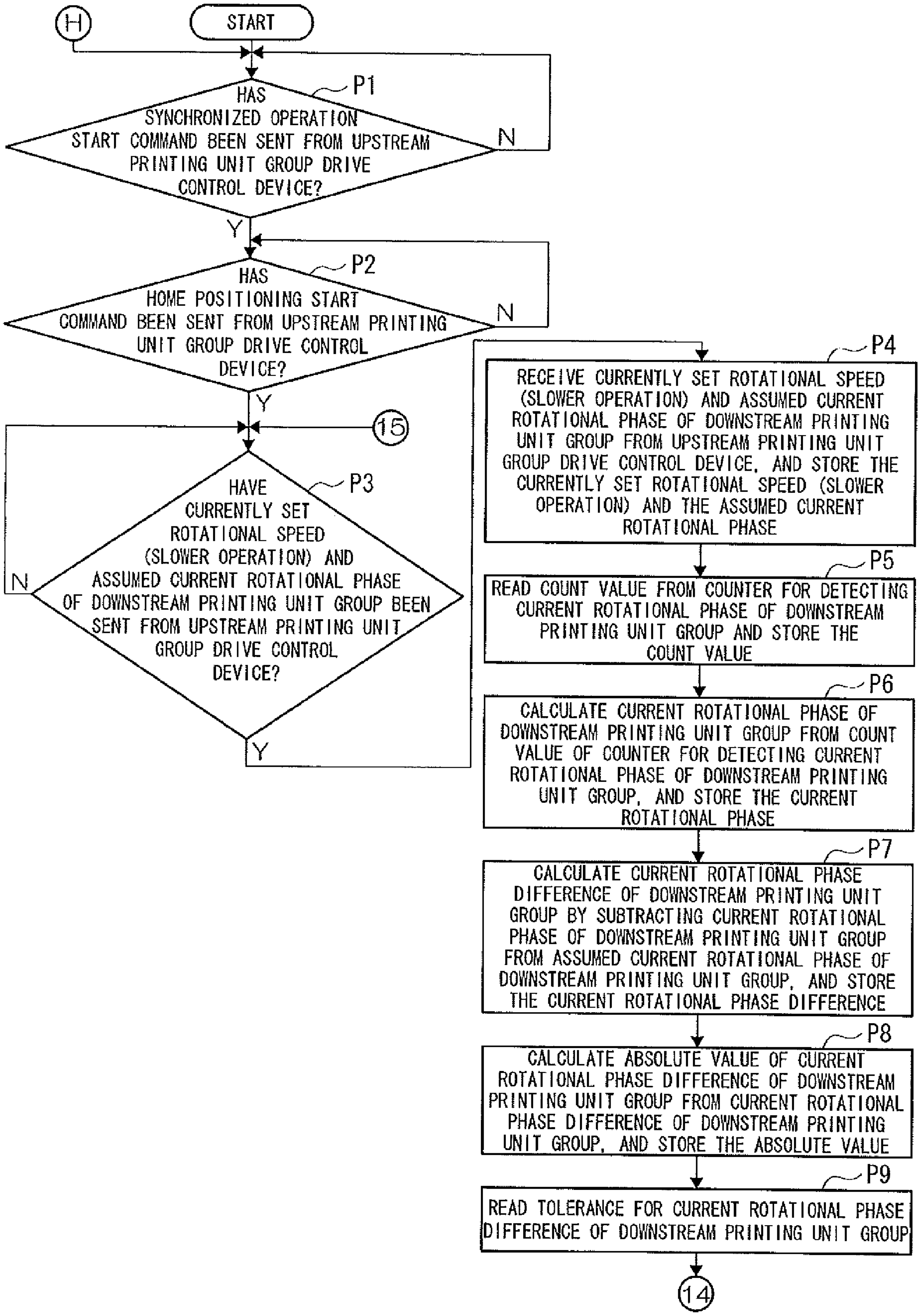

H
START
P1
HAS SYNCHRONIZED OPERATION START COMMAND BEEN SENT FROM UPSTREAM PRINTING UNIT GROUP DRIVE CONTROL DEVICE?
N
Y
P2
HAS HOME POSITIONING START COMMAND BEEN SENT FROM UPSTREAM PRINTING UNIT GROUP DRIVE CONTROL DEVICE?
N
Y
15
P3
HAVE CURRENTLY SET ROTATIONAL SPEED (SLOWER OPERATION) AND ASSUMED CURRENT ROTATIONAL PHASE OF DOWNSTREAM PRINTING UNIT GROUP BEEN SENT FROM UPSTREAM PRINTING UNIT GROUP DRIVE CONTROL DEVICE?
N
Y
P4
RECEIVE CURRENTLY SET ROTATIONAL SPEED (SLOWER OPERATION) AND ASSUMED CURRENT ROTATIONAL PHASE OF DOWNSTREAM PRINTING UNIT GROUP FROM UPSTREAM PRINTING UNIT GROUP DRIVE CONTROL DEVICE, AND STORE THE CURRENTLY SET ROTATIONAL SPEED (SLOWER OPERATION) AND THE ASSUMED CURRENT ROTATIONAL PHASE
P5
READ COUNT VALUE FROM COUNTER FOR DETECTING CURRENT ROTATIONAL PHASE OF DOWNSTREAM PRINTING UNIT GROUP AND STORE THE COUNT VALUE
P6
CALCULATE CURRENT ROTATIONAL PHASE OF DOWNSTREAM PRINTING UNIT GROUP FROM COUNT VALUE OF COUNTER FOR DETECTING CURRENT ROTATIONAL PHASE OF DOWNSTREAM PRINTING UNIT GROUP, AND STORE THE CURRENT ROTATIONAL PHASE
P7
CALCULATE CURRENT ROTATIONAL PHASE DIFFERENCE OF DOWNSTREAM PRINTING UNIT GROUP BY SUBTRACTING CURRENT ROTATIONAL PHASE OF DOWNSTREAM PRINTING UNIT GROUP FROM ASSUMED CURRENT ROTATIONAL PHASE OF DOWNSTREAM PRINTING UNIT GROUP, AND STORE THE CURRENT ROTATIONAL PHASE DIFFERENCE
P8
CALCULATE ABSOLUTE VALUE OF CURRENT ROTATIONAL PHASE DIFFERENCE OF DOWNSTREAM PRINTING UNIT GROUP FROM CURRENT ROTATIONAL PHASE DIFFERENCE OF DOWNSTREAM PRINTING UNIT GROUP, AND STORE THE ABSOLUTE VALUE
P9
READ TOLERANCE FOR CURRENT ROTATIONAL PHASE DIFFERENCE OF DOWNSTREAM PRINTING UNIT GROUP
14

