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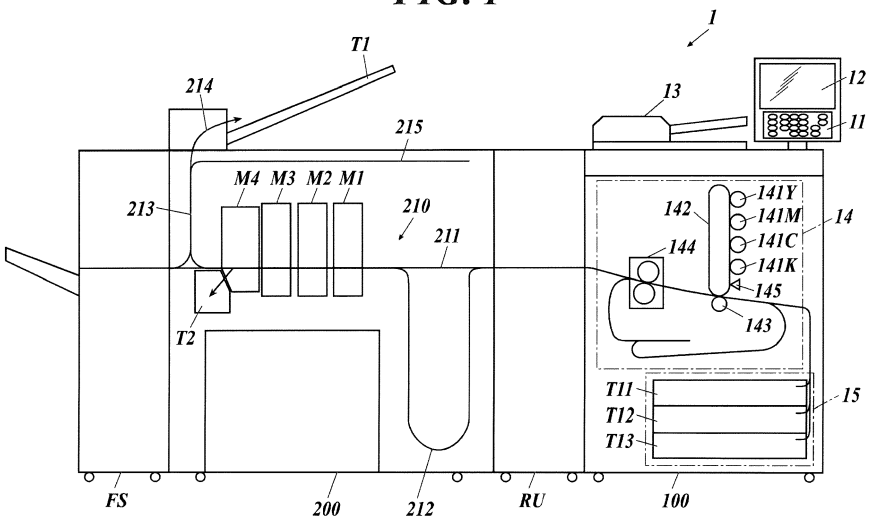
(54) SHEET PROCESSING APPARATUS AND IMAGE FORMING APPARATUS

(57) Disclosed is a sheet processing apparatus (200), including: a sheet conveyer that conveys a sheet; a first type processing unit (M1, M3) that performs first type processing on the sheet in cooperation with conveyance of the sheet by the sheet conveyer; a second type processing unit (M2, M4) that performs second type processing on the sheet while the conveyance of the sheet by the sheet conveyer is stopped; and a hardware processor (220) that controls the sheet conveyer, the first type processing unit (M1, M3) and the second type processing unit (M2, M4), wherein the hardware processor (220) performs a changing control that changes an operation state of the first type processing unit (M1, M3) in the middle of performing the first type processing on the single sheet according to an operation of the second type processing that is performed in the middle of the first type processing.

FIG. 1



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Description

BACKGROUND

Technical Field

[0001] The present invention relates to a sheet processing apparatus and an image forming apparatus.

Description of the Related Art

[0002] Post processing apparatuses (sheet processing apparatuses) have been known in the art, which perform various post processing such as cutting, perforating, binding and creasing on sheets on which an image has been formed by an image forming apparatus main body (e.g. see JP-A 2006-321000 and JP-A 2008-36838).

SUMMARY

[0003] In such a post processing apparatus, a processing unit that performs processing while conveying a sheet may sometimes be mixed with a processing unit that stops conveyance of the sheet when performing processing. An example is cutting in the sheet conveying direction and cutting in the sheet width direction.

[0004] In such cases, for temporal and spatial efficiency, the processing unit that stops conveyance of a sheet and performs processing is disposed in the conveyance zone for the processing unit that perform processing while conveying the sheet. In this case, it is necessary to temporarily stop conveyance of the sheet when the latter processing is performed.

[0005] However, temporarily stopping conveyance of the sheet in the conveyance zone for the processing unit that perform processing while conveying the sheet may have an influence on a processed final product (printed matter), which may result in the degraded processing quality.

[0006] The present invention has been made in view of the above problems in the prior art, and an object of the present invention is to efficiently process a sheet while maintaining the processing quality.

[0007] To achieve at least one of the abovementioned objects, according to an aspect of the present invention, a sheet processing apparatus reflecting one aspect of the present invention comprises: a sheet conveyer that conveys a sheet; a first type processing unit that performs first type processing on the sheet in cooperation with conveyance of the sheet by the sheet conveyer; a second type processing unit that performs second type processing on the sheet while the conveyance of the sheet by the sheet conveyer is stopped; and a hardware processor that controls the sheet conveyer, the first type processing unit and the second type processing unit, wherein the hardware processor performs a changing control that changes an operation state of the first type processing unit in the middle of performing the first type processing on the single sheet according to an operation of the second type processing that is performed in the middle of the first type processing.

[0008] The change of the operation state by the changing control may be a change from a driving state to a stop state.

[0009] The change of the operation state by the changing control may be a change from a driving state to a state freely driven by the conveyance of the sheet.

[0010] The hardware processor may change the operation state of the first type processing unit in the middle of performing the first type processing on the single sheet in response to start of the second type processing and maintains the changed operation state after the second type processing is completed.

[0011] The first type processing unit may comprise a blade for performing the first type processing, and switch a state of the blade between driving rotation by a driving motor and free rotation unengaged from the driving motor according to a control command of the hardware processor.

[0012] The hardware processor may obtain image information on an image to be formed on the single sheet, and in response to a job involving the second type processing that is performed in the middle of the first type processing on the single sheet, make a determination as to whether to perform the changing control based on the image information.

[0013] The hardware processor may make the determination as to whether to perform the changing control based on a position in the sheet where the first type processing is to be performed and the image information.

[0014] To achieve at least one of the abovementioned objects, according to another aspect of the present invention, an image forming apparatus reflecting one aspect of the present invention comprises: an image former that forms an image on a sheet; and the sheet processing apparatus as described above as a post processing apparatus that performs post processing on the sheet on which the image has been formed by the image forming apparatus.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] The advantages and features provided by one or more embodiments of the invention will become more fully understood from the detailed description given hereinbelow and the appended drawings which are given by way of illustration only, and thus are no intended as a definition of the limits of the present invention, wherein:

FIG. 1 illustrates the internal configuration of an image forming apparatus according to an embodiment of the present invention;

FIG. 2 is a functional block diagram of the controlling configuration of the image forming apparatus according to the embodiment of the present invention;

FIG. 3 is a schematic side view of main components

of a sheet processing apparatus according to the embodiment of the present invention;
FIG. 4 is a schematic view from above of the main components of the sheet processing apparatus according to the embodiment of the present invention;
FIG. 5 is another schematic view from above of the main components of the sheet processing apparatus according to the embodiment of the present invention, which is partly different from FIG. 4;
FIG. 6 is a flowchart of sheet processing according to an embodiment of the present invention;
FIG, 7 is a schematic view illustrating an apparatus configuration that corresponds to the timing chart of FIG. 8;
FIG. 8 is a timing chart of the sheet processing according to the embodiment of the present invention; and
FIG. 9 is an example of the sheet processing which is based on the timing chart of FIG. 8.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0016] Hereinafter an embodiment of the present invention will be described referring to the drawings. However, the scope of the invention is not limited to the disclosed embodiments.

Overview of Image Forming Apparatus

[0017] As illustrated in FIG. 1 and FIG. 2, an image forming apparatus 1 according to the embodiment includes an image forming apparatus main body 100, a relay unit RU, a post processing apparatus (sheet processing apparatus) 200 and a finisher FS.

[0018] The image forming apparatus main body 100 electrophotographically forms a color image based on image data that is obtained by scanning an image of an original or received from an external device.

[0019] As illustrated in FIG. 1 and FIG. 2, the image forming apparatus main body 100 includes an operation interface 11, a display 12, an document reading unit 13, an image former 14, a sheet feeder 15, an image formation controller 16, a storage 17, a controller IF (Interface) 18 and an image processor 19.

[0020] The operation interface (reception means) 11 includes a touch panel covering a display screen of the display 12, number buttons, and various operation buttons such as a start button. The operation interface 11 outputs an operation signal to the image formation controller 16 based on a user operation.

