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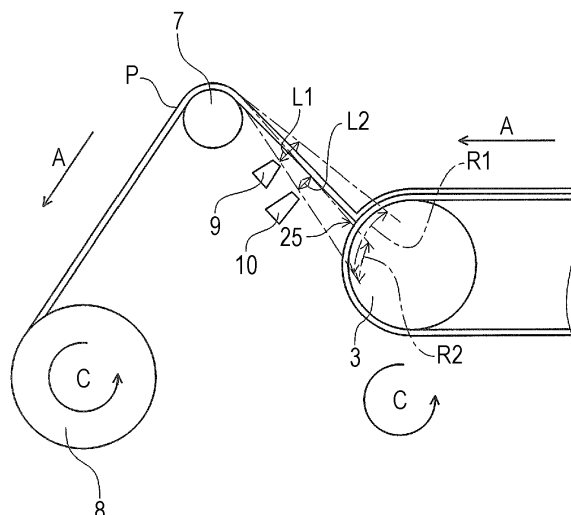
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(54) **Recording apparatus and method**

(57) A recording apparatus (1) includes: an adhesive belt (2) that supports and transports a recording medium (P); a recording head (6); a first sensor (9) that detects the separation of the recording medium from the adhesive belt within a first range (R1); a second sensor (10) that detects the separation of the recording medium from the adhesive belt within a second range (R2) contained in the first range (R1); a take-up section (8) that winds the recording medium (P); and a controller (11). The con-

troller transports the recording medium at an average feed speed (VA) while rotating the take-up section (8) at a constant angular velocity and switching between a moving state and stopped state of the adhesive belt (2), and has a first mode of controlling the average feed speed (VA) to a constant speed by switching between the moving state and the stopped state, based on information from the second sensor (10) so that the recording medium (P) is separated within the second range (R2).

FIG. 3



Description

BACKGROUND

1. Technical Field

[0001] The present invention relates to a recording apparatus and a recording method.

2. Related Art

[0002] In the past, recording apparatuses which include a plurality of rotating bodies, an adhesive belt and a take-up section have been used. The adhesive belt is tightly looped over the rotating bodies and holds a recording medium while transporting it; the take-up section winds the recording medium. Some of such disclosed recording apparatuses further include a sensor that detects a location at which a recording medium is separated from an adhesive belt.

[0003] JP-A-2007-196625 discloses a recording apparatus that can control the separation location of a recording medium, based on a variation in the expansion of a fabric used as a recording medium.

[0004] The above recording apparatus is equipped with a mechanism for decreasing the drying time for recorded images, which greatly influences their qualities.

[0005] JP-A-10-331078 discloses a fabric that contains a predetermined surface active agent. This fabric exhibits a good drying property and enables images to be recorded with high quality.

[0006] In a recording apparatus as described above, when the speed at which the adhesive belt transports a recording medium is higher than the speed at which the take-up section winds the recording medium, the recording medium may become entangled in the adhesive belt. In other words, an entanglement error may occur.

[0007] The roll diameter of the take-up section is initially the same as that of its roll core and then gradually increases with the winding of the recording medium. Assuming that the winding motor in the take-up section rotates at a regular speed, when its roll diameter is small, the winding speed of the recording medium is relatively low. Therefore, a recording apparatus that continuously transports a recording medium by using the adhesive belt, like that described in JP-A-2007-196625, needs to wind the recording medium at a high speed by rotating the winding motor at a high speed when the roll diameter of the take-up section is small. Thus, such recording apparatuses inevitably use high capacity winding motors.

[0008] On the other hand, the provision of a sensor can prevent an occurrence of an entanglement error even if the take-up section winds a recording medium at a low speed. More specifically, the sensor detects the separation location of the recording medium, and the adhesive belt stops transporting the recording medium when a risk that the recording medium will become entangled in the adhesive belt increases. With this configuration, a small

capacity winding motor can be used for the take-up section, and the need to rotate the winding motor at a high speed can be eliminated. Here, the configuration that causes a sensor to detect the separation location of a recording medium and prevents an occurrence of an entanglement error by stopping a running adhesive belt is abbreviated below as "entanglement error prevention measures."

[0009] Suppose the winding motor rotates at a regular speed, or at a regular angular velocity. When the roll diameter of the take-up section is small, the take-up section winds a recording medium at a low speed. However, as the roll diameter increases with the winding of the recording medium, the take-up section winds the recording medium at a higher speed. If the aforementioned "entanglement error prevention measures" are applied to the configuration in which the speed at which the take-up section winds the recording medium gradually increases, disadvantages that will be described below may arise.

[0010] When the roll diameter of the take-up section is small, the take-up section winds the recording medium at a lower speed than that at which the adhesive belt transports the recording medium. Therefore, the recording medium becomes entangled in the adhesive belt. In response to this, a sensor detects that the recording medium is entangled in the adhesive belt, and the adhesive belt stops running. In the meantime, the take-up section winds the recording medium, thereby eliminating the entanglement of the recording medium. However, since the take-up section winds the recording medium at a low speed as described above, it takes a long time to wind the recording medium, and the adhesive belt stops running for a long time.

[0011] The take-up section winds the recording medium at a higher speed as the roll diameter of the take-up section increases. Therefore, even if the sensor detects the entanglement of the recording medium and the adhesive belt stops being driven, the adhesive belt does not stop for a long time.

[0012] An average speed (also referred to below as an "average feed speed") at which the adhesive belt transports the recording medium decreases as the stop time period of the adhesive belt increases. In other words, the average speed increases as the stop time period of the adhesive belt decreases. Thus, as the roll diameter increases with the winding of the recording medium in the take-up section, the winding speed of the take-up section gradually increases. In response, the average feed speed of the adhesive belt also increases with the varying winding speed.

[0013] When a recording apparatus that includes an adhesive belt and a take-up section records an image onto a recording medium over the adhesive belt, it typically subjects the image to a drying process by using a drying section provided upstream from the location at which the recording medium will be wound around the take-up section. When the roll diameter of the take-up section increases, the winding speed and average feed

speed of the adhesive belt increases and therefore times and decrease. Here, the time represents a time required to transport an image recorded onto the recording medium to the drying section; the time represents a time required to pass an image recorded onto the recording medium through the drying section.

[0014] Therefore, while a recording apparatus is transporting the recording medium by using the adhesive belt and is recording images onto the recording medium, the drying time for the recorded images, which corresponds to the sum of the times and , is gradually decreasing. Such a variation in the drying time (+) may develop unevenness in the recorded images.

SUMMARY

[0015] An advantage of some aspects of the invention is to provide a recording apparatus which includes: an adhesive belt that supports and transports a recording medium; and a take-up section that winds the recording medium enables a low capacity winding motor to be used for the take-up section but can prevent an occurrence of an entanglement error in the adhesive belt and print images with a high quality.

[0016] A recording apparatus according to a first aspect of the invention includes: an adhesive belt that supports and transports a recording medium and is looped over a plurality of rotating bodies; a recording head that records an image onto the recording medium; a first sensor that detects that the recording medium is separated from the adhesive belt within a first range; a second sensor that detects that the recording medium is separated from the adhesive belt within a second range contained in the first range; a take-up section that winds the recording medium; and a controller that controls a rotation of the take-up section and a movement of the adhesive belt. The controller is configured to transport the recording medium at an average feed speed while rotating the take-up section at a constant angular velocity and switching between a moving state and stopped state of the adhesive belt. In addition, the controller has a first mode of controlling the average feed speed to a constant average feed speed by switching between the moving state and the stopped state, based on information from the second sensor so that the recording medium is separated within the second range.