Fig.8B

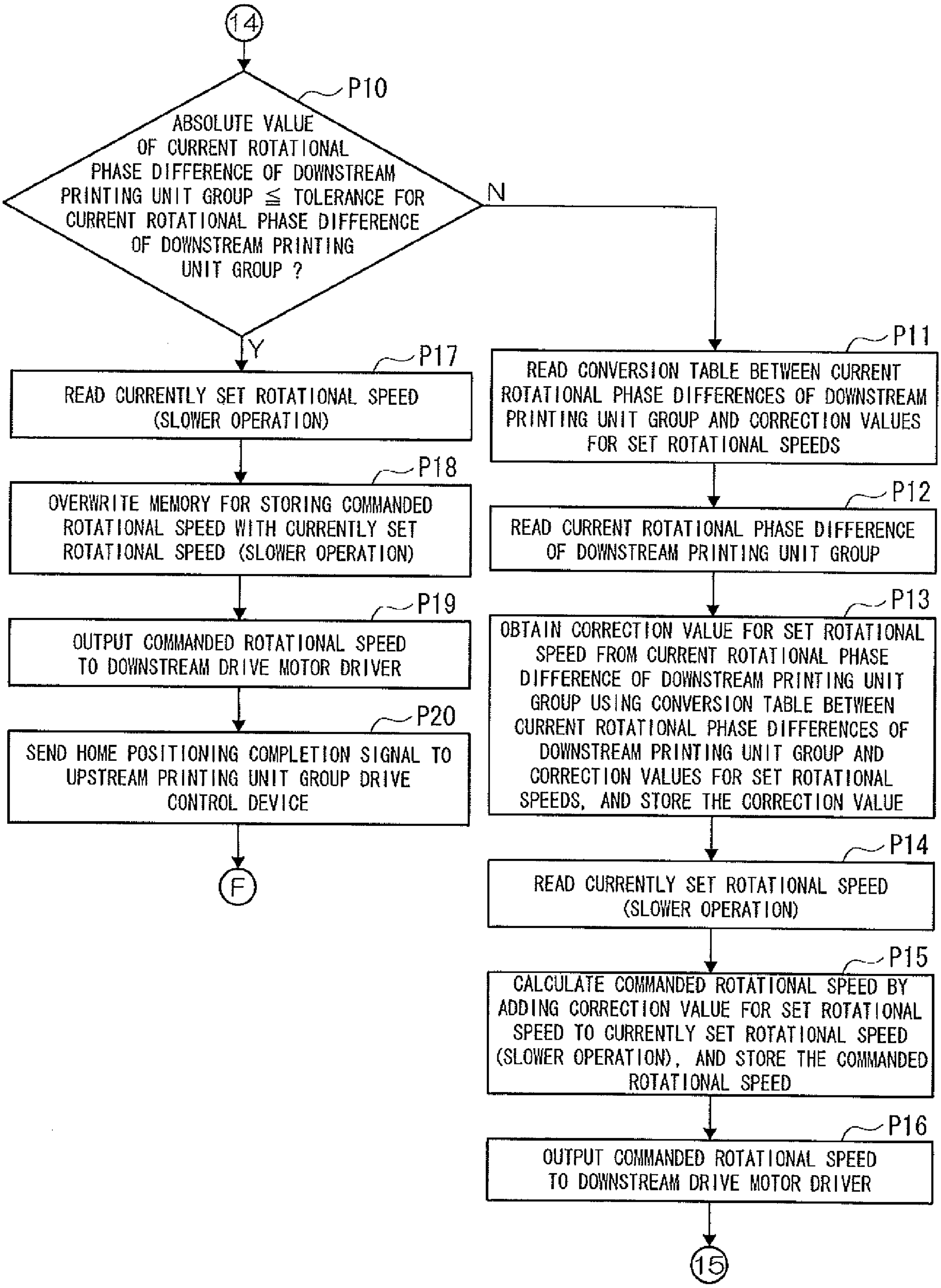

14
P10
ABSOLUTE VALUE OF CURRENT ROTATIONAL PHASE DIFFERENCE OF DOWNSTREAM PRINTING UNIT GROUP ≦ TOLERANCE FOR CURRENT ROTATIONAL PHASE DIFFERENCE OF DOWNSTREAM PRINTING UNIT GROUP ?
N
Y
P17
READ CURRENTLY SET ROTATIONAL SPEED (SLOWER OPERATION)
P18
OVERWRITE MEMORY FOR STORING COMMANDED ROTATIONAL SPEED WITH CURRENTLY SET ROTATIONAL SPEED (SLOWER OPERATION)
P19
OUTPUT COMMANDED ROTATIONAL SPEED TO DOWNSTREAM DRIVE MOTOR DRIVER
P20
SEND HOME POSITIONING COMPLETION SIGNAL TO UPSTREAM PRINTING UNIT GROUP DRIVE CONTROL DEVICE
F
P11
READ CONVERSION TABLE BETWEEN CURRENT ROTATIONAL PHASE DIFFERENCES OF DOWNSTREAM PRINTING UNIT GROUP AND CORRECTION VALUES FOR SET ROTATIONAL SPEEDS
P12
READ CURRENT ROTATIONAL PHASE DIFFERENCE OF DOWNSTREAM PRINTING UNIT GROUP
P13
OBTAIN CORRECTION VALUE FOR SET ROTATIONAL SPEED FROM CURRENT ROTATIONAL PHASE DIFFERENCE OF DOWNSTREAM PRINTING UNIT GROUP USING CONVERSION TABLE BETWEEN CURRENT ROTATIONAL PHASE DIFFERENCES OF DOWNSTREAM PRINTING UNIT GROUP AND CORRECTION VALUES FOR SET ROTATIONAL SPEEDS, AND STORE THE CORRECTION VALUE
P14
READ CURRENTLY SET ROTATIONAL SPEED (SLOWER OPERATION)
P15
CALCULATE COMMANDED ROTATIONAL SPEED BY ADDING CORRECTION VALUE FOR SET ROTATIONAL SPEED TO CURRENTLY SET ROTATIONAL SPEED (SLOWER OPERATION), AND STORE THE COMMANDED ROTATIONAL SPEED
P16
OUTPUT COMMANDED ROTATIONAL SPEED TO DOWNSTREAM DRIVE MOTOR DRIVER
15