[0021] The display (display means) 12, which includes a liquid crystal display (LCD), displays various screens according to an instruction of a display signal from the image formation controller 16.

[0022] The document reading unit 13, which includes an automatic document feeder (ADF), a scanner and the like, reads an image of an original to obtain image data and outputs the image data to the image formation controller 16.

[0023] The image former 14 forms an image on a sheet fed from the sheet feeder 15 based on image data that has been processed by the image processor 19.

[0024] The image former 14 includes photosensitive drums 141Y, 141M, 141C, 141K corresponding respectively to colors of yellow (Y), magenta (M), cyan (C) and black (K), an intermediate transfer belt 142, a secondary transfer roller 143, a fixer 144, a density sensor 145 and the like.

[0025] The photosensitive drum 141Y is uniformly charged and thereafter scanned and exposed by a laser beam based on yellow image data so that an electrostatic latent image is formed. Then, yellow toner is allowed to attach to the electrostatic latent image on the photosensitive drum 141Y so that the image is developed.

[0026] The photosensitive drums 141M, 141C, 141K work similarly as the photosensitive drum 141Y except that the respective colors are different, and the description thereof is omitted.

[0027] The toner images formed on the photosensitive drums 141Y, 141M, 141C, 141K are sequentially transferred onto a rotating intermediate transfer belt 142 (primary transfer). That is, a color toner image in which toner images of four colors are superimposed is formed on the intermediate transfer belt 142. The color toner image on the intermediate transfer belt 142 is collectively transferred onto a sheet by a secondary transfer roller 143 (secondary transfer).

[0028] The fixer 144 includes a heating roller for heating the sheet on which the color toner image has been transferred, and a pressure roller for pressing the sheet. The fixer 144 fixes the color toner image by heat and pressure.

[0029] The sheet feeder 15, which includes sheet feeding trays T11 to T13, feeds sheets to the image former 14. In each of the sheet feeding trays T11 to T13, sheets with predetermined sheet type and size are stored.

[0030] The image formation controller (controlling means) 16 includes a CPU, a ROM and a memory.

[0031] The CPU reads out various processing programs stored in the ROM and integrally controls the operation of the components of the image forming apparatus main body 100 according to the programs. When post processing is performed on an output sheet, the CPU outputs an instruction to the post processing apparatus 200 to execute predetermined post processing.

[0032] The ROM, which includes a non-volatile semiconductor memory and the like, stores various processing programs, parameters for executing the programs, files and the like.

[0033] The memory, which includes a dynamic random access memory (DRAM) and the like, temporarily stores various data such as programs and image data relating to various image processing.

[0034] The storage 17 is a non-volatile storage device such as a hard disk drive or a semiconductor memory for storing various data such as programs and image

data. The storage 17 stores data such as programs and various setting data in a manner readable by the image formation controller 16.

[0035] The controller IF 18 receives image data input from an external device.

[0036] The image processor 19 performs necessary image processing on image data stored in the storage 17, image data obtained by the document reading unit 13 reading an image of an original, or image data input from the external device. The image processor 19 then sends the processed image data to the image former 14. Such image processing include gradation processing, halftone processing, color conversion processing and the like. The gradation processing is to convert the gray level of each pixel in image data to a corrected gray level so that the density characteristic of the image to be formed on a sheet matches a desired density characteristic. The halftone processing is error diffusion processing, screen processing by ordered dithering or the like. The color conversion processing is to convert of RGB levels to CMYK levels.

[0037] The relay unit RU, which is disposed between the image forming apparatus main body 100 and the post processing apparatus 200, has a function of synchronizing with the conveyance speed of a sheet conveyed from the image forming apparatus main body 100.

[0038] The post processing apparatus 200 performs post processing on a sheet that is output from the relay unit, according to need. Examples of such post processing include slitting, gutter slitting, CD cutting, creasing, FD/CD perforating and the like. Post processing is not essential, and the post processing apparatus 200 perform post processing only when instructed by the image forming apparatus main body 100. When there is no post processing to be performed, the post processing apparatus 200 simply conveys a received sheet to the finisher FS.

[0039] As illustrated in FIG. 1 and FIG. 2, the post processing apparatus 200 includes a sheet conveyer 210, post processing units M1 to M4, a purge tray T1 to which a sheet purged from the post processing apparatus 200 is ejected, a card tray T2 to which a sheet cut in the size of a business card or the like by the post processing apparatus 200 is ejected, and a post processing controller 220 (hardware processor).

[0040] The sheet conveyer 210 conveys a sheet received from the relay unit RU to the post processing units M1 to M4. The sheet conveyer 210 further conveys the sheet on which post processing has been performed in the post processing units M1 to M4 to one of the trays (purge tray T1, card tray T2) or the finisher FS.

[0041] The sheet conveyer 210 includes a straight conveyance path 211 having a skew correcting function of correcting skew of a sheet heading to the post processing unit M1, a long sheet unit 212 having a CD (sheet width direction, cross direction) adjusting function of adjusting the position of a long sheet heading to the post processing unit M1 in the cross direction by making the long sheet take a detour, a reverse ejection path 213 for reversing a sheet (up to regular size) after post processing by the post processing units M1 to M4 and ejecting the reversed sheet to the finisher FS, a two-way path 214 that serves as a sheet ejection path for ejecting a sheet to the purge tray T1 as well as a reverse path for reversing the sheet, a long sheet unit 215 for reversing a long sheet after post processing by the post processing units M1 to M4.

[0042] The post processing units M1 to M4 perform post processing on a received sheet. The post processing units M1 to M4 perform post processing on a sheet when a part of the sheet is in a space path (the reverse sheet ejection path 213, the two-way path 214 or the long unit 215).

[0043] The post processing controller 220 includes a CPU, a ROM and a memory.

[0044] The CPU reads out various processing programs stored in the ROM and integrally controls the components of the post processing apparatus 200 according to the programs. For example, the CPU communicates with the image formation controller 16 of the image forming apparatus main body 100. When a setting of reversing the post processing position is received on the operation interface 11, the CPU controls the post processing unit M1 to M4 to perform post processing based on the setting.

[0045] The finisher FS has a function of stapling, folding, punching for a sheet on which an image has been formed.

Interrupt Control of Post Processing

[0046] Next, a process in the post processing apparatus 200 is described referring to FIG. 3 to FIG. 9, in which FD (sheet conveyance direction, feed direction) processing is interrupted by CD processing.

[0047] First, specific examples of processing will be described.

[0048] As illustrated in FIG. 3 and FIG. 4, the post processing units M1 to M4 are arranged in the written order from the upstream of the sheet conveyance.

[0049] The post processing unit M1 cuts a sheet S in the feed direction, which includes a cutting blades M1a that rotate about an axis in the cross direction.

[0050] The post processing unit M2 forms a CD perforation in the sheet, which includes a perforating blade M2a that rotates around an axis in the feed direction and moves in the cross direction.

[0051] The post processing unit M3 forms FD perforations in the sheet S, which includes perforating blades M3a that rotate around an axis in the cross direction.

[0052] Typically, pulleys for pressing the sheet are opposed to the rotating blades.

[0053] The post processing unit M4 cuts the sheet S in the cross direction, which includes an upper movable blade M4a and a lower fixed blade M4a each having a cutting edge extending in the cross direction. The upper movable blade M4a moves up and down.

[0054] As illustrated in FIG. 5, the post processing unit M3 may be a gutter slitter that cuts the sheet S along two cutting lines in the feed direction.

[0055] The FD processing is to process the sheet S in cooperation with the conveyance of the sheet S by the sheet conveyer 210. That is, the FD processing is first type processing. Accordingly, the post processing unit M1 and the post processing unit M3 are first type processing units.