[0017] Herein, the term "adhesive belt" refers to a belt having a surface to which an adhesive is applied. A recording medium is supported by this surface while being detachably bonded thereto.

[0018] The controller has a first mode of controlling the average feed speed to a constant average feed speed by switching between the moving state and the stopped state, based on information from the second sensor so that the recording medium is separated within the second range.

[0019] According to the first aspect, the average feed speed is controlled to the constant average feed speed

so that the recording medium is separated from the second range positioned downstream of the adhesive belt and upstream of the take-up section. This makes it possible to feed the recording medium at the constant average feed speed to the downstream side while preventing an occurrence of an entanglement error in the adhesive belt, thus printing images with high quality.

[0020] The controller preferably controls the average feed speed to the constant average feed speed by controlling a stop time period of the adhesive belt.

[0021] Controlling a stop time period of the adhesive belt in order to control the average feed speed to the constant average feed speed can produce substantially the same effect as the first aspect.

[0022] The first mode preferably starts when the second sensor initially detects the separation location within the second range.

[0023] The average feed speed of the adhesive belt in the first mode is preferably the same as a winding speed initially set in the first mode.

[0024] The average feed speed of the adhesive belt in the first mode can be preferably set lower than a winding speed initially set in the first mode.

[0025] The controller preferably has a second mode of repeatedly stopping a movement of the adhesive belt if the second sensor detects a separation location of the recording medium within the second range and starting the movement of the adhesive belt if the second sensor detects the separation location of the recording medium outside the second range.

[0026] Providing the second mode can record images with great productivity.

[0027] A recording method according to a second aspect of the invention includes: transporting a recording medium supported on the adhesive belt looped over a plurality of rotating bodies; recording an image onto the recording medium by using a recording head; detecting that the recording medium is separated from the adhesive belt within a first range by using a first sensor; detecting that the recording medium is separated from the adhesive belt within a second range contained in the first range by using a second sensor; winding the recording medium by using a take-up section; transporting the recording medium at an average feed speed while rotating the take-up section at a constant angular velocity and switching between a moving state and stopped state of the adhesive belt; and executing a first mode of controlling the average feed speed to a constant average feed speed by switching between the moving state and the stopped state, based on information from the second sensor so that the recording medium is separated within the second range.

[0028] The second aspect can produce substantially the same effect as the first aspect.

BRIEF DESCRIPTION OF THE DRAWINGS

[0029] Embodiments of the invention will now be de-

scribed by way of example only with reference to the accompanying drawings, wherein like numbers reference like elements.

Fig. 1 schematically illustrates a side surface of a recording apparatus in an embodiment of the invention.

Fig. 2 is a block diagram illustrating the recording apparatus.

Fig. 3 is an enlarged view illustrating the main section of the recording apparatus.

Fig. 4 is another enlarged view illustrating the main section of the recording apparatus.

Fig. 5 is further another enlarged view illustrating the main section of the recording apparatus.

Fig. 6 shows a relationship of: the average feed speed of the adhesive belt; the moving and stopped states of the adhesive belt; and the detection result of the second sensor, in a first mode.

Fig. 7 shows a relationship of: the average feed speed of the adhesive belt; the moving and stopped states of the adhesive belt; and the detection result of the second sensor, in a second mode.

DESCRIPTION OF EXEMPLARY EMBODIMENTS

[0030] A recording apparatus in an embodiment of the invention will be described below with reference to the accompanying drawings. It should be noted that the invention is not limited to the embodiment and drawings.

Embodiment

[0031] Fig. 1 schematically illustrates a side surface of a recording apparatus 1 in an embodiment of the invention. The recording apparatus 1 in this embodiment includes: a driving roller 3 and a driven roller 4 that rotate in a rotation direction C. An adhesive belt 2 is tightly looped over the driving roller 3 and the driven roller 4 and supports a recording medium P while transporting it in a transport direction A. In other words, the adhesive belt 2 is tightly looped over a plurality of rotating bodies and supports and transports the recording medium P. The recording apparatus 1 in this embodiment is provided with two rollers, or the driving roller 3 and the driven roller 4, as the plurality of rotating bodies; however three or more rollers may be provided and some of these may be driving rollers. Herein, the term "adhesive belt" refers to a belt having a surface to which an adhesive is applied. A recording medium is supported by this surface while being detachably bonded thereto.

[0032] A recording head 6 having an ink discharging section F from which an ink is discharged is provided on a path along which the adhesive belt 2 transports the recording medium P. The recording apparatus 1 discharges the ink onto the recording medium P through the ink discharging section F while the carriage 5 causes the recording head 6 to reciprocate in directions B perpen-

dicular to the transport direction A, thereby creating desired images.

[0033] The recording head 6 reciprocates to record images onto the recording medium P while the recording medium P stops being transported. Therefore, the adhesive belt 2 intermittently transports the recording medium P. More specifically, a recording process of discharging the ink onto the recording medium P through the ink discharging section F in the recording head 6 and a transporting process of transporting the recording medium P by moving the adhesive belt 2 by a preset amount are performed alternately. In short, the recording head 6 intermittently records images, and the adhesive belt 2 intermittently moves in turn.

[0034] The above expression "intermittently moves" refers to a driving method of switching between the moving and stopped states of the adhesive belt 2. More specifically, in the moving state, the driving roller 3 is continuously driven until the adhesive belt 2 moves by a preset amount d; in the stopped state, the driving of the driving roller 3 is stopped such that the adhesive belt 2 stops for a predetermined period of time.

[0035] The recording apparatus 1 in this embodiment is provided with the recording head 6 that reciprocates to record images; however it may be provided with a so-called line head having a plurality of nozzles from which inks are discharged, the nozzles being arranged in a direction perpendicular to the transport direction A. The term "line head" refers to a recording head used for a recording apparatus that creates images by fixing one of a recording head and a recording medium and moving the other. The line head has a nozzle region that extends in the direction perpendicular to the transport direction A of the recording medium P and covers the whole length of the recording medium P in this perpendicular direction. Note that this nozzle region does not necessarily have to cover the whole lengths of all the types of recording media P in the perpendicular direction which the recording apparatus supports. If a recording apparatus is provided with a line head as described above, it can continuously transport a recording medium P by using an adhesive belt 2.

[0036] In the recording apparatus 1 in this embodiment, the recording medium P is separated from the adhesive belt 2 within a predetermined range, then passes over a driven roller 7 fixed at a preset location and is wound around a take-up section 8, as will be described later. While winding the recording medium P, the take-up section 8 is rotating in the rotation direction C.

[0037] The take-up section 8 is controlled by a controller 11, which will be described later, in such a way that it rotates at an angular velocity 1. Assuming that the angular velocity 1 of the take-up section 8 is constant, as the roll diameter of the take-up section 8 increases with the winding of the recording medium P, the take-up section 8 winds the recording medium P at a higher speed. Therefore, the constant angular velocity 1 of the take-up section 8 is set to a small value. Consequently, the take-

up section 8 can be implemented by a low capacity motor. However, in an initial state where a small amount of recording medium P is wound around the take-up section 8 and therefore the roll diameter is small, the take-up section 8 winds the recording medium P at a low speed.