Fig.9A

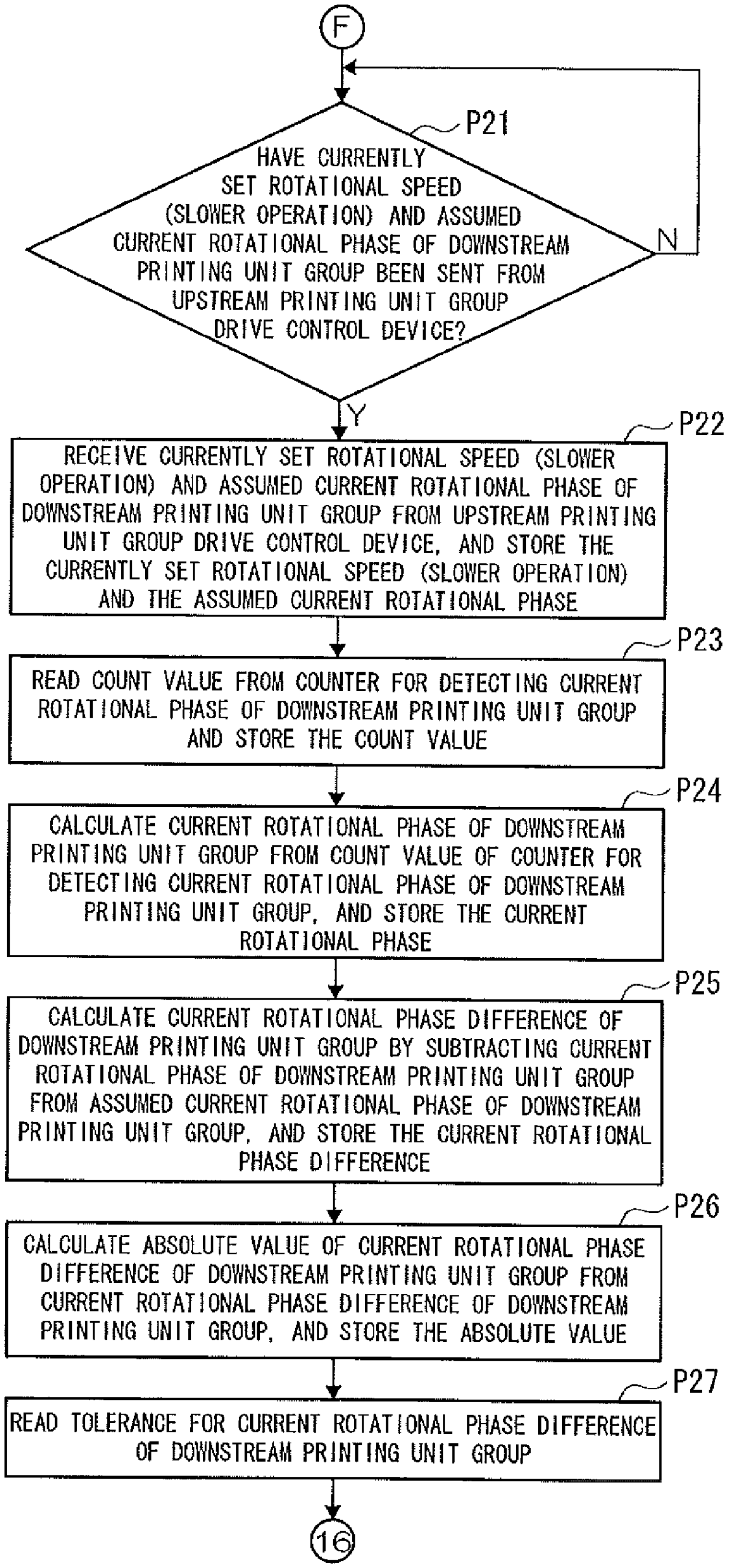

F
P21
HAVE CURRENTLY SET ROTATIONAL SPEED (SLOWER OPERATION) AND ASSUMED CURRENT ROTATIONAL PHASE OF DOWNSTREAM PRINTING UNIT GROUP BEEN SENT FROM UPSTREAM PRINTING UNIT GROUP DRIVE CONTROL DEVICE?
N
Y
P22
RECEIVE CURRENTLY SET ROTATIONAL SPEED (SLOWER OPERATION) AND ASSUMED CURRENT ROTATIONAL PHASE OF DOWNSTREAM PRINTING UNIT GROUP FROM UPSTREAM PRINTING UNIT GROUP DRIVE CONTROL DEVICE, AND STORE THE CURRENTLY SET ROTATIONAL SPEED (SLOWER OPERATION) AND THE ASSUMED CURRENT ROTATIONAL PHASE
P23
READ COUNT VALUE FROM COUNTER FOR DETECTING CURRENT ROTATIONAL PHASE OF DOWNSTREAM PRINTING UNIT GROUP AND STORE THE COUNT VALUE
P24
CALCULATE CURRENT ROTATIONAL PHASE OF DOWNSTREAM PRINTING UNIT GROUP FROM COUNT VALUE OF COUNTER FOR DETECTING CURRENT ROTATIONAL PHASE OF DOWNSTREAM PRINTING UNIT GROUP, AND STORE THE CURRENT ROTATIONAL PHASE
P25
CALCULATE CURRENT ROTATIONAL PHASE DIFFERENCE OF DOWNSTREAM PRINTING UNIT GROUP BY SUBTRACTING CURRENT ROTATIONAL PHASE OF DOWNSTREAM PRINTING UNIT GROUP FROM ASSUMED CURRENT ROTATIONAL PHASE OF DOWNSTREAM PRINTING UNIT GROUP, AND STORE THE CURRENT ROTATIONAL PHASE DIFFERENCE
P26
CALCULATE ABSOLUTE VALUE OF CURRENT ROTATIONAL PHASE DIFFERENCE OF DOWNSTREAM PRINTING UNIT GROUP FROM CURRENT ROTATIONAL PHASE DIFFERENCE OF DOWNSTREAM PRINTING UNIT GROUP, AND STORE THE ABSOLUTE VALUE
P27
READ TOLERANCE FOR CURRENT ROTATIONAL PHASE DIFFERENCE OF DOWNSTREAM PRINTING UNIT GROUP
16

Fig.9B

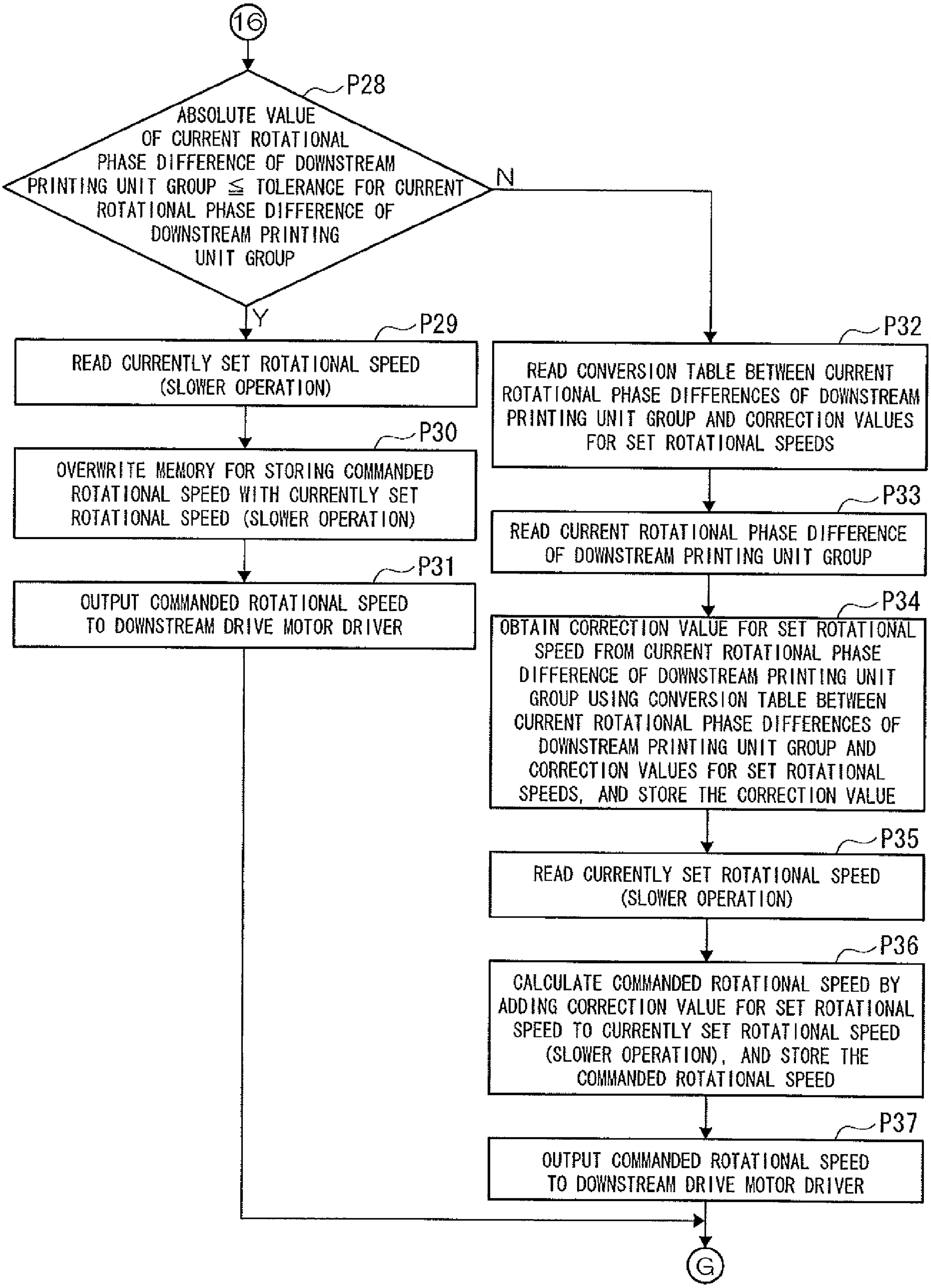

16
P28
ABSOLUTE VALUE OF CURRENT ROTATIONAL PHASE DIFFERENCE OF DOWNSTREAM PRINTING UNIT GROUP ≦ TOLERANCE FOR CURRENT ROTATIONAL PHASE DIFFERENCE OF DOWNSTREAM PRINTING UNIT GROUP
N
Y
P29
READ CURRENTLY SET ROTATIONAL SPEED (SLOWER OPERATION)
P30
OVERWRITE MEMORY FOR STORING COMMANDED ROTATIONAL SPEED WITH CURRENTLY SET ROTATIONAL SPEED (SLOWER OPERATION)
P31
OUTPUT COMMANDED ROTATIONAL SPEED TO DOWNSTREAM DRIVE MOTOR DRIVER
P32
READ CONVERSION TABLE BETWEEN CURRENT ROTATIONAL PHASE DIFFERENCES OF DOWNSTREAM PRINTING UNIT GROUP AND CORRECTION VALUES FOR SET ROTATIONAL SPEEDS
P33
READ CURRENT ROTATIONAL PHASE DIFFERENCE OF DOWNSTREAM PRINTING UNIT GROUP
P34
OBTAIN CORRECTION VALUE FOR SET ROTATIONAL SPEED FROM CURRENT ROTATIONAL PHASE DIFFERENCE OF DOWNSTREAM PRINTING UNIT GROUP USING CONVERSION TABLE BETWEEN CURRENT ROTATIONAL PHASE DIFFERENCES OF DOWNSTREAM PRINTING UNIT GROUP AND CORRECTION VALUES FOR SET ROTATIONAL SPEEDS, AND STORE THE CORRECTION VALUE
P35
READ CURRENTLY SET ROTATIONAL SPEED (SLOWER OPERATION)
P36
CALCULATE COMMANDED ROTATIONAL SPEED BY ADDING CORRECTION VALUE FOR SET ROTATIONAL SPEED TO CURRENTLY SET ROTATIONAL SPEED (SLOWER OPERATION), AND STORE THE COMMANDED ROTATIONAL SPEED
P37
OUTPUT COMMANDED ROTATIONAL SPEED TO DOWNSTREAM DRIVE MOTOR DRIVER
G