[0056] The CD processing is performed on the sheet S while the conveyance of the sheet S by the sheet conveyer 210 is stopped. That is, the CD processing is second type processing. Accordingly, the post processing unit M2 and the post processing unit M4 are second type processing units.

[0057] The post processing controller 220 controls the sheet conveyer 210, the first type processing units M1, M3 and the second type processing units M2, M4 to perform post processing as described below.

[0058] As illustrated in FIG. 6, the post processing controller 220 obtains post processing information and image information from the image formation controller 16 (SI, S2).

[0059] Next, based on the post processing information, the post processing controller 220 makes a determination as to whether it is necessary to perform CD processing (second type processing) in the middle of FD processing (first type processing) (S3).

[0060] If Yes in Step S3, the post processing controller 220 makes a determination as to whether the FD processing is to be performed in an image area based on the post processing information and the image information (S4). That is, the post processing controller 220 makes a determination as to whether to perform a changing control based on the position in the sheet S where the first type processing is to be performed and the image information. As used herein, the FD processing refers to one that is interrupted by the CD processing.

[0061] As described above, the post processing controller 220 obtains information on the image formed on the single sheet S. When the second type processing is to be performed on the same sheet S in the middle of the first type processing, the post processing controller 220 makes a determination as to whether to perform the changing control based on the image information.

[0062] If Yes in Step S4, the post processing controller 220 stops the sheet conveyance in the middle of the FD processing when the sheet reaches the position for the CD processing. The post processing controller 220 then controls the second type processing unit (M2 or M4) to perform the CD processing. During the CD processing, the post processing controller 220 suspends the operation of the first type processing unit (M1 or M3) that performs the FD processing (S5). As for the post processing unit M1, the post processing controller 220 stops rotation of the cutting blades M1a. As for the post processing unit M3, the post processing controller 220 stops rotation of the perforating blades M3a. While the rotation is stopped, the blade may be freely driven (freely rotatable) according to the conveyance of the sheet S. In this way, the rotation is temporality stopped in synchronization with the stoppage of the sheet conveyance. However, when the sheet conveyance is resumed, the blades (M1a, M3a) are driven by the contacting sheet S and thereby resumes rotation.

[0063] If No in Step S3 or Step S4, the post processing controller 220 stops the sheet conveyance similarly in the middle of the FD processing when the sheet reaches the position for the CD processing. The post processing controller 220 then controls the second processing unit (M2 or M4) to perform the CD processing. However, during the CD processing, the post processing controller 220 continues the operation of the first processing unit (M1 or M3) that performs the FD processing. As for the post processing unit M1, the post processing controller 220 continues rotation of the cutting blades M1a. As for the post processing unit M3, the post processing controller 220 continues rotation of the cutting blades M3a.

[0064] In any case, the first type processing unit (M1 or M3) is in a driving state before the FD processing (first type processing) is stopped due to the interruption by the CD processing.

[0065] The post processing controller 220 performs the post processing according to the above-described setting (S7).

[0066] This is described more specifically with the example shown in FIG. 3 and FIG. 4. In the example, the changing control is to change the state of the perforating blades M3a from driving to driven rotation.

[0067] In FIG. 4, the solid line frame P1 in the sheet S shows cutting lines, the dashed lines P2 show FD perforation lines, the dashed line P3 shows a CD perforation line, and the dashed-dotted lines I show an image area. In FIG. 5, the dashed-dotted lines P4 show gutter slitting lines.

[0068] In the example, the operation of the post processing unit M3 (FD perforating unit) is particularly described.

[0069] When the sheet S with an image printed by the image forming apparatus main body 100 is conveyed and subjected to FD and CD cutting and FD and CD perforating as illustrated in FIG. 4, the process is performed in the following sequence.

[0070] (1) Start FD cutting, (2) start FD perforating, (3) perform CD cutting (front end), (4) perform CD perforating, (5) finish the FD cutting, (6) finish the FD perforating, and (7) perform CD cutting (rear end).

[0071] The above-described process is described in more detail. First, (1) the side end cutting of the sheet S is started, which is performed by the FD cutting post processing unit M1 disposed in the upstream with respect to the sheet S. Then, (2) when the front end of the sheet S reaches the position of the FD perforating blades M3a, the FD perforating is started. In this step, rotation of the FD perforating blades M3a is started before entry of the sheet S. Further, the rotation of the FD perforating blades

M3a is controlled so that the rotation speed becomes equal to the sheet conveyance speed at the time of entry of the sheet S. Then, (3) the sheet S is temporarily stopped at the position for cutting the front end thereof, and the CD cutting is performed by the CD cutting post processing unit M4. In this step, power transmission from a driving motor to the perforating blades M3a is cut off beforehand so that the perforating blades M3a, which were subjected to the rotation control in step (2), are freely rotatable and driven by the sheet. After the CD cutting, the sheet conveyance is resumed, (4) the sheet is stopped at the position for the CD perforating, the CD perforating is performed by the CD perforating post processing unit M2, the sheet conveyance is resumed, (5) the FD cutting and (6) the FD perforating are performed to the rear end of the sheet and finished, (7) the sheet is stopped at the position for the rear-end CD cutting, and the CD cutting is performed by the CD cutting post processing unit M4. Thus, the processing sequence for the single sheet S is completed.

[0072] For the above-described sequence, the first type processing units M1, M3 are configured such that the blades (M1a, M3a) are switchable between driving rotation and free rotation according to a control command from the post processing controller 220. The free rotation refers to a state disengaged from a driving motor. The free rotation of the blades (M1a, M3a) driven by the sheet is necessary only in the conveyance direction. Therefore, only with a one-way clutch provided to each rotation shaft of the blades (M1a, M3a), it is possible to achieve the free rotation of the blades (M1a, M3a) driven by the sheet when the driving motor is stopped.

[0073] As described above, the post processing controller 220 can perform the changing control so as to change the operating state of the first type processing unit (M1, M3) in the middle of the first processing on the sheet S in response to the operation of the second processing that is performed in the middle of the first processing. The post processing controller 220 may be configured such that whether to apply the changing control is selectable according to a user operation on the operation interface (receiving means) 11. When the changing control is applied, conditional application may be further selectable. For example, the application may depend on the sheet type or the like.

[0074] Specifically, the changing control is to change the operating state from a driving state to a halting state. The halting state refers to a state in which the operation is temporarily stopped since the blades are freely rotatable and driven by sheet conveyance. The perforating blades M3a stop the rotation when the conveyance of the sheet S is stopped.

[0075] In the changing control, the post processing controller 220 changes the operation state of the first type processing unit in the middle of the first processing on the single sheet S in response to starting the second type processing, and thereafter maintains the changed operation state even after completion of the second type processing. That is, the perforating blades M3a are driven and rotated by the sheet S when the conveyance of the sheet S is resumed.

[0076] Another specific example is further described referring to FIG. 7, FIG. 8 and FIG. 9.

[0077] FIG. 7 illustrates the apparatus configuration corresponding to the timing chart of FIG. 8, and FIG. 9 illustrates an example of the sheet processing. A FD perforating post processing unit M10 and a CD perforating post processing unit M20 are arranged in the written order from the upstream in the sheet conveyance direction. The post processing unit M10 includes perforating blades MIOa. The post processing unit M20 includes a perforating blade M20a.

[0078] The same reference signs (M01 to M07) are denoted to the drivers and sensors in FIG. 7 and the driving signals and sensor signals in FIG. 8 to show the correspondence between them. The sensors M01, M03, M05, M07 each detect the timing of passage of a sheet.