[0038] A heater H is provided between the take-up section 8 and the driven roller 7; the heater H heats and dries images that have been created in the recording medium P through the discharge of the ink. The created images are naturally dried after the ink discharging section F has discharged the ink and before the image reaches the heater H, and then thermally dried by passing through the heating region of the heater H. After the images have been naturally and thermally dried in this manner, the recording medium P with the images is wound around the take-up section 8.

[0039] A first sensor 9 and a second sensor 10 are installed on the transport path of the recording medium P and between the location at which the recording medium P is separated from the adhesive belt 2 and the location of the driven roller 7. Each of the first sensor 9 and the second sensor 10 is an optical sensor that can detect the relative location of the recording medium P by irradiating a surface of the recording medium P with light at a right angle and receiving the light reflected from this surface. Based on the respective detected locations of the recording medium P relative to the locations of the first sensor 9 and the second sensor 10, the location at which the recording medium P is separated from the adhesive belt 2 can be pinpointed. Using this method can detect the location more accurately than using any other relevant method. An exemplary relevant method uses: an irradiation source; a reflective material disposed opposite the irradiation source; and an optical sensor that receives light to be reflected by the reflective material. Further, the irradiation source irradiates a surface of the recording medium P with light traveling in a direction along the surface and then the optical sensor detects that the reflected light is blocked by the recording medium P, recognizing that the recording medium P is separated from the adhesive belt 2. Such relevant methods are prone to cause detection failures, because the length (thickness) of the recording medium P in a direction perpendicular to the surface of recording medium P is short and the detection timing for the optical sensor may not accordingly coincide with the timing at which the reflected light is blocked by the recording medium P.

[0040] Next, a description will be given of an electrical configuration of the recording apparatus 1 in this embodiment. Fig. 2 is a block diagram illustrating the recording apparatus 1 in this embodiment. The controller 11 includes a CPU 12 that takes control over the recording apparatus 1. The CPU 12 is connected to both a ROM 14 that stores, for example, various control programs and maintenance sequences to be executed by the CPU 12 and a RAM 15 that temporarily stores data via a system bus 13.

[0041] The CPU 12 is connected to a head driver 16

via the system bus 13; the head driver 16 drives the recording head 6. The CPU 12 is connected to a motor driver 17 via the system bus 13. The motor driver 17 drives: a carriage motor 18 that moves the carriage 5; a transport motor 19 that is a driving source for the driving roller 3 that acts as a moving mechanism for the adhesive belt 2 supporting and transporting the recording medium P; and a winding motor 20 that is a driving source for the take-up section 8. The CPU 12 is connected to a heater driver 23 via the system bus 13; the heater driver 23 operates the heater H to heat and dry images created in the recording medium P. The CPU 12 is connected to an I/O section 21 via the system bus 13. The I/O section 21 is connected to the first sensor 9, the second sensor 10 and a PC 22; the PC 22 is an external device through which data to be recorded and the like are input to the recording apparatus 1. The PC 22 is provided with a GUI (graphical user interface) 24.

[0042] Next, a more detailed description will be given with reference to an enlarged view of the main section in the recording apparatus 1. Figs. 3 to 5 are enlarged views each illustrating the main section of the recording apparatus 1 in this embodiment.

[0043] As illustrated in Figs. 3 to 5, the first sensor 9 detects whether or not the recording medium P is present (whether it receives light reflected from a surface of the recording medium P) within a detection range having a length L1. The first sensor 9 can thereby detect whether or not a separation location 25 at which the recording medium P is separated from the adhesive belt 2 is within a first range R1. In other words, the first sensor 9 can detect that the recording medium P is separated from the adhesive belt 2 within the first range R1. In addition, the second sensor 10 detects whether or not the recording medium P is present (whether it receives light reflected from the surface of the recording medium P) within a detection range having a length L2. The second sensor 10 can thereby detect whether or not the separation location 25 at which the recording medium P is separated from the adhesive belt 2 is within a second range R2 contained in the first range R1. In other words, the second sensor 10 can detect that the recording medium P is separated from the adhesive belt 2 within the second range R2 contained in the first range R1.

[0044] In Fig. 3, the separation location 25 of the recording medium P is within the first range R1 but outside the second range R2. In Fig. 4, the separation location 25 of the recording medium P is outside the first range R1 (i.e., outside the second range R2). In Fig. 5, the separation location 25 of the recording medium P is within both the first range R1 and the second range R2. Specifically, viewing the state in Fig. 3 as a reference, the state of Fig. 4 arises when the speed at which the take-up section 8 winds the recording medium P continues to be higher than the speed at which the adhesive belt 2 transports the recording medium P or when the take-up section 8 continues to wind the recording medium P while the adhesive belt 2 stops moving. The state of Fig. 5

arises when the speed at which the take-up section 8 winds the recording medium P continues to be lower than the speed at which the adhesive belt 2 transports the recording medium P or the adhesive belt 2 continues to move while the take-up section 8 stops winding the recording medium P.

[0045] If the first sensor 9 detects the separation location 25 of the recording medium P within the first range R1, the controller 11 controls the take-up section 8 to wind the recording medium P. In the states of Figs. 3 and 5, the separation location 25 of the recording medium P is within the first range R1, and the take-up section 8 is winding the recording medium P in the rotation direction C under the control of the controller 11. In the state of Fig. 4, the separation location 25 of the recording medium P is outside the first range R1. In this case, under the control of the controller 11, the take-up section 8 stops winding the recording medium P, and the driving roller 3 is intermittently driven in the rotation direction C in accordance with the intermittent recording performed by the recording head 6.

[0046] The controller 11 has a first mode, which will be described with reference to Fig. 6. In the first mode, the controller 11 switches between a moving state and stopped state of the adhesive belt 2, based on information from the second sensor 10 so that the recording medium P is separated from the adhesive belt 2 within the second range R2, thereby controlling an average feed speed VA of the adhesive belt 2 to a constant average feed speed VC.

[0047] When the recording medium P is transported while the adhesive belt 2 is switched between the moving and stopped states, the take-up section 8 continues to wind the recording medium P independently of the state of the adhesive belt 2. In other words, the recording medium P is continuously wound by the take-up section 8 even when the adhesive belt 2 stops moving.

[0048] The average feed speed VA of the adhesive belt 2 is controlled to the constant average feed speed VC, it is possible to prevent an occurrence of an entanglement error in the adhesive belt 2 and feed the recording medium P to the downstream side at the constant average feed speed VC.

[0049] The above control makes it possible to cause the ink discharging section F to record an image onto the recording medium P and feed the recording medium P to, for example, the heater H provided upstream of the take-up section 8 at regular time intervals. This can reduce a variation in a drying time for a recorded image, thus printing images with high quality.