Fig.10A

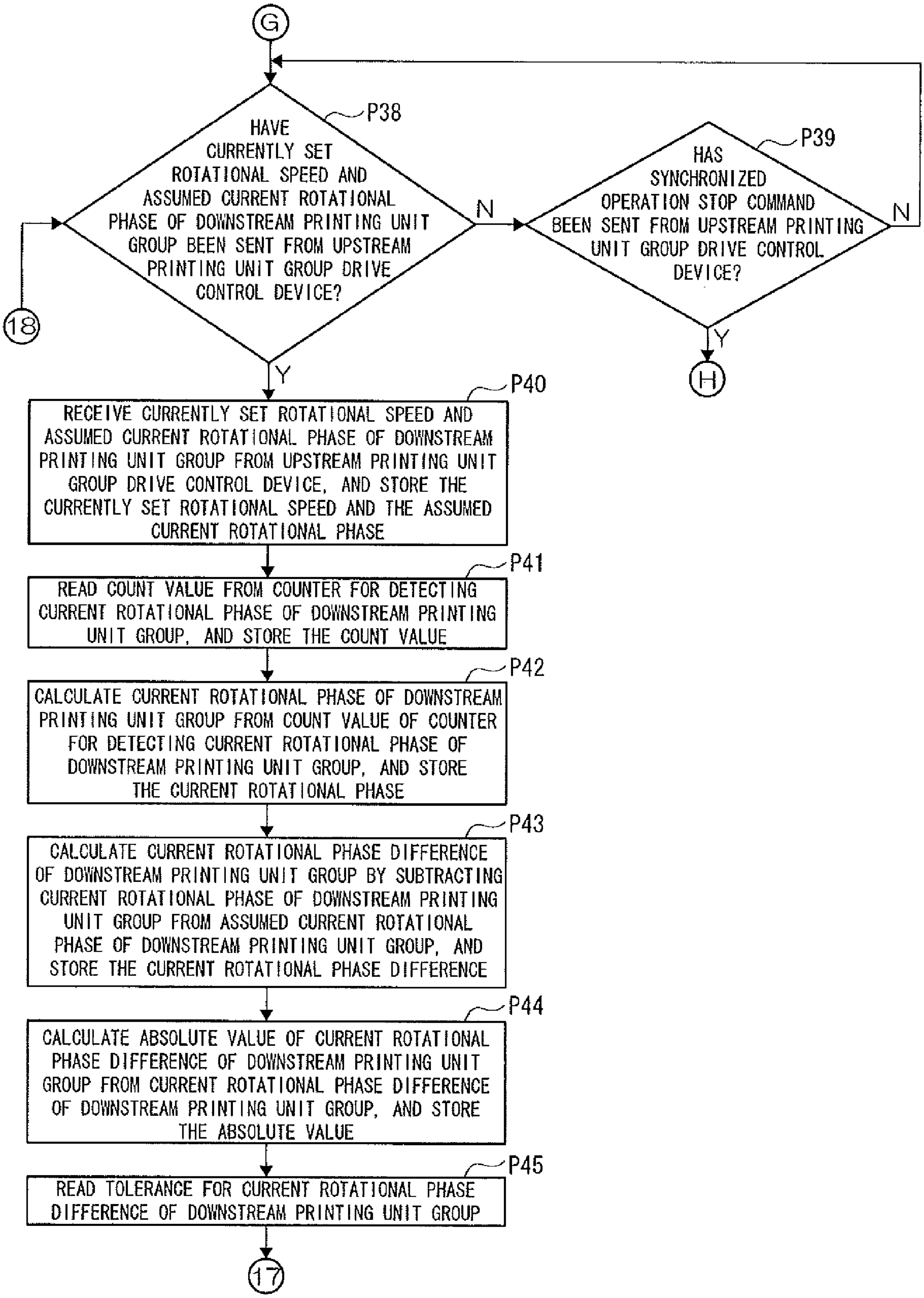

G
HAVE CURRENTLY SET ROTATIONAL SPEED AND ASSUMED CURRENT ROTATIONAL PHASE OF DOWNSTREAM PRINTING UNIT GROUP BEEN SENT FROM UPSTREAM PRINTING UNIT GROUP DRIVE CONTROL DEVICE?
P38
N
Y
HAS SYNCHRONIZED OPERATION STOP COMMAND BEEN SENT FROM UPSTREAM PRINTING UNIT GROUP DRIVE CONTROL DEVICE?
P39
N
Y
H
18
RECEIVE CURRENTLY SET ROTATIONAL SPEED AND ASSUMED CURRENT ROTATIONAL PHASE OF DOWNSTREAM PRINTING UNIT GROUP FROM UPSTREAM PRINTING UNIT GROUP DRIVE CONTROL DEVICE, AND STORE THE CURRENTLY SET ROTATIONAL SPEED AND THE ASSUMED CURRENT ROTATIONAL PHASE
P40
READ COUNT VALUE FROM COUNTER FOR DETECTING CURRENT ROTATIONAL PHASE OF DOWNSTREAM PRINTING UNIT GROUP, AND STORE THE COUNT VALUE
P41
CALCULATE CURRENT ROTATIONAL PHASE OF DOWNSTREAM PRINTING UNIT GROUP FROM COUNT VALUE OF COUNTER FOR DETECTING CURRENT ROTATIONAL PHASE OF DOWNSTREAM PRINTING UNIT GROUP, AND STORE THE CURRENT ROTATIONAL PHASE
P42
CALCULATE CURRENT ROTATIONAL PHASE DIFFERENCE OF DOWNSTREAM PRINTING UNIT GROUP BY SUBTRACTING CURRENT ROTATIONAL PHASE OF DOWNSTREAM PRINTING UNIT GROUP FROM ASSUMED CURRENT ROTATIONAL PHASE OF DOWNSTREAM PRINTING UNIT GROUP, AND STORE THE CURRENT ROTATIONAL PHASE DIFFERENCE
P43
CALCULATE ABSOLUTE VALUE OF CURRENT ROTATIONAL PHASE DIFFERENCE OF DOWNSTREAM PRINTING UNIT GROUP FROM CURRENT ROTATIONAL PHASE DIFFERENCE OF DOWNSTREAM PRINTING UNIT GROUP, AND STORE THE ABSOLUTE VALUE
P44
READ TOLERANCE FOR CURRENT ROTATIONAL PHASE DIFFERENCE OF DOWNSTREAM PRINTING UNIT GROUP
P45
17