[0079] In FIG. 8, trigger signals t1 to t11 are shown. The protruding signal SA shown by the dashed line is a driving signal that is sent when the driving rotation of the perforating blade M10a in the post processing unit M10 is resumed after processing by the post processing unit M20 is completed. However, this example is not the case. When the trigger signal t3 is sent to stop the sheet conveyance and the driving of the perforating blade M10a, the perforating blades M10a are stopped and become freely rotatable and driven. When the trigger signal t6 is sent to resume the sheet conveyance, the perforating blades M10a are driven to resume their rotation.

[0080] This is described in more detail.

[0081] When the post processing apparatus 200 receives a sheet S with an image printed by the image forming apparatus main body 100 and an entrance sensor M01 detects the sheet S, the post processing controller 220 turns on the sheet conveyance driving to drive conveying rollers so as to start a sheet conveyance control (tl). When the FD timing sensor M03 detects the sheet S, the post processing controller 220 turns on the FD perforation driving M04 a predetermined time after the detection so as to start the processing for FD perforations P01 (t2). Thereafter, when the CD timing sensor M05 detects the sheet S, the sheet is further conveyed to a predetermined position for CD perforating. Then, the post processing controller 220 turns off the sheet conveyance driving to stop the sheet S and turns off the FD perforation driving M04 (t3, t4). Thereafter, the post processing controller 220 turns on the CD perforation driving M06 to start processing for a CD perforation P02 (t5).

[0082] During the CD perforating, the FD perforation driving is OFF since the sheet S is stopped, and the rotation of the perforating blades M10a is stopped accordingly.

[0083] After the CD perforating is completed, the post processing controller 220 turns on the sheet conveyance driving M02 while keeping the FD perforation driving OFF, so as to start the sheet conveyance control and

resume the FD perforating (t6). The FD perforating is performed by using the sheet conveyance as the driving power, in which the sheet S is conveyed in contact with the perforating blades M10a. Alternatively, the post processing controller 220 may turn on the FD perforation driving M04.

[0084] Thereafter, if the FD perforation driving M04 is on, the FD timing sensor M03 detects the rear end of the sheet S. A predetermined time after the detection, the post processing controller 220 turns off the FD perforation driving M04 so as to finish the processing for the FD perforations P01. (t7)

[0085] Thereafter, when the CD timing sensor M05 detects the rear end of the sheet S, the sheet S is further conveyed to a position for the processing for a CD perforation P03. Then, the post processing controller 220 turns off the sheet conveyance driving M02 (t8) and performs the processing for the CD perforation P03 (t9). After completion of the processing, the post processing controller 220 resumes the sheet conveyance (t10), and the exit sensor M07 detects the rear end of the sheet S. A predetermined time after the detection, the post processing controller 220 turns off the sheet conveyance driving M02 (t11). Thus, the series of processing on the single sheet S is completed.

[0086] As described above, when a sheet is temporarily stopped in a conveyance zone where a processing unit performs processing while conveying the sheet, the stoppage may have an influence on the processed final product (printed matter), which may result in the degraded processing quality.

[0087] However, in the present embodiment, the rotation of the blades for the FD processing is temporarily stopped according to need. This allows efficient sheet processing without causing degradation of the processing quality.

[0088] This is described in more detail.

[0089] A plurality of processing may sometimes have to be performed in parallel on a single sheet. For example, CD processing is performed in the middle of FD processing. In this case, it is necessary to perform the FD processing while rotary driving the blade and conveying the sheet. However, when the CD processing is performed in the middle of this FD processing, it is necessary to stop the sheet.

[0090] Since the FD processing is suspended due to the stoppage of the sheet conveyance, the rotation of the FD processing blade may be either continued or stopped.

[0091] However, a problem occurs in either case. A problem when the rotation of the blade is stopped is follows. If the rotation of the blade does not reach a predetermined speed before the sheet conveyance is resumed, the sheet may not be sharply cut, and a clean cut edge may not be obtained. Further, the temporarily stopping the rotation may lead to the decreased productivity.

[0092] A problem when the rotation of the blade is continued is as follows. If there is an image at the position of the cutting blades as illustrated in FIG. 4 and FIG. 5, the side surfaces of the blades are contaminated by continuously rubbing the image, and the contaminant may be transferred to the edge of the sheet.

[0093] In the embodiments, the rotation of the FD processing blade is suitably controlled based on the processing status of the other CD processing unit, the image position, the processing position and the like. For example, the blade is stopped at a position where there is an image. This allows efficient sheet processing without causing degradation of the processing quality.

[0094] In the above-described embodiments, the interrupting CD processing and the interrupted FD processing are mainly perforating. However, the present invention is not limited thereto. The interrupting CD processing and the interrupted FD processing may be gutter slitting, creasing, folding or the like.

[0095] In the above-described embodiments, the interrupting processing is CD processing. However, the interrupting processing may be any type of second type processing that is performed on a sheet while the sheet conveyance by the sheet conveyer 210 is stopped. For example, punching, which forms a round hole at a predetermined position in a sheet, requires to stop the sheet conveyance. Accordingly, punching is interrupting processing for the first type processing that is performed on the sheet in cooperation with the sheet conveyance by the sheet conveyer 210.

[0096] In the above-described embodiments, the interrupted processing is FD processing. However, the interrupted processing may be any type of first type processing that is performed in cooperation with the sheet conveyance by the sheet conveyer 210. This is because such processing is interrupted processing for the second type processing that is performed while the sheet conveyance is stopped.

[0097] In the above-described embodiments, the blades are changed from a driving state to a driven state so that the rotation is temporarily stopped, and the blades are freely driven when the sheet conveyance is resumed. Instead, the blade may be changed from the driving state to forced stop so that the rotation is temporality stopped, and the driving of the blade may be thereafter resumed.

[0098] Although embodiments of the present invention have been described and illustrated in detail, the disclosed embodiments are made for purposes of illustration and example only and not limitation. The scope of the present invention should be interpreted by terms of the appended claims.

Claims

1. A sheet processing apparatus (200), comprising:

a sheet conveyer (210) that conveys a sheet;
a first type processing unit (M1, M3) that performs first type processing on the sheet in co-

operation with conveyance of the sheet by the sheet conveyer;
a second type processing unit (M2, M4) that performs second type processing on the sheet while the conveyance of the sheet by the sheet conveyer is stopped; and
a hardware processor (220) that controls the sheet conveyer, the first type processing unit (M1, M3) and the second type processing unit (M2, M4),
wherein the hardware processor (220) performs a changing control that changes an operation state of the first type processing unit (M1, M3) in the middle of performing the first type processing on the single sheet according to an operation of the second type processing that is performed in the middle of the first type processing.

2. The sheet processing apparatus (200) according to claim 1, wherein the change of the operation state by the changing control is a change from a driving state to a stop state.

3. The sheet processing apparatus (200) according to claim 1, wherein the change of the operation state by the changing control is a change from a driving state to a state freely driven by the conveyance of the sheet.

4. The sheet processing apparatus (200) according to claim 3, wherein the hardware processor (220) changes the operation state of the first type processing unit (M1, M3) in the middle of performing the first type processing on the single sheet in response to start of the second type processing and maintains the changed operation state after the second type processing is completed.

5. The sheet processing apparatus (200) according to claim 4, wherein the first type processing unit (M1, M3) comprises a blade for performing the first type processing, and switches a state of the blade between driving rotation by a driving motor and free rotation unengaged from the driving motor according to a control command of the hardware processor (220).

6. The sheet processing apparatus (200) according to any one of claims 1 to 5, wherein the hardware processor (220) obtains image information on an image to be formed on the single sheet, and in response to a job involving the second type processing that is performed in the middle of the first type processing on the single sheet, makes a determination as to whether to perform the changing control based on the image information.