[0050] According to the recording apparatus 1 in this embodiment, in the moving state where the adhesive belt 2 is intermittently driven, the moving speed VB and moving time tB of the adhesive belt 2 are set to constant values such that the driving roller 3 can feed the adhesive belt 2 by the preset amount d with a single movement, the preset amount d being determined in accordance with the intermittent recording performed by the recording

head 6. Therefore, varying a stop time period t0 for the intermittently moving adhesive belt 2 can adjust the average feed speed VA of the adhesive belt 2. The shorter the stop time period t0, the higher the average feed speed VA. In other words, the longer the stop time period t0, the lower the average feed speed VA. If the stop time period t0 is set to a constant value, the average feed speed VA of the adhesive belt 2 becomes constant.

[0051] While the take-up section 8 is winding the recording medium P during the recording, its winding speed gradually increases. Therefore, the maximum average feed speed Vmax of the adhesive belt 2 is set such that it can conform to the winding speed of the take-up section 8 with a large diameter. When the average feed speed VA reaches the maximum average feed speed Vmax, the stop time period t0 becomes a time period tmin. If the controller 11 does not perform the control, the adhesive belt 2 intermittently moves at the maximum average feed speed Vmax.

[0052] Next, a more detailed description will be given of a configuration in which the controller 11 controls the average feed speed VA of the adhesive belt 2 to the constant average feed speed VC by switching between the moving and stopped states of the adhesive belt 2 based on information from the second sensor 10 so that the recording medium P is separated from the adhesive belt 2 within the second range R2.

[0053] Fig. 6 shows a relationship of: the average feed speed of the adhesive belt 2 (upper graph); the moving and stopped states of the adhesive belt 2 (middle graph); and the detection result of the second sensor (lower part), when the control is performed in the first mode. First, suppose the separation location 25 of the recording medium P is within the first range R1 but outside the second range R2 when the recording of images starts. In addition, the controller 11 does not perform the control, and therefore the adhesive belt 2 intermittently moves at the maximum average feed speed Vmax, namely, under the condition of the stop time period t0 being the time period tmin.

[0054] When the recording apparatus 1 starts recording images, for example, if the take-up section 8 remains a core nearly and the take-up section 8 accordingly winds the recording medium P at a low speed, the feed amount of the adhesive belt 2 is greater than the winding amount of the take-up section 8. In this case, if the recording apparatus 1 continues to record images, the separation location 25 of the recording medium P enters the second range R2. In Fig. 5, the separation location 25 of the recording medium P is within the second range R2, and the driving roller 3 stops rotating under the control of the controller 11 such that the adhesive belt 2 stops moving.

[0055] If the second sensor 10 detects the separation location 25, the controller 11 controls the driving roller 3 in such a way that the adhesive belt 2 stops moving. In this case, the adhesive belt 2 stops moving at the timing when the driving roller 3 is not driven during the intermittent driving. A time T1 indicates when the second sensor 10 first detects the separation location 25 after the re-

cording apparatus 1 has started recording images. In this embodiment, when the second sensor 10 first detects the recording medium P after the recording of images has started, the controller 11 starts the control in the first mode. In the lower part of Fig. 6, the state where the second sensor 10 detects the separation location 25 is denoted by ON; the state where the second sensor 10 does not detect the separation location 25 is denoted by OFF.

[0056] When the adhesive belt 2 enters the stopped state, only the take-up section 8 rotates to wind the recording medium P. Then, when the separation location 25 moves to the outside of the second range R2 (see Fig. 3), the second sensor 10 enters a non-detection state (OFF) where the separation location 25 is not detected. In response to this, the adhesive belt 2 starts moving, namely, enters the moving state. The time T2 (see the graph at the middle of Fig. 6) indicates when the second sensor 10 does not detect the separation location 25 and the adhesive belt 2 thereby resumes moving. The period over which the adhesive belt 2 stays in the stopped state, or the difference between the time T2 and the time T1, is referred to as a stop time period t1.

[0057] After the stop time period t1 is acquired, or after the time T2, the stop time period t0 in the intermittent driving, over which the adhesive belt 2 stays in the stopped state, is set to the stop time period t1. In this way, the average feed speed VA of the adhesive belt can be controlled to the constant average feed speed VC so that the recording medium P is separated from the adhesive belt 2 within the second range R2.

[0058] The stop time period t1 is a time period that enables the detection state of the second sensor 10 to be switched from ON to OFF when the take-up section 8 winds the recording medium P at a winding speed V1, the winding speed V1 being the initial speed upon the recording of images in the first mode. By setting the stop time period t0 to the stop time period t1, the constant average feed speed VC of the adhesive belt 2 can be made to conform to the winding speed V1 of the take-up section 8 which has been initially set in the first mode. In other words, the average feed speed VC can be made substantially the same as the winding speed V1.

[0059] The constant average feed speed VC of the adhesive belt 2 is desirably the same as the winding speed V1 of the take-up section 8 which has been initially set in the first mode. Note that the constant average feed speed VC of the adhesive belt 2 may be not only exactly the same as but also substantially the same as the winding speed V1 of the take-up section 8.

[0060] The winding speed V1 of the take-up section 8 can also be determined from the radius r1 of the take-up section 8 ($V1 = r1 \cdot 1$). Here, the radius r1 of the take-up section 8 can be determined based on information regarding the total amount of recording medium P wound around the take-up section 8 and the thickness of the recording medium P. Alternatively, a sensor that detects the radius r1 of the take-up section 8 or a speed sensor

that directly measures the winding speed V1 may be installed in the take-up section 8.

[0061] Alternatively, the stop time period t0 may be set longer than the stop time period t1. The longer the stop time period, the lower the average feed speed VC. In this case, the winding speed V1 becomes higher than the constant average feed speed VC. Therefore, it is possible to reliably prevent the recording medium P from being entangled in the adhesive belt 2. The constant average feed speed VC of the adhesive belt 2 may be set by a user to an arbitrary value that is equal to or less than the winding speed V1 of the take-up section 8 which has been initially set in the first mode.

[0062] When the recording medium P is transported at a constant speed while the adhesive belt 2 is switched between the moving and stopped states under the condition of the stop time period t0 being the time period t1, the winding speed of the take-up section 8 gradually increases. As a result, the second sensor 10 enters the off state during the stopped state of the adhesive belt 2, as shown in the lower graph of Fig. 6. In the first mode, however, the stopped state of the adhesive belt 2 which continues for the stop time period t0 (= t1) is prioritized. Furthermore, when the adhesive belt 2 continues to transport the adhesive belt 2 at the constant average feed speed VC that has been initially set in the first mode, the separation location 25 of the recording medium P moves to the outside of the second range R2 but within the first range R1, because the winding speed of the take-up section 8 gradually increases during the first mode.

[0063] Before the control in the first mode is performed, the stop time period t0 may be set to a constant value without performing a process of acquiring the stop time period t1. For example, the ROM 14 may store, in advance, data regarding the relationship between the total amount of the recording medium P wound around the take-up section 8 and the stop time period t1. Then, the stop time period t1 that would be acquired upon starting the control in the first mode may be determined from the total amount of the recording medium P stored in the PC 22, and then a constant value may be determined based on this stop time period t1. The control in the first mode may start in response to a user's instruction. In this case, the instruction is given, for example, by pressing a start button displayed in the GUI 24.

[0064] The control in the first mode is terminated whenever one image is recorded. Alternatively, the termination may be made in response to a user's instruction. In this case, the instruction is given, for example, by pressing a termination button displayed in the GUI 24.