Fig.10B

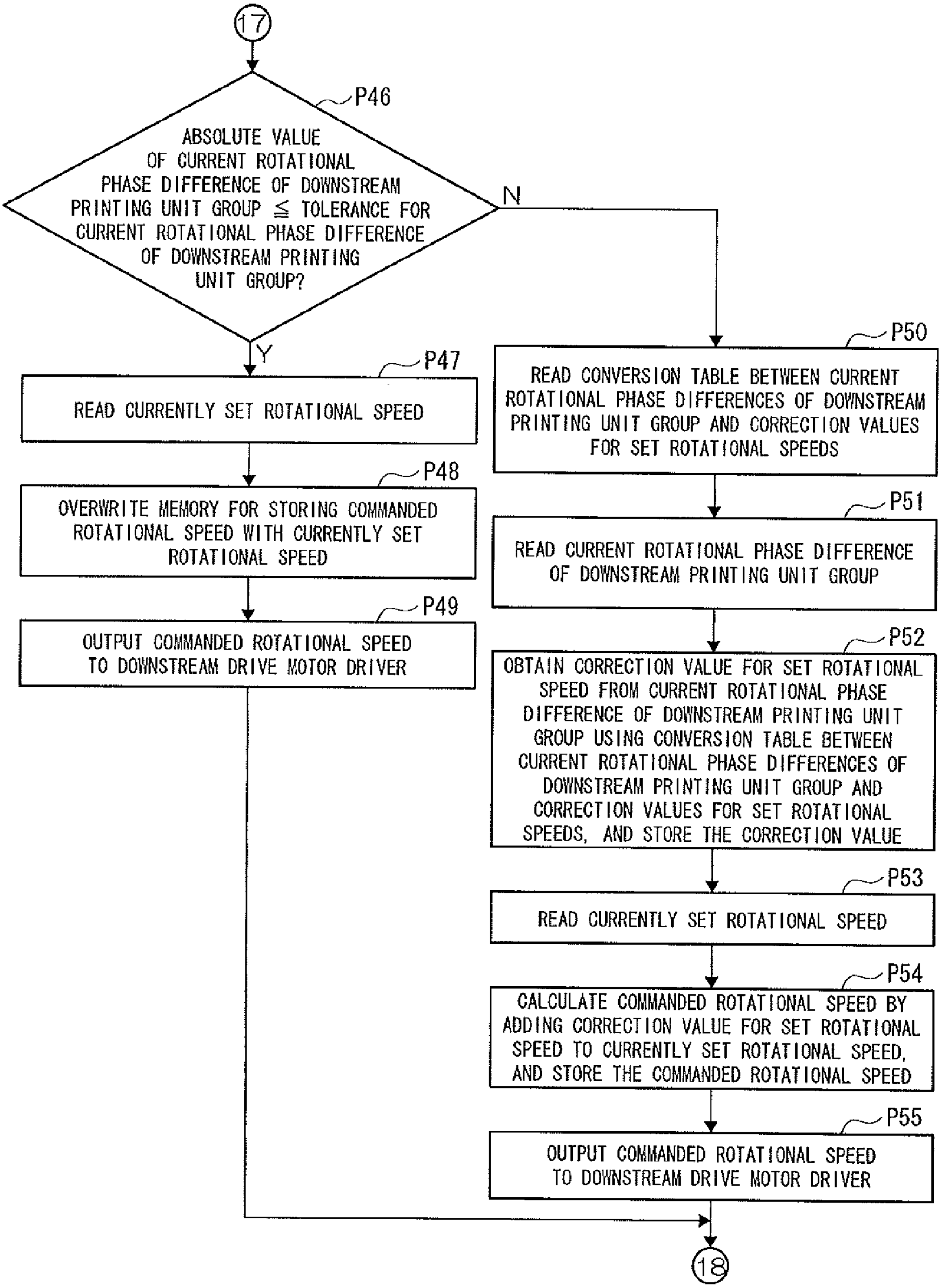

17
P46
ABSOLUTE VALUE OF CURRENT ROTATIONAL PHASE DIFFERENCE OF DOWNSTREAM PRINTING UNIT GROUP ≦ TOLERANCE FOR CURRENT ROTATIONAL PHASE DIFFERENCE OF DOWNSTREAM PRINTING UNIT GROUP?
N
Y
P47
READ CURRENTLY SET ROTATIONAL SPEED
P48
OVERWRITE MEMORY FOR STORING COMMANDED ROTATIONAL SPEED WITH CURRENTLY SET ROTATIONAL SPEED
P49
OUTPUT COMMANDED ROTATIONAL SPEED TO DOWNSTREAM DRIVE MOTOR DRIVER
P50
READ CONVERSION TABLE BETWEEN CURRENT ROTATIONAL PHASE DIFFERENCES OF DOWNSTREAM PRINTING UNIT GROUP AND CORRECTION VALUES FOR SET ROTATIONAL SPEEDS
P51
READ CURRENT ROTATIONAL PHASE DIFFERENCE OF DOWNSTREAM PRINTING UNIT GROUP
P52
OBTAIN CORRECTION VALUE FOR SET ROTATIONAL SPEED FROM CURRENT ROTATIONAL PHASE DIFFERENCE OF DOWNSTREAM PRINTING UNIT GROUP USING CONVERSION TABLE BETWEEN CURRENT ROTATIONAL PHASE DIFFERENCES OF DOWNSTREAM PRINTING UNIT GROUP AND CORRECTION VALUES FOR SET ROTATIONAL SPEEDS, AND STORE THE CORRECTION VALUE
P53
READ CURRENTLY SET ROTATIONAL SPEED
P54
CALCULATE COMMANDED ROTATIONAL SPEED BY ADDING CORRECTION VALUE FOR SET ROTATIONAL SPEED TO CURRENTLY SET ROTATIONAL SPEED, AND STORE THE COMMANDED ROTATIONAL SPEED
P55
OUTPUT COMMANDED ROTATIONAL SPEED TO DOWNSTREAM DRIVE MOTOR DRIVER
18

Fig.11A

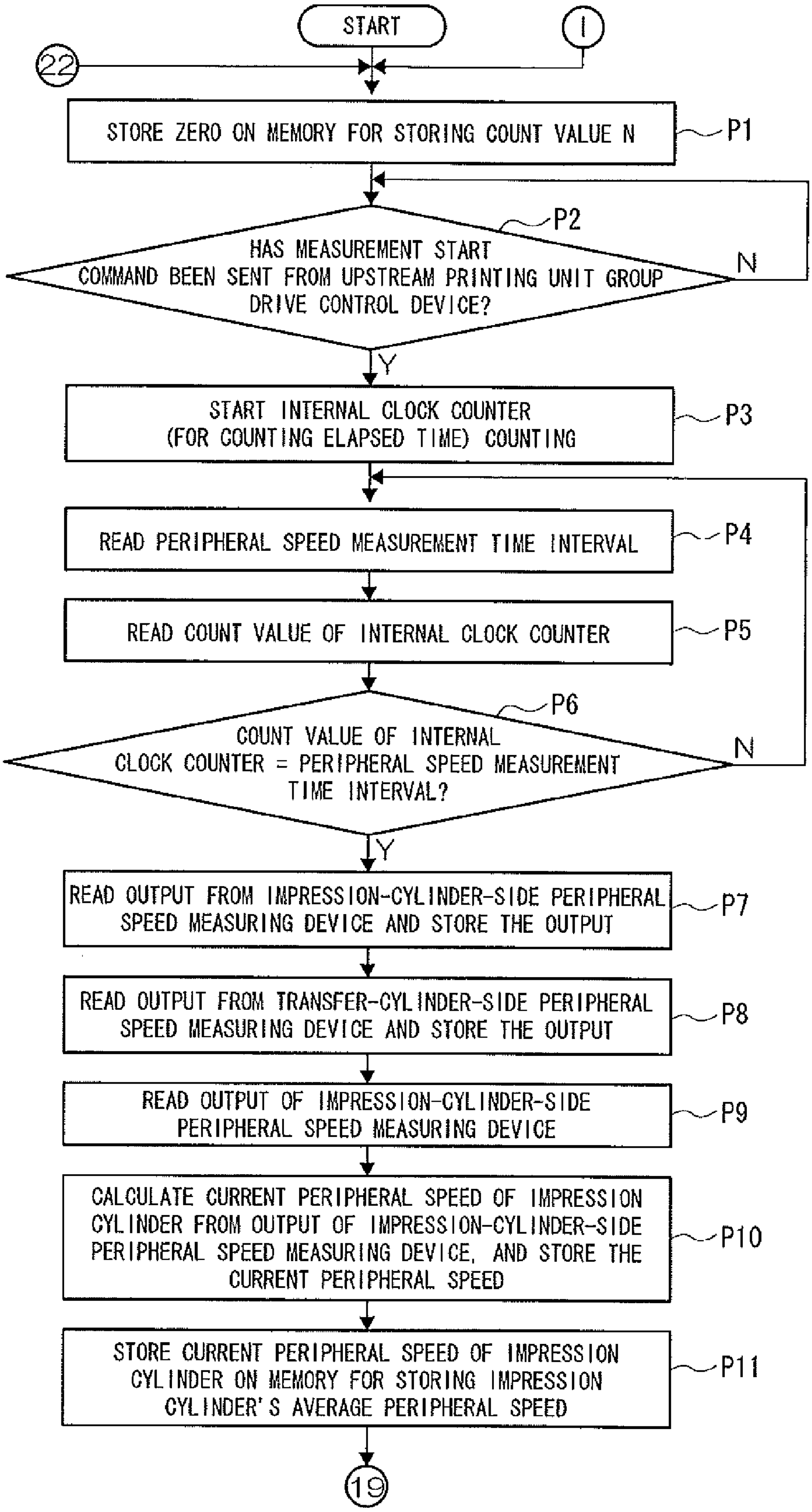
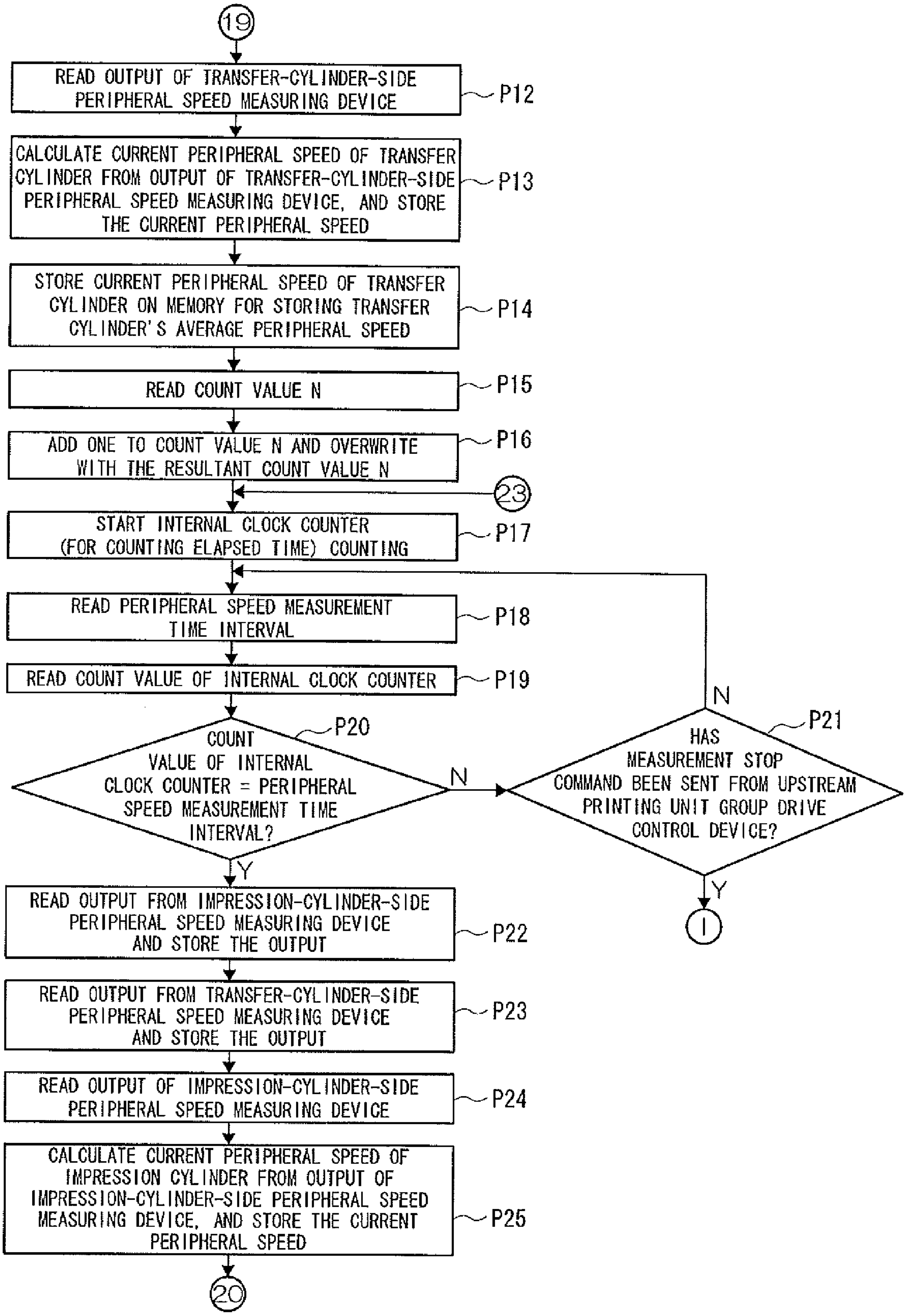