7. The sheet processing apparatus (200) according to claim 6, wherein the hardware processor (220) makes the determination as to whether to perform the changing control based on a position in the sheet where the first type processing is to be performed and the image information.

8. An image forming apparatus (1), comprising:

an image former (100) that forms an image on a sheet; and
the sheet processing apparatus (200) according to any one of claims 1 to 7 as a post processing apparatus that performs post processing on the sheet on which the image has been formed by the image forming apparatus.

FIG. 1

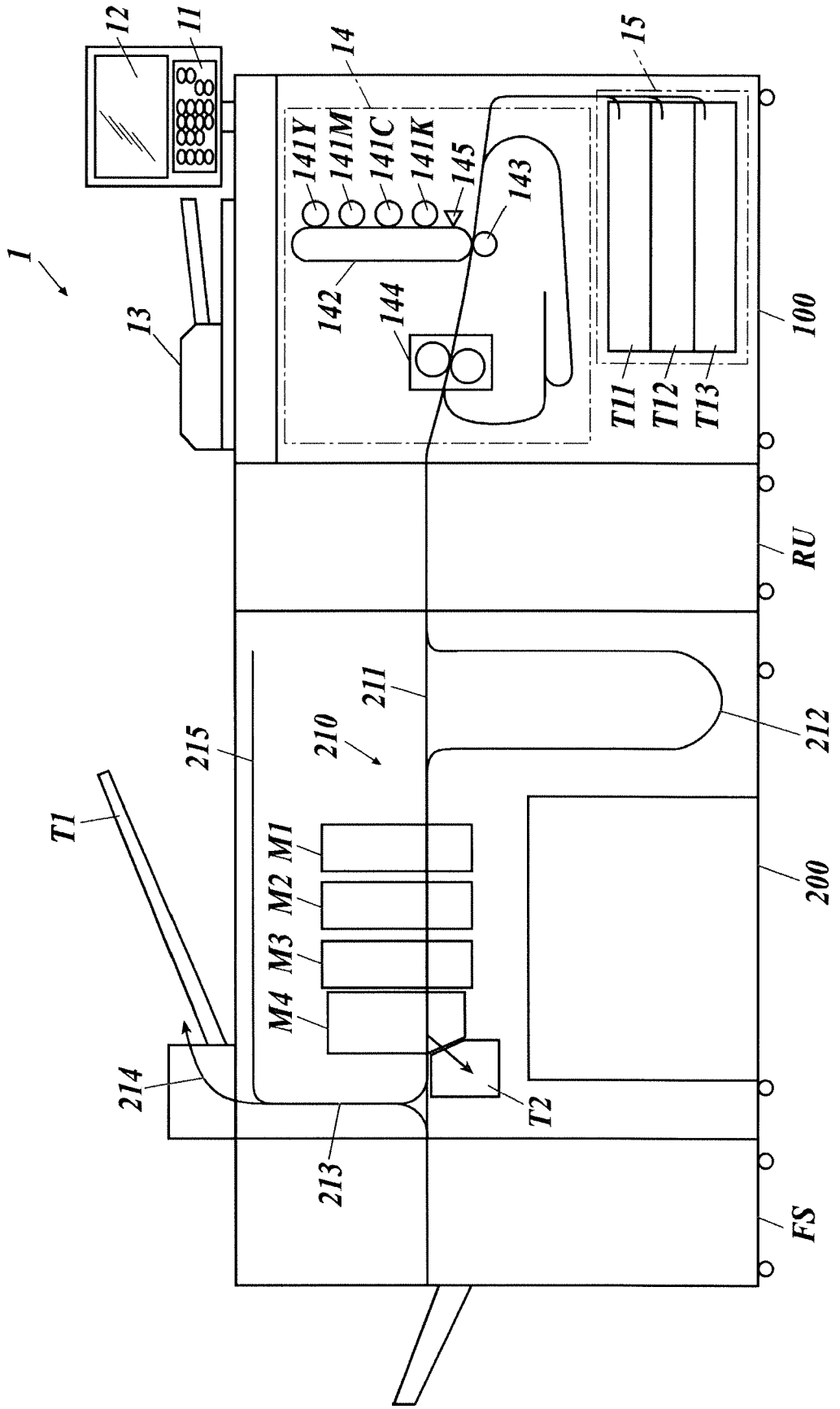

1
11
12
13
14
141Y
141M
141C
141K
142
143
144
145
15
T11
T12
T13
100
RU
210
211
212
215
T1
M1
M2
M3
M4
200
214
213
T2
FS

FIG. 2

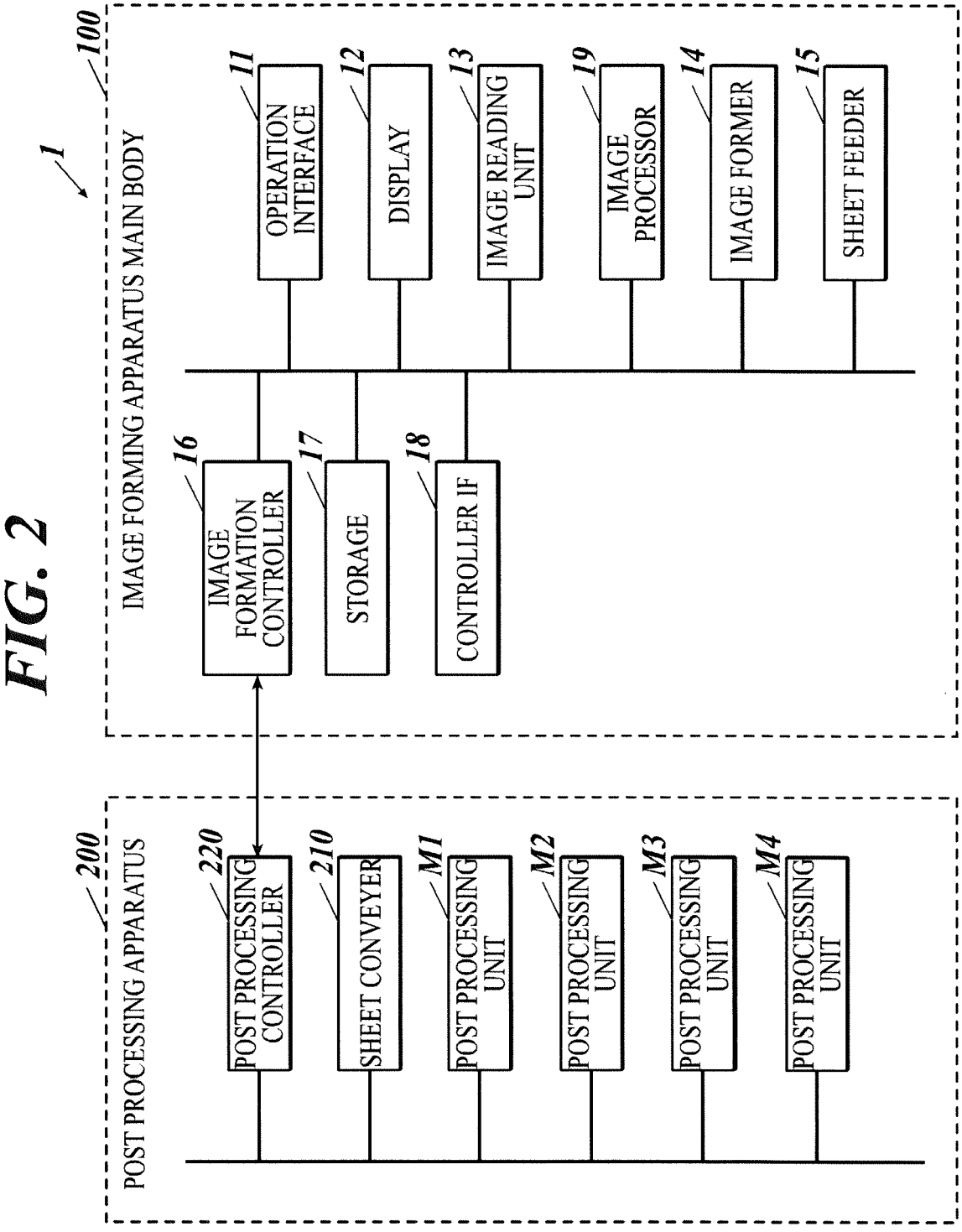

1
100
IMAGE FORMING APPARATUS MAIN BODY
11
OPERATION INTERFACE
12
DISPLAY
13
IMAGE READING UNIT
19
IMAGE PROCESSOR
14
IMAGE FORMER
15
SHEET FEEDER
16
IMAGE FORMATION CONTROLLER
17
STORAGE
18
CONTROLLER IF
200
POST PROCESSING APPARATUS
220
POST PROCESSING CONTROLLER
210
SHEET CONVEYER
M1
POST PROCESSING UNIT
M2
POST PROCESSING UNIT
M3
POST PROCESSING UNIT
M4
POST PROCESSING UNIT