[0065] The control in the first mode may be terminated when the total length of images recorded exceeds a preset length. As the roll diameter of the take-up section 8 increases with the recording of images, its winding speed increasingly becomes higher than the winding speed V1 initially set in the first mode. Since the average feed speed of the adhesive belt 2 is controlled to the constant average feed speed VC, the winding speed of the take-

up section 8 exceeds the average feed speed VC with the recording of images, in which case the separation location 25 of the recording medium P moves to the outside of the first range R1. When the separation location 25 of the recording medium P moves to the outside of the first range R1, the first sensor 9 detects it whereby the take-up section 8 stops rotating. In this case, even if the recording of images is further continued, the moving speed of the adhesive belt 2 is still controlled to the constant average feed speed VC. As a result, an image recorded in the recording medium P reaches the heater H provided upstream of the take-up section 8 at regular time intervals whereby a variation in a drying time for recorded images is reduced. However, the average feed speed may be reset to a higher speed by, for example, keeping the rotation of the take-up section 8 without stopping it. In this way, the control in the first mode can be set in advance such that it is terminated before the winding speed of the take-up section 8 becomes so fast that the separation location 25 of the recording medium P moves to the outside of the first range R1.

[0066] When not performing the control in the above first mode, the recording apparatus 1 records images in the second mode that will be described below. In the second mode, if the second sensor 10 detects the separation location 25 of the recording medium P within the second range R2, the adhesive belt 2 stops moving. If the second sensor 10 detects the separation location 25 of the recording medium P outside the second range R2, the adhesive belt 2 starts moving. These operations are repeated. Fig. 7 shows a relationship of: the average feed speed of the adhesive belt 2; the moving and stopped states of the adhesive belt 2; and the detection result of the second sensor.

[0067] Suppose the control in the second mode starts when the take-up section 8 remains a core nearly, or has a small diameter. The roll diameter of the take-up section 8 increases with the recording of images, and the winding speed at which the take-up section 8 winds the recording medium P thereby increases. As a result, every time the adhesive belt 2 moves and stops based on the detection result of the second sensor 10, the time interval between when the adhesive belt 2 stops moving and when it starts moving decreases, as shown in the graph at the middle of Fig. 7. In other words, the stop time period of the adhesive belt decreases. Here, the following relationship is satisfied:

$$t_1 > t_2 > t_3 > t_4 > t_5.$$

In the graph in the lower part of Fig. 7, the state where the second sensor 10 detects the separation location 25 is denoted by ON; the state where the second sensor 10 does not detect the separation location 25 is denoted by OFF.

[0068] The shorter the stop time period of the adhesive belt 2, the higher the average feed speed VA of the adhesive belt 2 (see the graph in the upper part of Fig. 7).

When the roll diameter of the take-up section 8 sufficiently increases, the stop time period of the adhesive belt 2 becomes a time period t_{min} , in which case the average feed speed VA of the adhesive belt 2 reaches the moving speed V_{max} thereof.

[0069] In the second mode, as described above, as the winding speed at which the take-up section 8 winds the recording medium P increases, the average feed speed VA of the adhesive belt 2 increases. Under the control in the second mode, the average feed speed VA of the adhesive belt 2 increases in proportion to the increase in the winding speed of the take-up section 8. It is thus possible to record images with great productivity.

15 Other Configurations of Recording Apparatus 1

[0070] A recording apparatus 1 in this embodiment is provided with a recording head 6 that reciprocates in directions B perpendicular to a transport direction A of a recording medium P, thereby recording images onto a recording medium P, as described above. A controller 11 controls a driving roller 3 to be intermittently driven in accordance with the reciprocating movement. If a second sensor 10 detects a separation location 25 of the recording medium P within a second range R2 in the course of the recording with the recording head 6, the controller 11 desirably controls a movement mechanism for the recording head 6 which includes a carriage motor 18 to move the recording head 6 to a home position after the recording of an image by the recording head 6, which accompanies one directional recording movement in the reciprocating movement, has been completed. With the control performed by the controller 11 in this manner, the recording of an image which accompanies one directional recording movement in the reciprocating movement can be completely done. This can prevent a defective image from being recorded, thereby protecting images that have ever been recorded and also protect the recording head 6 at the home position.

[0071] A recording apparatus 1 in this embodiment is provided with a recording head 6 that reciprocates in directions B perpendicular to a transport direction A of a recording medium P, thereby recording images onto a recording medium P, as described above. A controller 11 controls a driving roller 3 to be intermittently driven in accordance with the reciprocating movement. Further, before the driving of the driving roller 3 which is accompanied by the intermittent driving, the controller 11 controls a second sensor 10 to detect whether or not a separation location 25 of a recording medium P is within a second range R2. If the separation location 25 of the recording medium P is within the second range R2, the controller 11 controls the driving roller 3 to maintain the adhesive belt 2 in the stopped state. If the separation location 25 of the recording medium P is not within the second range R2, the controller 11 desirably controls the driving roller 3 to drive the driving roller 3 in accordance with the driving timing of the driving roller 3 which is ac-

accompanied by the intermittent driving. Under the control performed in this manner by the controller 11, the second sensor 10 detects whether or not the separation location 25 of the recording medium P is within the second range R2 while the adhesive belt 2 is in the stopped state. This can prevent an occurrence of a defective recording operation, for example, by blocking the adhesive belt 2 from stopping at a halfway position.

[0072] The invention is not limited to the embodiment described above; it will be appreciated that various modifications are possible within the scope of the invention described in the claims and these modifications fall within the scope of the invention.

Claims

1. A recording apparatus (1) comprising:

an adhesive belt (2) for supporting and transporting a recording medium (P), the adhesive belt being looped over a plurality of rotating bodies (3, 4);

a recording head (6) for recording an image onto the recording medium;

a first sensor (9) for detecting that the recording medium is separated from the adhesive belt within a first range (R1);

a second sensor (10) for detecting that the recording medium is separated from the adhesive belt within a second range (R2) contained in the first range;

a take-up section (8) for winding the recording medium; and

a controller (11) for controlling a rotation of the take-up section and a movement of the adhesive belt,

the controller configured to transport the recording medium at an average feed speed while rotating the take-up section at a constant angular velocity and switching between a moving state and stopped state of the adhesive belt,

the controller having a first mode of controlling the average feed speed to a constant average feed speed by switching between the moving state and the stopped state, based on information from the second sensor so that the recording medium is separated within the second range.

2. The recording apparatus according to Claim 1, wherein

the controller is configured to control the average feed speed to the constant average feed speed by controlling a stop time period of the adhesive belt.

3. The recording apparatus according to Claim 1 or Claim 2 is configured to

the first mode when the second sensor initially de-

fects the separation location within the second range.

4. The recording apparatus according to any one of the preceding claims, wherein

the average feed speed of the adhesive belt in the first mode is the same as a winding speed initially set in the first mode.

5. The recording apparatus according to any one of Claims 1 to 3, wherein

the average feed speed of the adhesive belt in the first mode can be set lower than a winding speed initially set in the first mode.

6. The recording apparatus according to any one of the preceding claims, wherein

the controller has a second mode of repeatedly stopping a movement of the adhesive belt if the second sensor detects a separation location of the recording medium within the second range and starting the movement of the adhesive belt if the second sensor detects the separation location of the recording medium outside the second range.