START
1
22
STORE ZERO ON MEMORY FOR STORING COUNT VALUE N
P1
HAS MEASUREMENT START COMMAND BEEN SENT FROM UPSTREAM PRINTING UNIT GROUP DRIVE CONTROL DEVICE?
P2
N
Y
START INTERNAL CLOCK COUNTER (FOR COUNTING ELAPSED TIME) COUNTING
P3
READ PERIPHERAL SPEED MEASUREMENT TIME INTERVAL
P4
READ COUNT VALUE OF INTERNAL CLOCK COUNTER
P5
COUNT VALUE OF INTERNAL CLOCK COUNTER = PERIPHERAL SPEED MEASUREMENT TIME INTERVAL?
P6
N
Y
READ OUTPUT FROM IMPRESSION-CYLINDER-SIDE PERIPHERAL SPEED MEASURING DEVICE AND STORE THE OUTPUT
P7
READ OUTPUT FROM TRANSFER-CYLINDER-SIDE PERIPHERAL SPEED MEASURING DEVICE AND STORE THE OUTPUT
P8
READ OUTPUT OF IMPRESSION-CYLINDER-SIDE PERIPHERAL SPEED MEASURING DEVICE
P9
CALCULATE CURRENT PERIPHERAL SPEED OF IMPRESSION CYLINDER FROM OUTPUT OF IMPRESSION-CYLINDER-SIDE PERIPHERAL SPEED MEASURING DEVICE, AND STORE THE CURRENT PERIPHERAL SPEED
P10
STORE CURRENT PERIPHERAL SPEED OF IMPRESSION CYLINDER ON MEMORY FOR STORING IMPRESSION CYLINDER'S AVERAGE PERIPHERAL SPEED
P11
19

Fig.11B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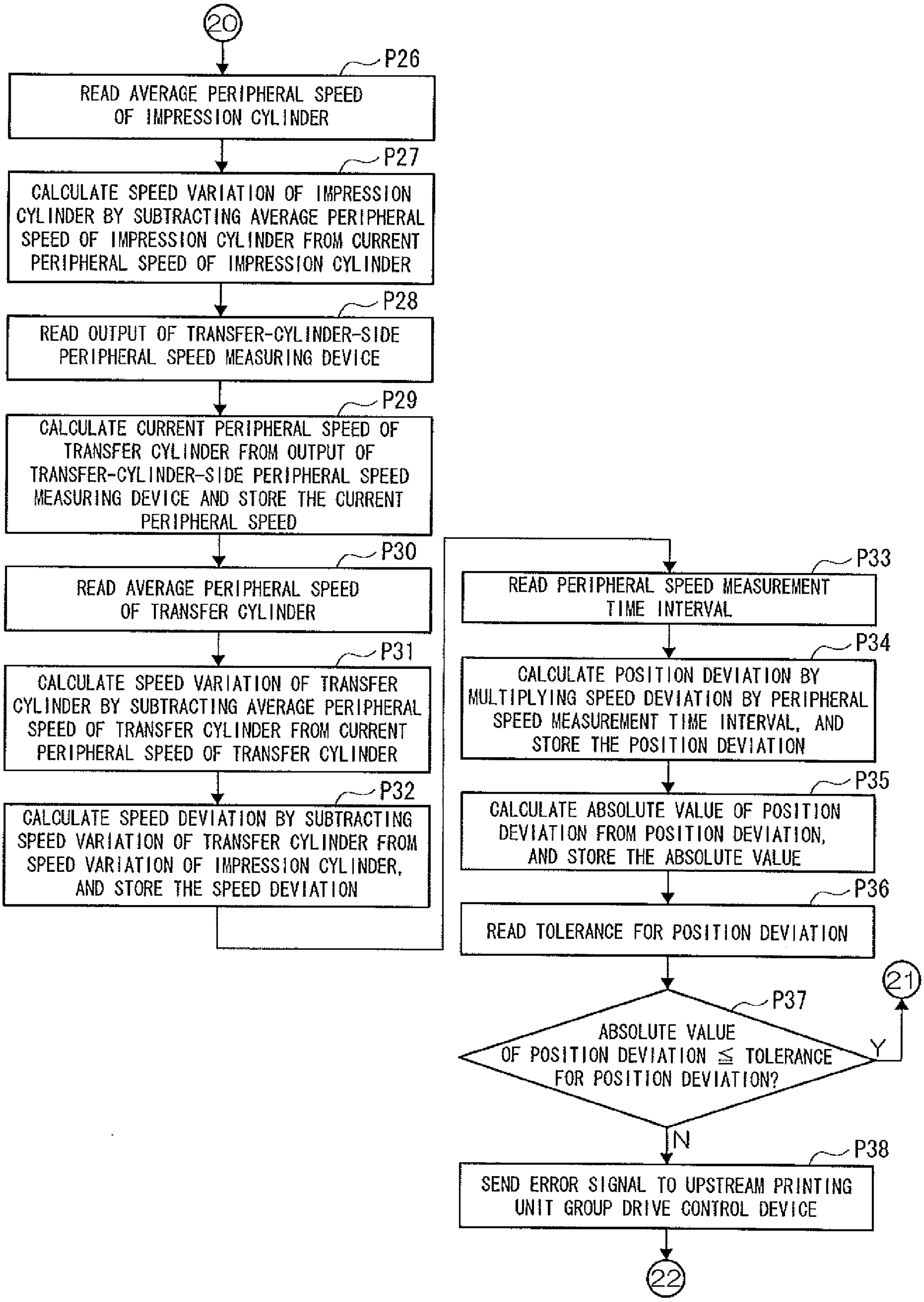
READ OUTPUT OF TRANSFER-CYLINDER-SIDE PERIPHERAL SPEED MEASURING DEVICE
P12
CALCULATE CURRENT PERIPHERAL SPEED OF TRANSFER CYLINDER FROM OUTPUT OF TRANSFER-CYLINDER-SIDE PERIPHERAL SPEED MEASURING DEVICE, AND STORE THE CURRENT PERIPHERAL SPEED
P13
STORE CURRENT PERIPHERAL SPEED OF TRANSFER CYLINDER ON MEMORY FOR STORING TRANSFER CYLINDER'S AVERAGE PERIPHERAL SPEED
P14
READ COUNT VALUE N
P15
ADD ONE TO COUNT VALUE N AND OVERWRITE WITH THE RESULTANT COUNT VALUE N
P16
23
START INTERNAL CLOCK COUNTER (FOR COUNTING ELAPSED TIME) COUNTING
P17
READ PERIPHERAL SPEED MEASUREMENT TIME INTERVAL
P18
READ COUNT VALUE OF INTERNAL CLOCK COUNTER
P19
COUNT VALUE OF INTERNAL CLOCK COUNTER = PERIPHERAL SPEED MEASUREMENT TIME INTERVAL?
P20
N
Y
HAS MEASUREMENT STOP COMMAND BEEN SENT FROM UPSTREAM PRINTING UNIT GROUP DRIVE CONTROL DEVICE?
P21
N
Y
I
READ OUTPUT FROM IMPRESSION-CYLINDER-SIDE PERIPHERAL SPEED MEASURING DEVICE AND STORE THE OUTPUT
P22
READ OUTPUT FROM TRANSFER-CYLINDER-SIDE PERIPHERAL SPEED MEASURING DEVICE AND STORE THE OUTPUT
P23
READ OUTPUT OF IMPRESSION-CYLINDER-SIDE PERIPHERAL SPEED MEASURING DEVICE
P24
CALCULATE CURRENT PERIPHERAL SPEED OF IMPRESSION CYLINDER FROM OUTPUT OF IMPRESSION-CYLINDER-SIDE PERIPHERAL SPEED MEASURING DEVICE, AND STORE THE CURRENT PERIPHERAL SPEED
P25
20