FIG. 3

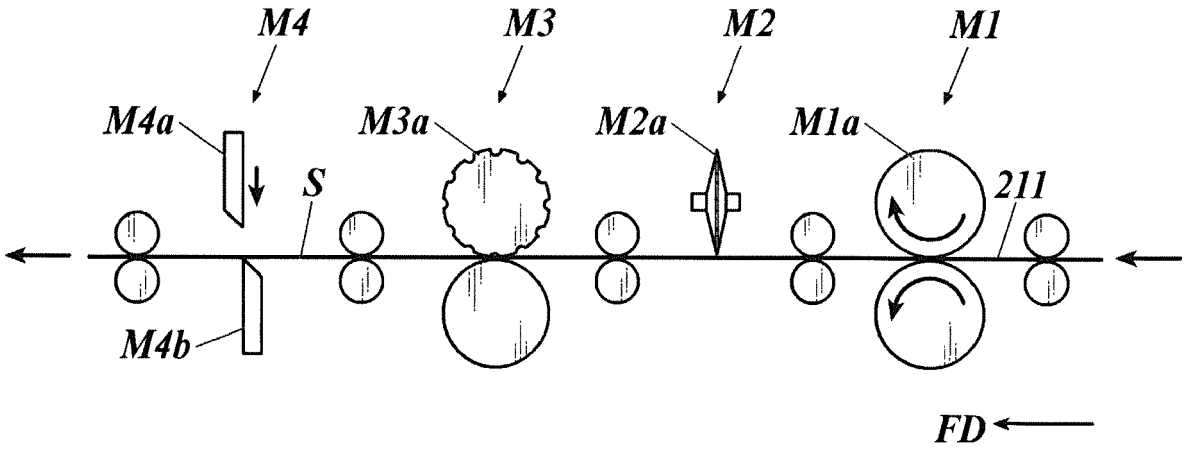


FIG. 4

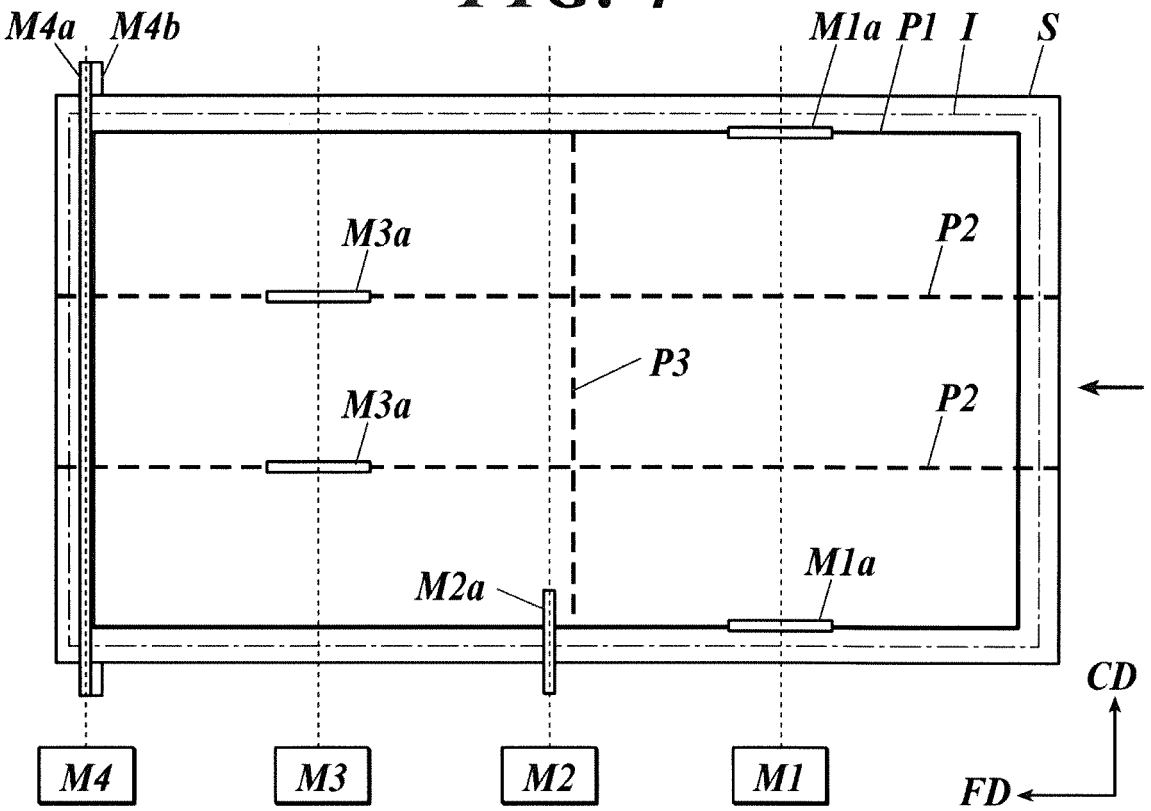

M4a
M4b
M1a
P1
I
S
M3a
P2
P3
M3a
P2
M2a
M1a
M4
M3
M2
M1
CD
FD

FIG. 5

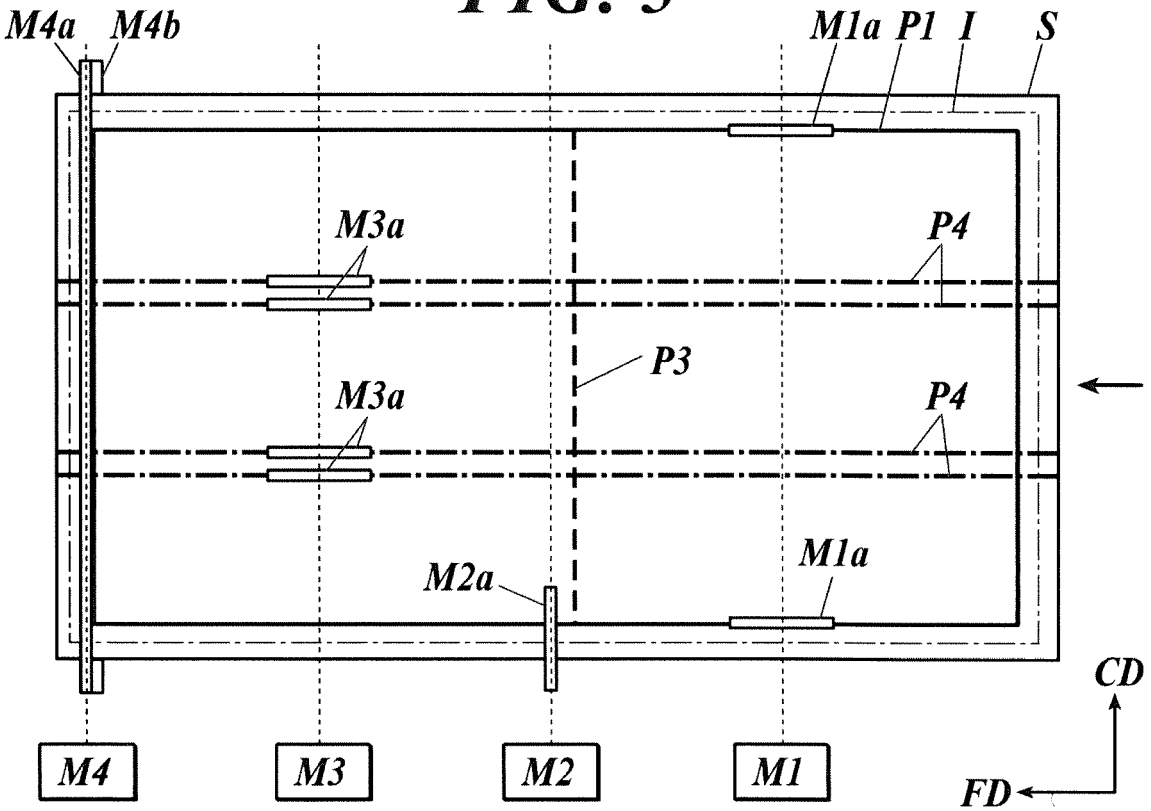

M4a
M4b
M1a
P1
I
S
M3a
P4
P3
M3a
P4
M2a
M1a
M4
M3
M2
M1
CD
FD

FIG. 6

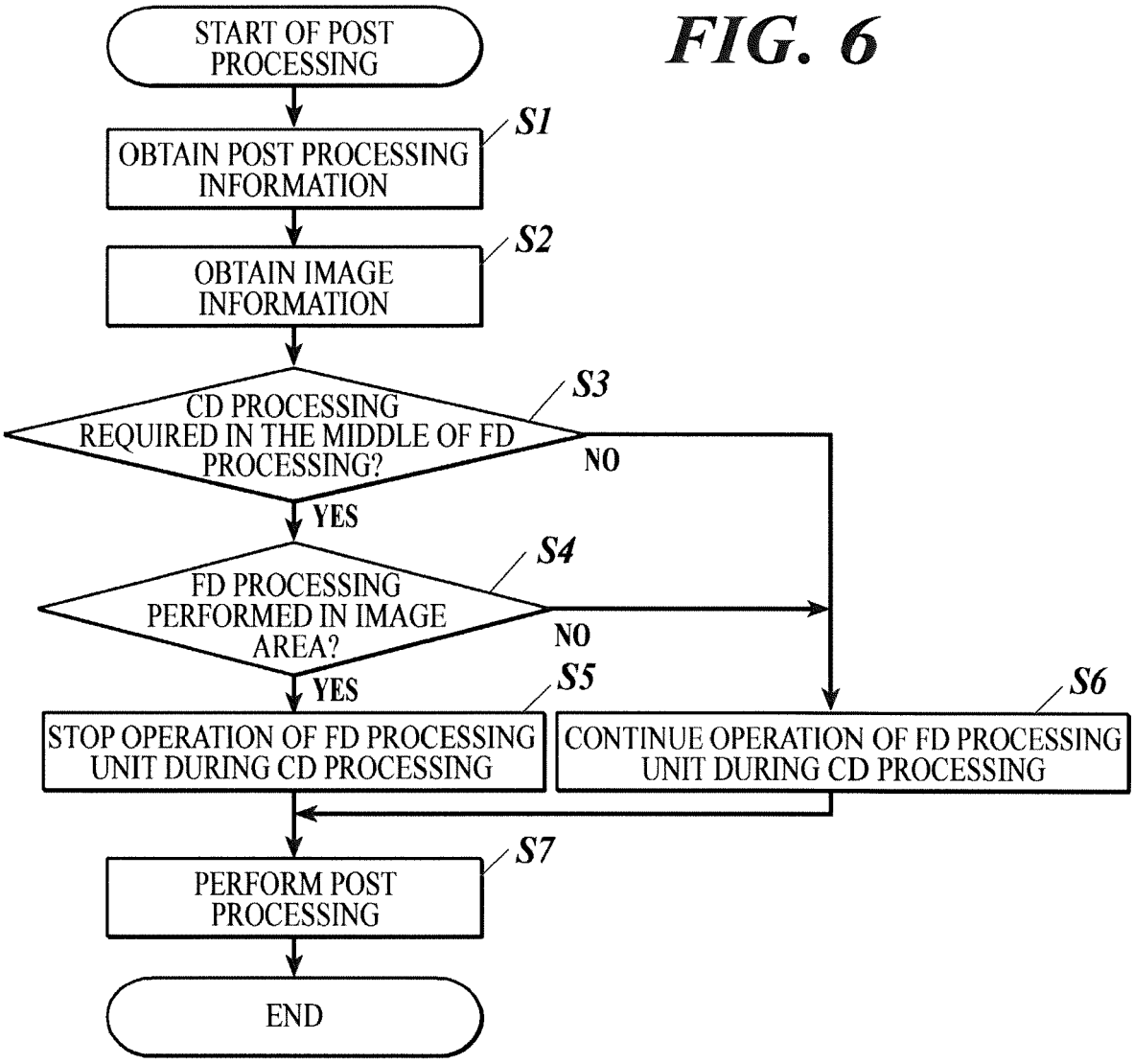

START OF POST PROCESSING
OBTAIN POST PROCESSING INFORMATION
S1
OBTAIN IMAGE INFORMATION
S2
CD PROCESSING REQUIRED IN THE MIDDLE OF FD PROCESSING?
S3
NO
YES
FD PROCESSING PERFORMED IN IMAGE AREA?
S4
NO
YES
STOP OPERATION OF FD PROCESSING UNIT DURING CD PROCESSING
S5
CONTINUE OPERATION OF FD PROCESSING UNIT DURING CD PROCESSING
S6
PERFORM POST PROCESSING
S7
END