7. A recording method comprising:

transporting a recording medium (P) supported on an adhesive belt (2), the adhesive belt being looped over a plurality of rotating bodies (3,4); recording an image onto the recording medium by using a recording head (6);

detecting that the recording medium is separated from the adhesive belt within a first range (R1) by using a first sensor (9);

detecting that the recording medium is separated from the adhesive belt within a second range (R2) contained in the first range by using a second sensor (10);

winding the recording medium by using a take-up section (8);

transporting the recording medium at an average feed speed while rotating the take-up section at a constant angular velocity and switching between a moving state and stopped state of the adhesive belt; and

executing a first mode of controlling the average feed speed to a constant average feed speed by switching between the moving state and the stopped state, based on information from the second sensor so that the recording medium is separated within the second range.

FIG. 1

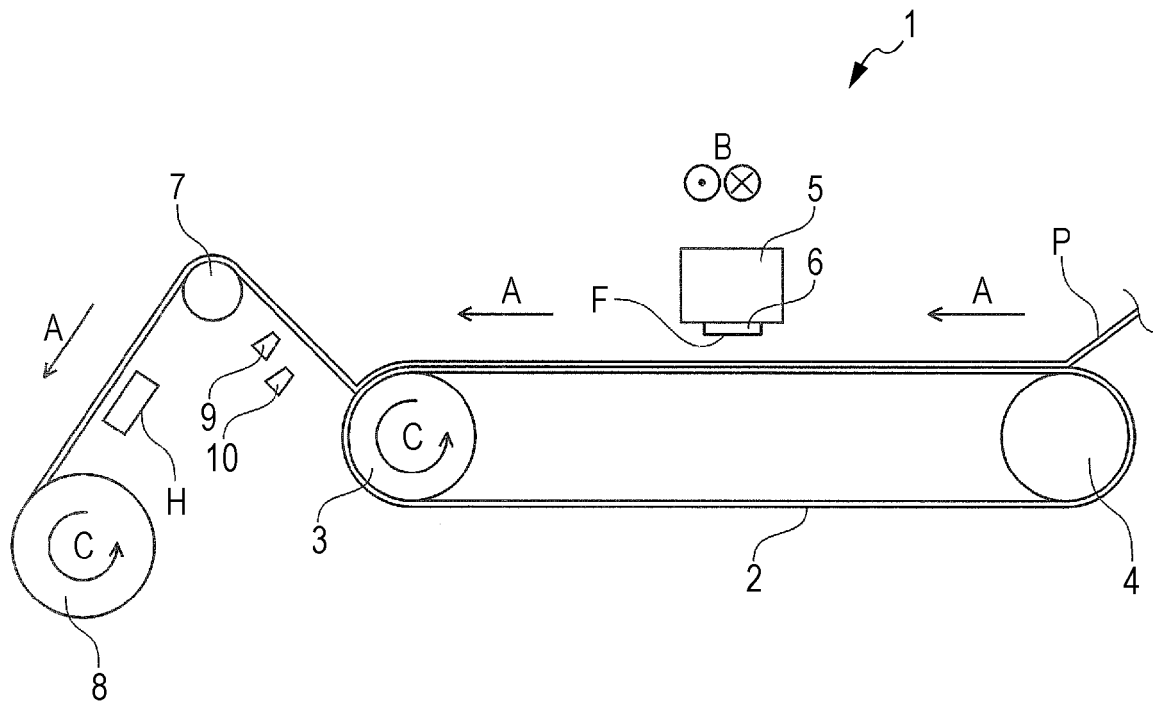


FIG. 2

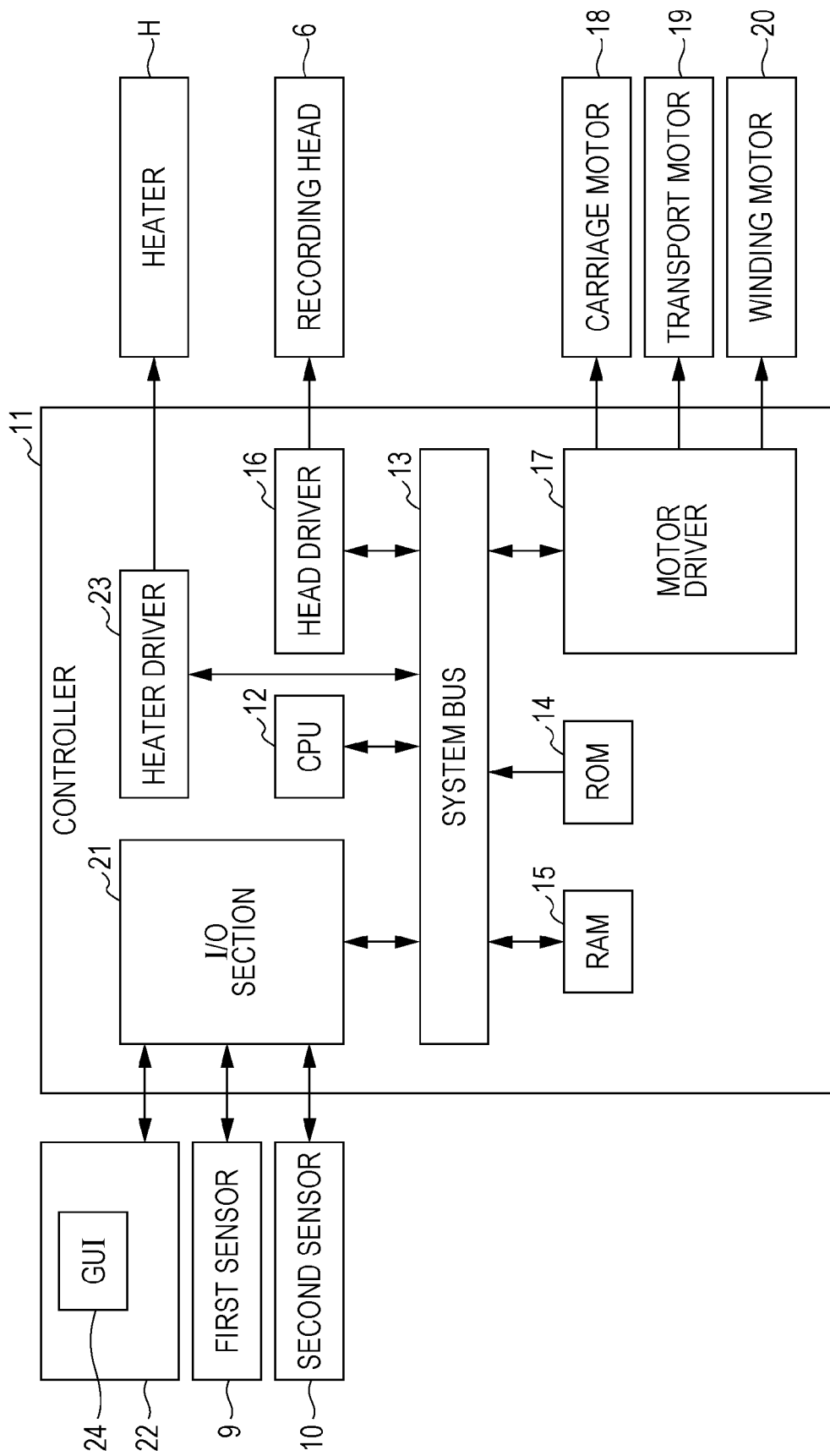


FIG. 3

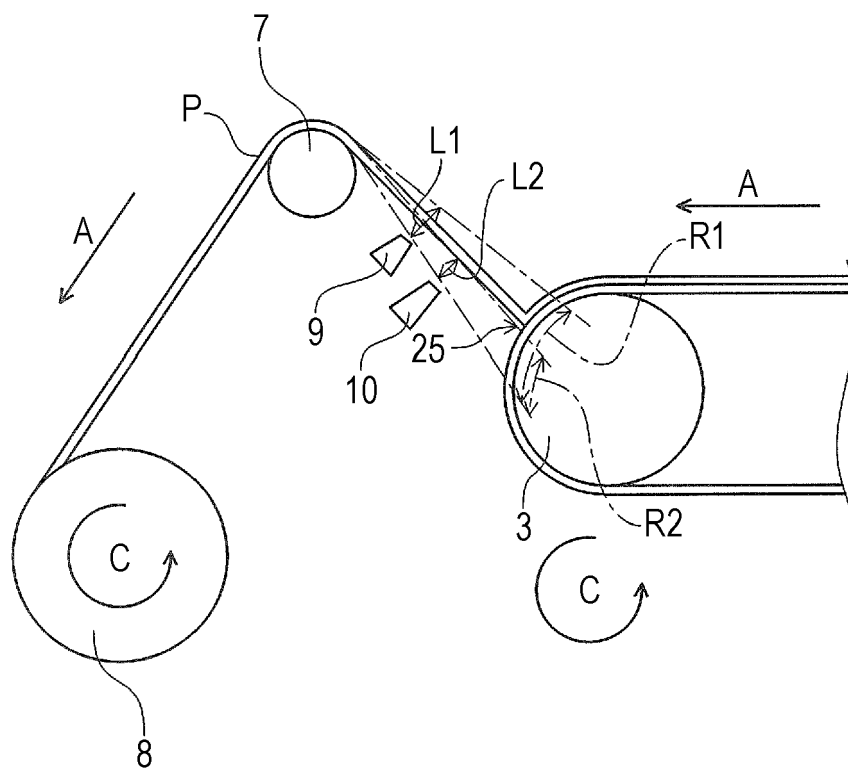


FIG. 4

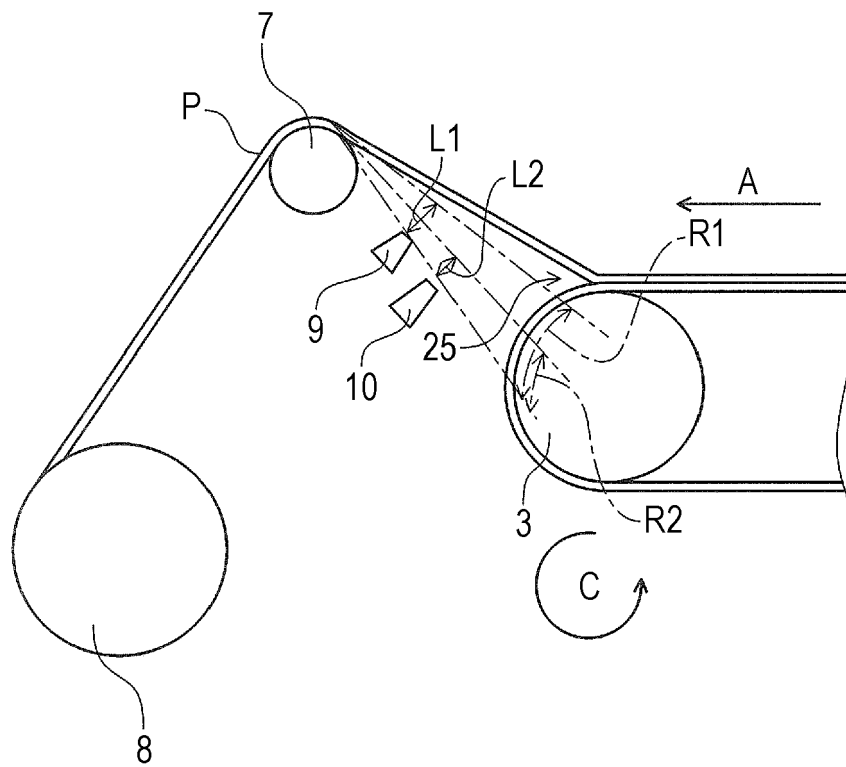


FIG. 5

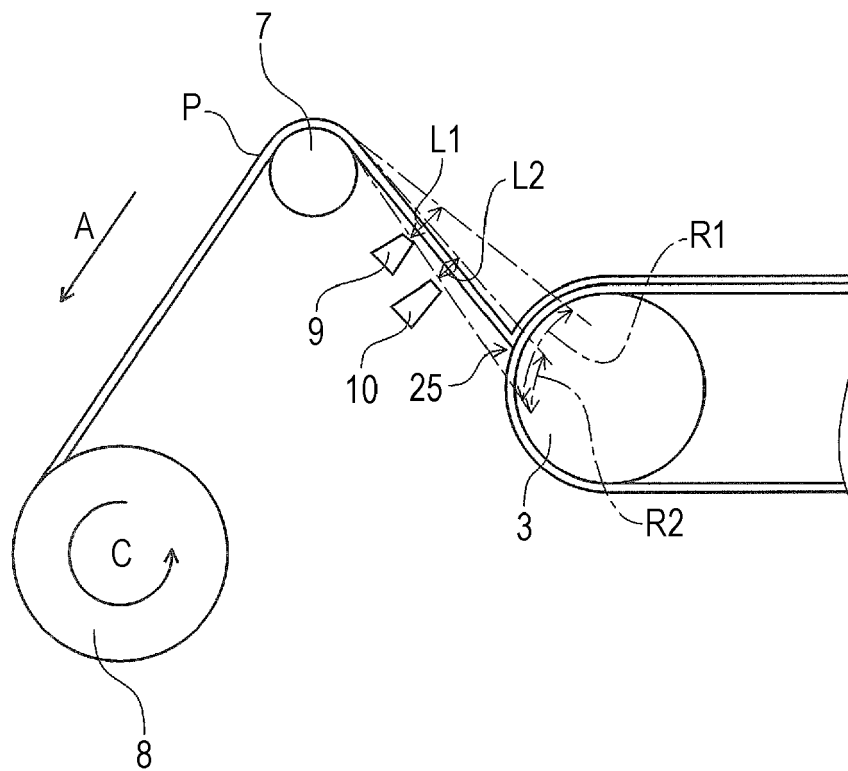


FIG. 6

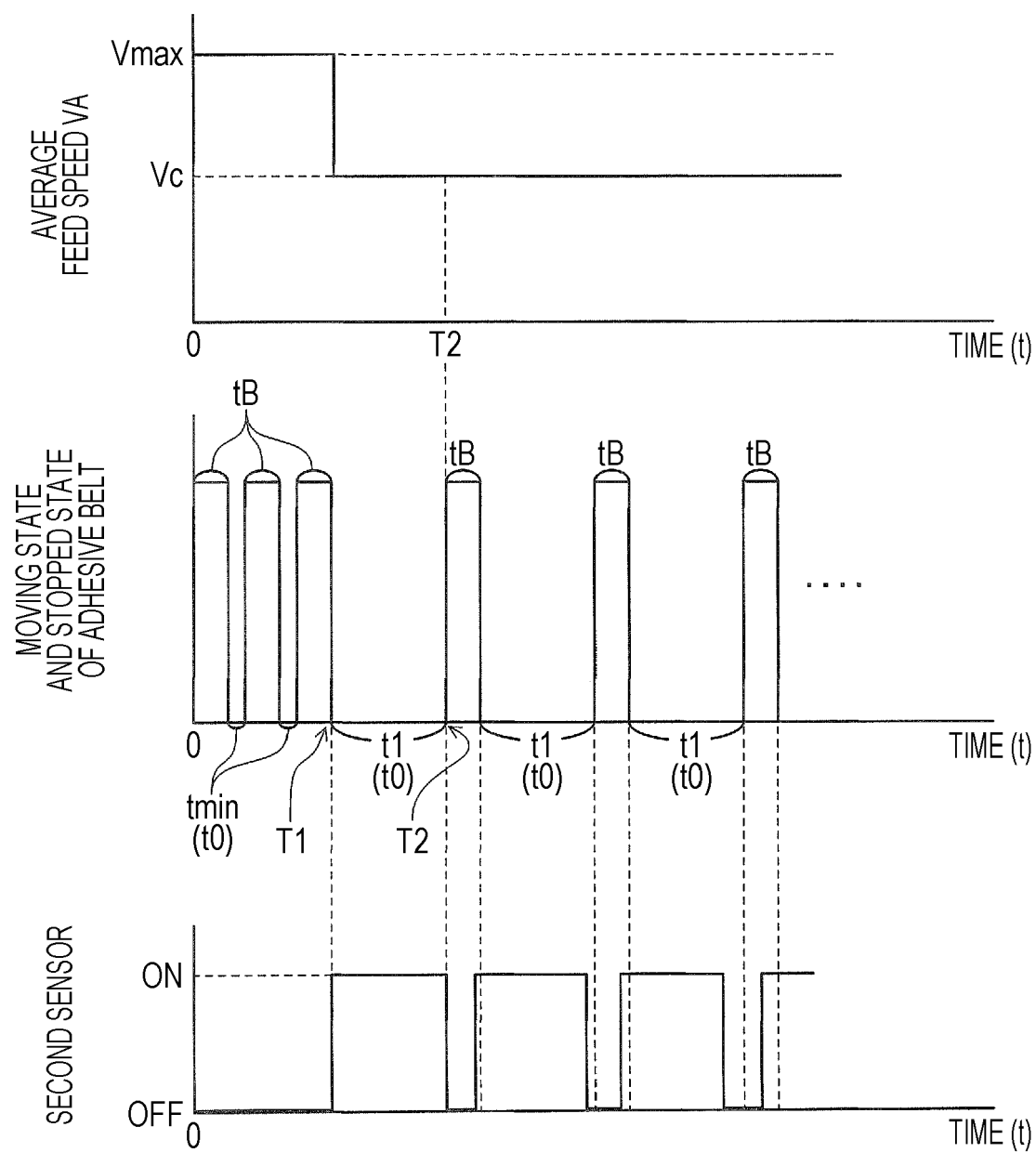
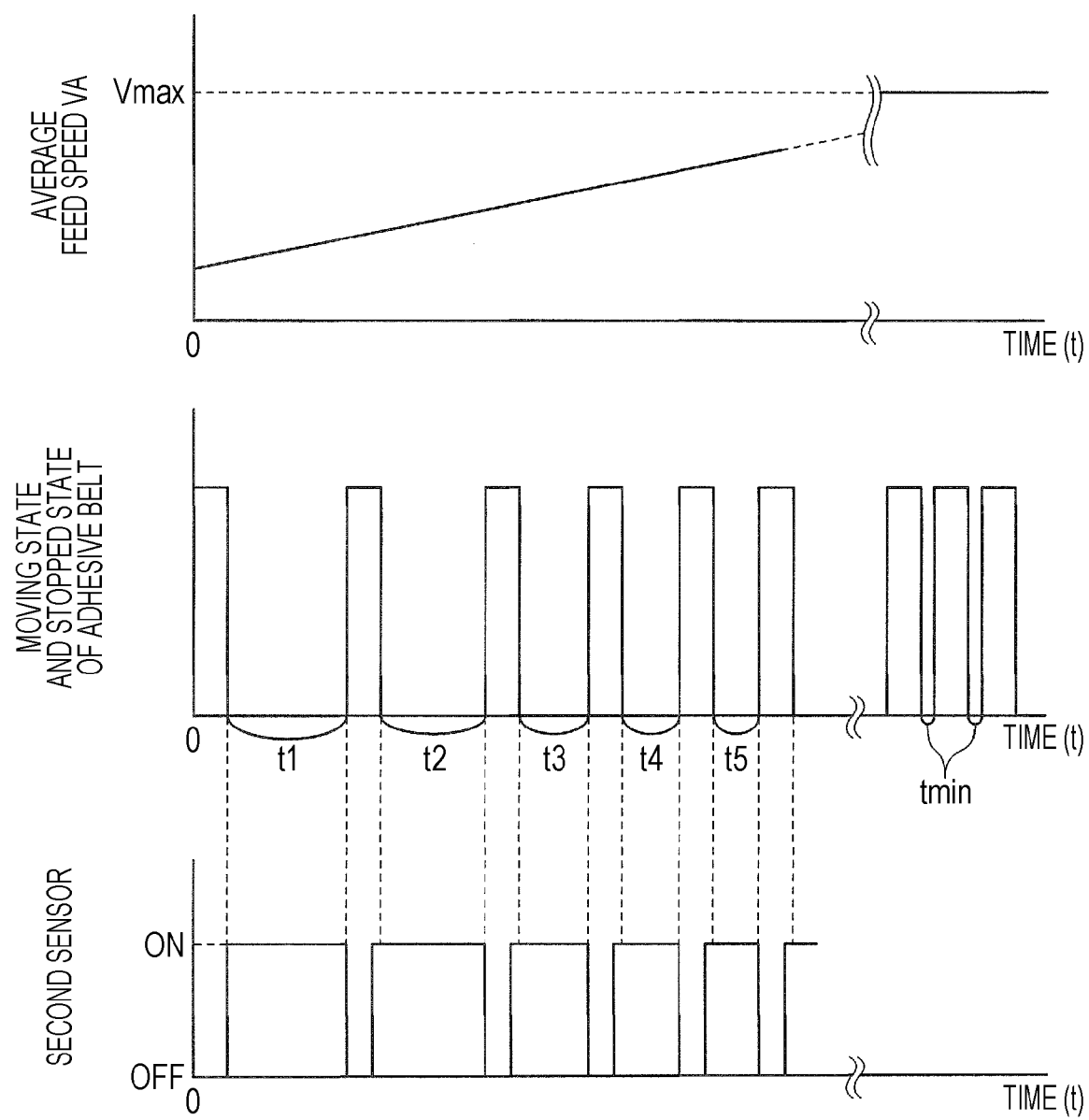


FIG. 7





EUROPEAN SEARCH REPORT

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The members are as contained in the European Patent Office EDP file on
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