Fig.11C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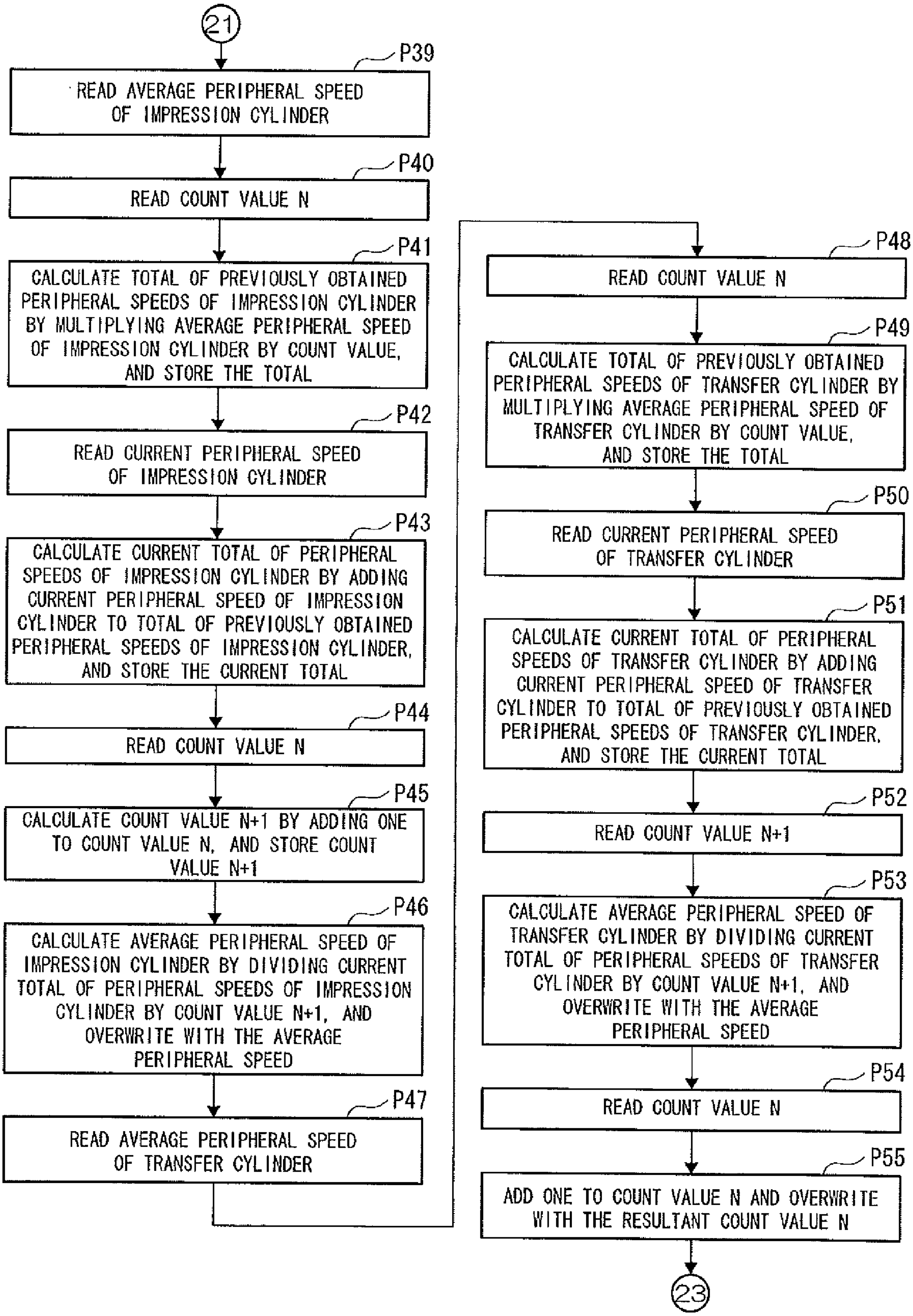
P26
READ AVERAGE PERIPHERAL SPEED OF IMPRESSION CYLINDER
P27
CALCULATE SPEED VARIATION OF IMPRESSION CYLINDER BY SUBTRACTING AVERAGE PERIPHERAL SPEED OF IMPRESSION CYLINDER FROM CURRENT PERIPHERAL SPEED OF IMPRESSION CYLINDER
P28
READ OUTPUT OF TRANSFER-CYLINDER-SIDE PERIPHERAL SPEED MEASURING DEVICE
P29
CALCULATE CURRENT PERIPHERAL SPEED OF TRANSFER CYLINDER FROM OUTPUT OF TRANSFER-CYLINDER-SIDE PERIPHERAL SPEED MEASURING DEVICE AND STORE THE CURRENT PERIPHERAL SPEED
P30
READ AVERAGE PERIPHERAL SPEED OF TRANSFER CYLINDER
P31
CALCULATE SPEED VARIATION OF TRANSFER CYLINDER BY SUBTRACTING AVERAGE PERIPHERAL SPEED OF TRANSFER CYLINDER FROM CURRENT PERIPHERAL SPEED OF TRANSFER CYLINDER
P32
CALCULATE SPEED DEVIATION BY SUBTRACTING SPEED VARIATION OF TRANSFER CYLINDER FROM SPEED VARIATION OF IMPRESSION CYLINDER, AND STORE THE SPEED DEVIATION
P33
READ PERIPHERAL SPEED MEASUREMENT TIME INTERVAL
P34
CALCULATE POSITION DEVIATION BY MULTIPLYING SPEED DEVIATION BY PERIPHERAL SPEED MEASUREMENT TIME INTERVAL, AND STORE THE POSITION DEVIATION
P35
CALCULATE ABSOLUTE VALUE OF POSITION DEVIATION FROM POSITION DEVIATION, AND STORE THE ABSOLUTE VALUE
P36
READ TOLERANCE FOR POSITION DEVIATION
P37
ABSOLUTE VALUE OF POSITION DEVIATION ≦ TOLERANCE FOR POSITION DEVIATION?
Y
21
N
P38
SEND ERROR SIGNAL TO UPSTREAM PRINTING UNIT GROUP DRIVE CONTROL DEVICE
22