FIG. 7

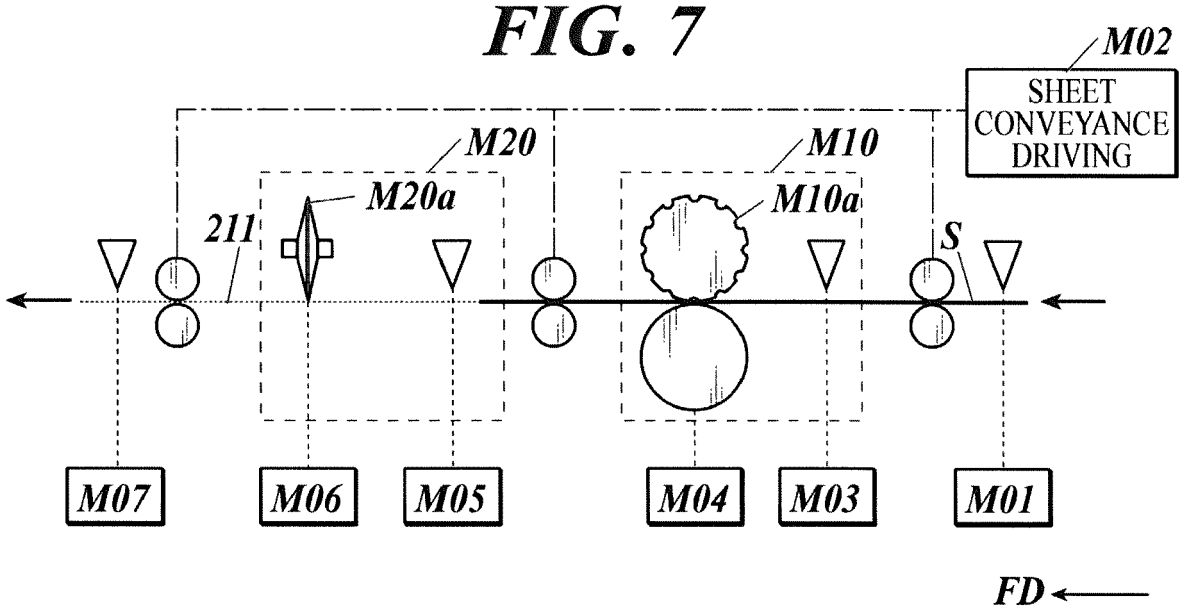

M02
SHEET CONVEYANCE DRIVING
M20
M20a
211
M10
M10a
S
M07
M06
M05
M04
M03
M01
FD

FIG. 8

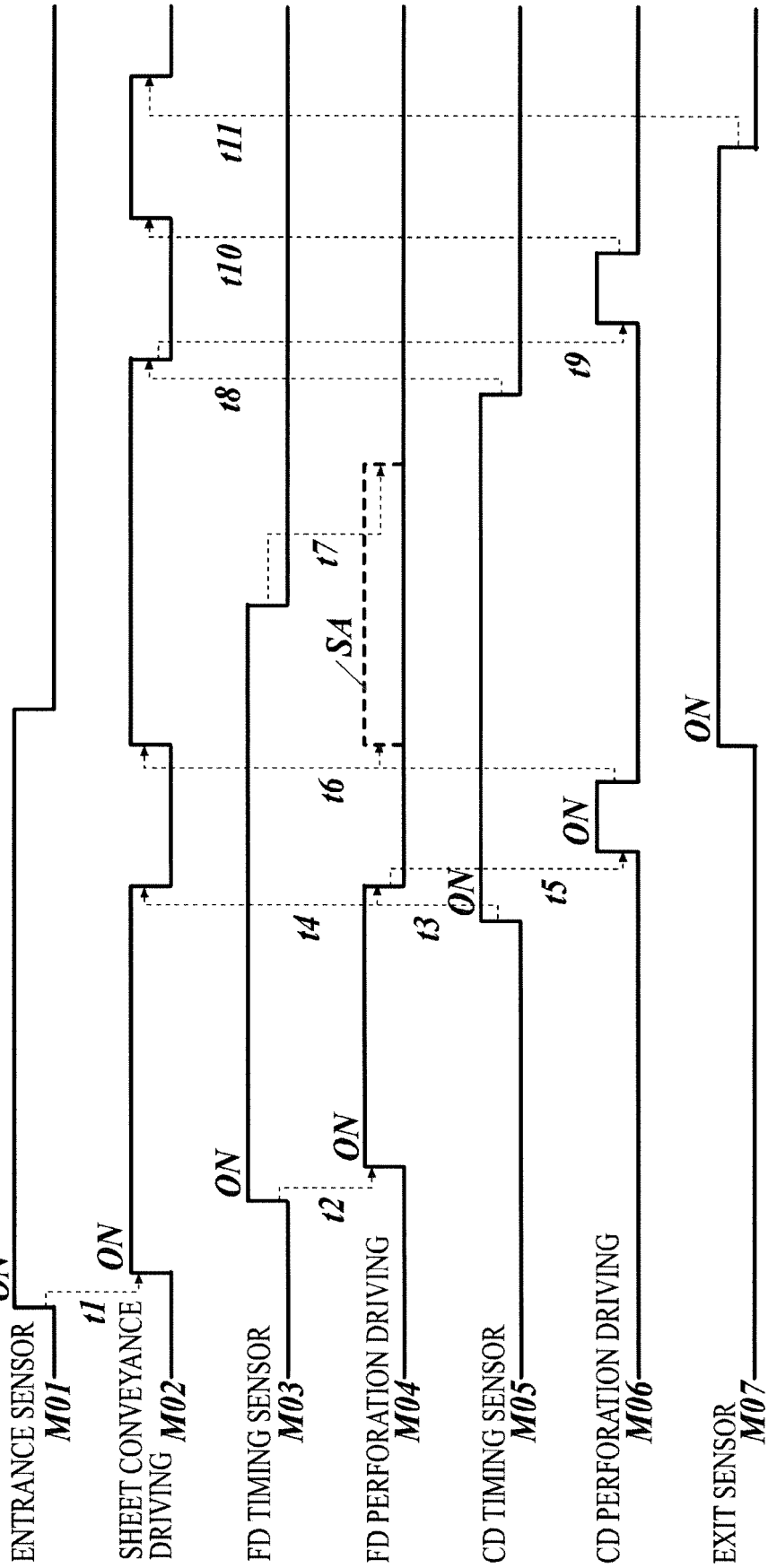
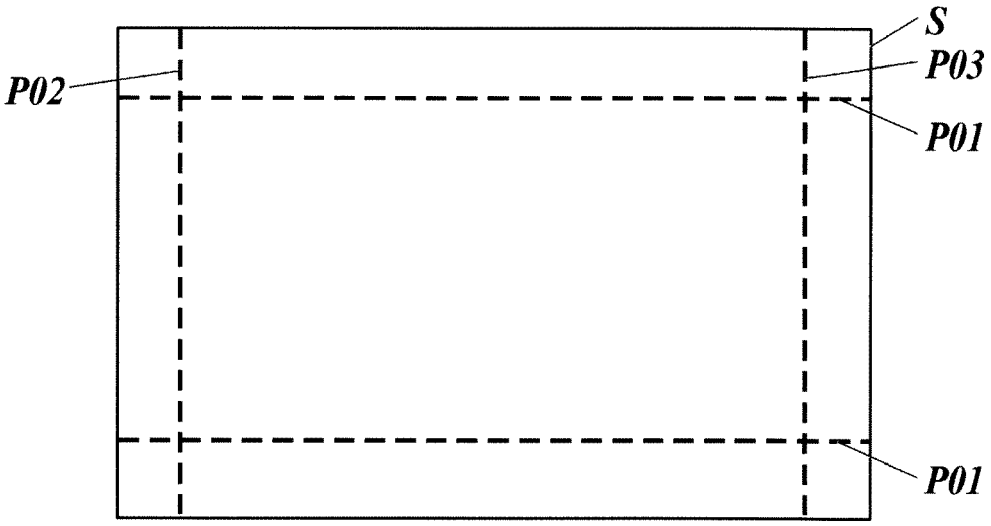

ENTRANCE SENSOR
M01
SHEET CONVEYANCE DRIVING
M02
FD TIMING SENSOR
M03
FD PERFORATION DRIVING
M04
CD TIMING SENSOR
M05
CD PERFORATION DRIVING
M06
EXIT SENSOR
M07
ON
t1
t2
t3
t4
t5
t6
SA
t7
t8
t9
t10
t11

FIG. 9



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EUROPEAN SEARCH REPORT

Application Number
EP 20 19 5155

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X,D A	JP 2006 321000 A (DUPLO SEIKO CORP) 30 November 2006 (2006-11-30) * paragraph [0034]; figures * * paragraph [0040] - paragraph [0041] *	1,2,4, 6-8 3,5	
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	19 February 2021	Canelas, Rui

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		JP 2006321000 A	30-11-2006
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