Fig.11D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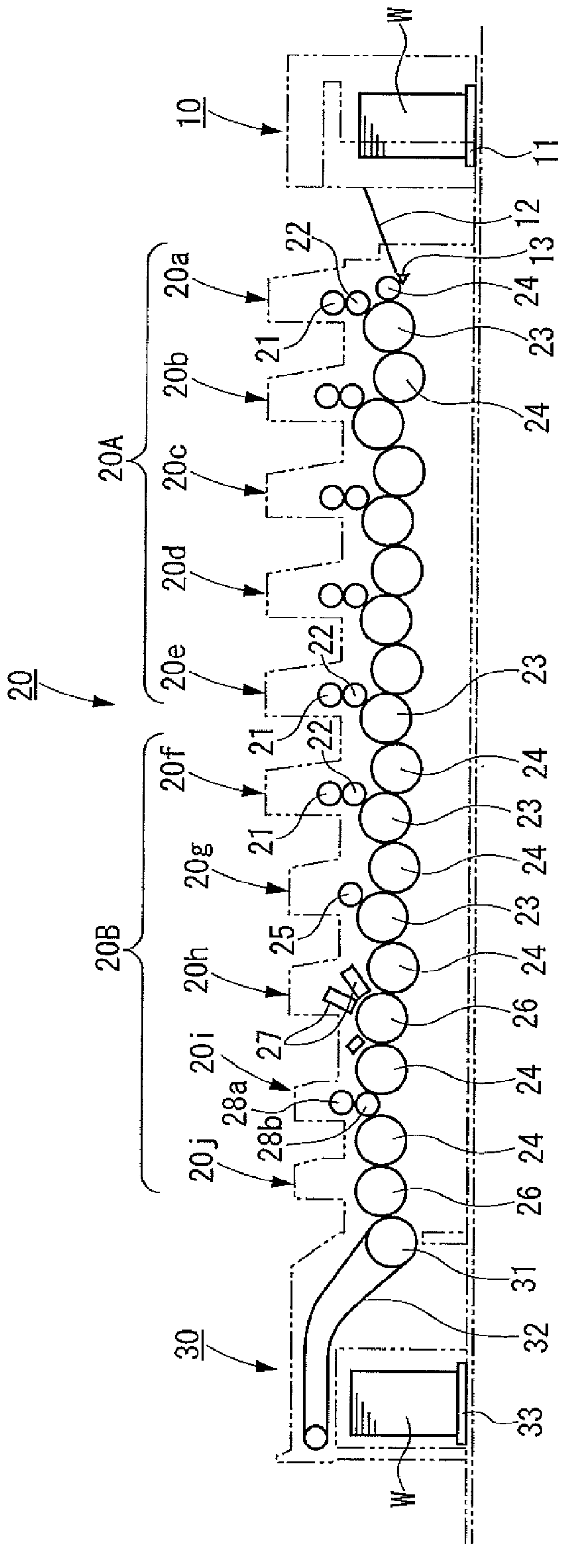
P39
READ AVERAGE PERIPHERAL SPEED OF IMPRESSION CYLINDER
P40
READ COUNT VALUE N
P41
CALCULATE TOTAL OF PREVIOUSLY OBTAINED PERIPHERAL SPEEDS OF IMPRESSION CYLINDER BY MULTIPLYING AVERAGE PERIPHERAL SPEED OF IMPRESSION CYLINDER BY COUNT VALUE, AND STORE THE TOTAL
P42
READ CURRENT PERIPHERAL SPEED OF IMPRESSION CYLINDER
P43
CALCULATE CURRENT TOTAL OF PERIPHERAL SPEEDS OF IMPRESSION CYLINDER BY ADDING CURRENT PERIPHERAL SPEED OF IMPRESSION CYLINDER TO TOTAL OF PREVIOUSLY OBTAINED PERIPHERAL SPEEDS OF IMPRESSION CYLINDER, AND STORE THE CURRENT TOTAL
P44
READ COUNT VALUE N
P45
CALCULATE COUNT VALUE N+1 BY ADDING ONE TO COUNT VALUE N, AND STORE COUNT VALUE N+1
P46
CALCULATE AVERAGE PERIPHERAL SPEED OF IMPRESSION CYLINDER BY DIVIDING CURRENT TOTAL OF PERIPHERAL SPEEDS OF IMPRESSION CYLINDER BY COUNT VALUE N+1, AND OVERWRITE WITH THE AVERAGE PERIPHERAL SPEED
P47
READ AVERAGE PERIPHERAL SPEED OF TRANSFER CYLINDER
P48
READ COUNT VALUE N
P49
CALCULATE TOTAL OF PREVIOUSLY OBTAINED PERIPHERAL SPEEDS OF TRANSFER CYLINDER BY MULTIPLYING AVERAGE PERIPHERAL SPEED OF TRANSFER CYLINDER BY COUNT VALUE, AND STORE THE TOTAL
P50
READ CURRENT PERIPHERAL SPEED OF TRANSFER CYLINDER
P51
CALCULATE CURRENT TOTAL OF PERIPHERAL SPEEDS OF TRANSFER CYLINDER BY ADDING CURRENT PERIPHERAL SPEED OF TRANSFER CYLINDER TO TOTAL OF PREVIOUSLY OBTAINED PERIPHERAL SPEEDS OF TRANSFER CYLINDER, AND STORE THE CURRENT TOTAL
P52
READ COUNT VALUE N+1
P53
CALCULATE AVERAGE PERIPHERAL SPEED OF TRANSFER CYLINDER BY DIVIDING CURRENT TOTAL OF PERIPHERAL SPEEDS OF TRANSFER CYLINDER BY COUNT VALUE N+1, AND OVERWRITE WITH THE AVERAGE PERIPHERAL SPEED
P54
READ COUNT VALUE N
P55
ADD ONE TO COUNT VALUE N AND OVERWRITE WITH THE RESULTANT COUNT VALUE N
23

Fig.12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W
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28a
28b
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32
33
W

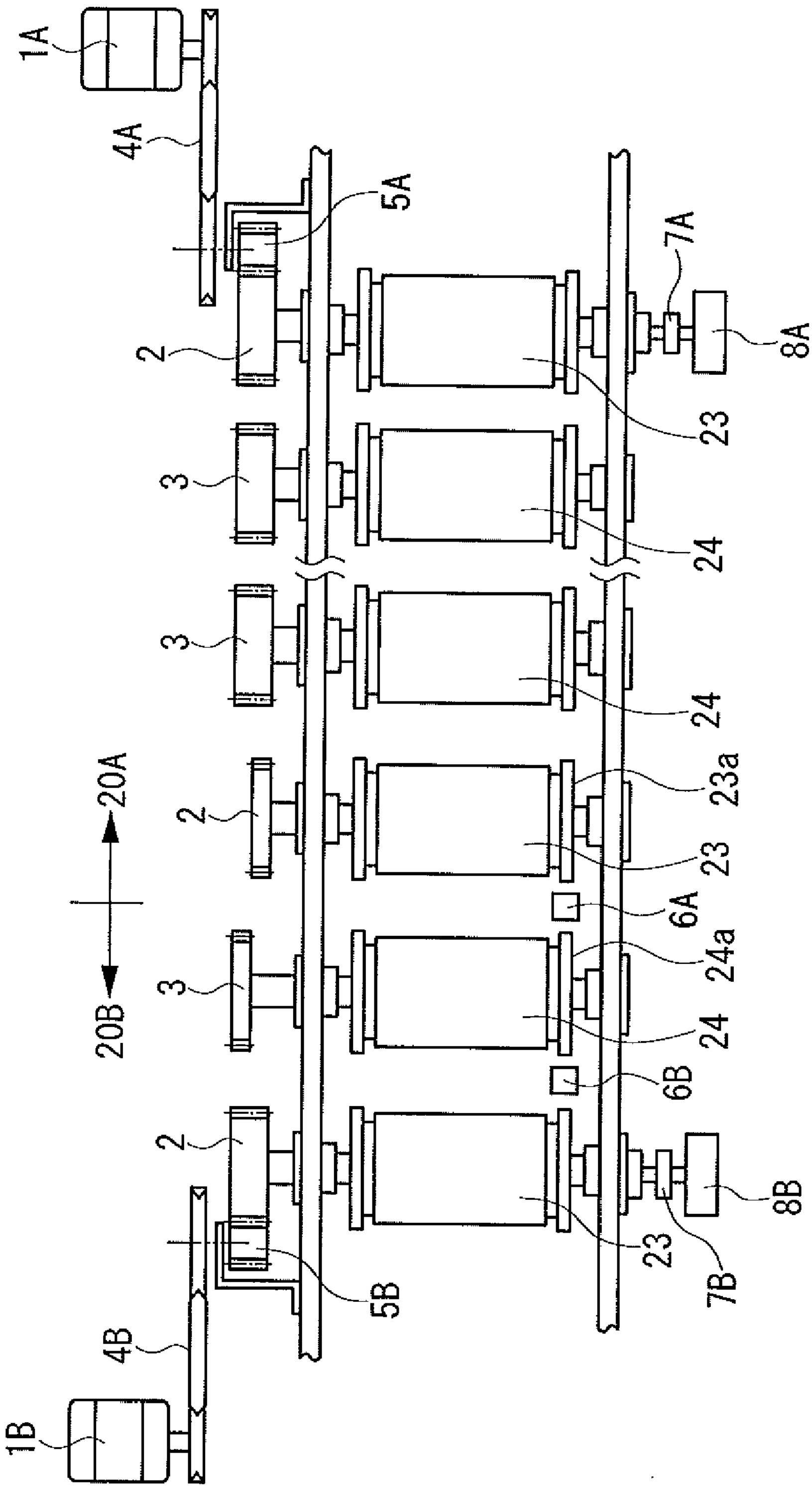
1A
4A
5A
7A
8A
2
23
3
24
3
24
20A
20B
2
23a
23
6A
3
24a
24
6B
2
23
8B
7B
5B
4B
1B

Fig.13

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EUROPEAN SEARCH REPORT

Application Number
EP 09 17 2537

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	DE 103 27 423 A1 (HEIDELBERGER DRUCKMASCH AG [DE]) 5 February 2004 (2004-02-05) * paragraph [0019]; figure 3 * -----	1-10	INV. B41F13/00 B41F33/00
X	EP 1 155 826 A2 (WIFAG MASCHF [CH]) 21 November 2001 (2001-11-21) * paragraph [0040] - paragraph [0051]; figures 4-6 * -----	1-10	
X	US 4 360 354 A (BISHOP THOMAS D) 23 November 1982 (1982-11-23) * column 3, line 66 - column 6, line 4; figure 1 * -----	1-10	
X,D	EP 1 717 031 A2 (KOMORI PRINTING MACH [JP]) 2 November 2006 (2006-11-02) * paragraph [0044] - paragraph [0049]; figures 3,5 * -----	1-10	

TECHNICAL FIELDS SEARCHED (IPC)

B41F

The present search report has been drawn up for all claims

3

Place of search	Date of completion of the search	Examiner
Munich	16 December 2009	Findeli, Bernard

CATEGORY OF CITED DOCUMENTS

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16-12-2009

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE 10327423 A1	05-02-2004	NONE	
EP 1155826 A2	21-11-2001	NONE	
US 4360354 A	23-11-1982	DE 2962802 D1	01-07-1982
		EP 0016084 A1	01-10-1980
		WO 8000231 A1	21-02-1980
		US 4617850 A	21-10-1986
EP 1717031 A2	02-11-2006	CN 1864988 A	22-11-2006
		JP 2006305903 A	09-11-2006
		US 2006260485 A1	23-11-2006

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Patent documents cited in the description

- JP 2006305903 A **[0004]**