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Image forming apparatus

Abstract

An image forming apparatus includes a transfer portion, a fixing unit, a conveyance belt configured to convey a sheet from the transfer portion toward the fixing unit, a driving portion configured to drive the conveyance belt, and a controller configured to control the driving portion. The controller is configured to, in a case of switching the image forming apparatus to a standby state in which the image forming apparatus is ready to start an image forming operation and stands by for input of an image forming job, execute preheating in which the fixing unit is preliminarily heated, and cause the driving portion to rotate the conveyance belt while the preheating is executed.

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References Cited

U.S. PATENT DOCUMENTS

Patent No.	Issued Date	Patentee Name	U.S. Cl.	CPC
12013653	12/2023	Takahashi	N/A	G03G 15/0131
2009/0060549	12/2008	Ahn	399/329	G03G 15/2039
2012/0087687	12/2011	Moteki et al.	N/A	N/A
2021/0364955	12/2020	Iwasaki	N/A	N/A
2021/0364970	12/2020	Sato	N/A	N/A

FOREIGN PATENT DOCUMENTS

Patent No.	Application Date	Country	CPC
2012083416	12/2011	JP	N/A

OTHER PUBLICATIONS

Notice of Allowance issued in U.S. Appl. No. 18/177,312, mailed Feb. 14, 2024. cited by applicant

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Background/Summary

BACKGROUND OF THE INVENTION

Field of the Invention

(1) The present invention relates to an image forming apparatus that forms an image on a recording material.

Description of the Related Art

(2) Japanese Patent Laid-Open No. 2012-83416 discloses a conveyance belt that conveys a recording material onto which a toner image has been transferred in a transfer portion to a fixing

unit in an image forming apparatus of an electrophotographic system.
(3) Preliminarily heating a fixing unit to shorten a waiting time (first print-out time: FPOT) between input of an image forming job and output of the first product is known. However, when the surface temperature of the conveyance belt of the above-described document is locally raised by radiant heat from the heated fixing unit, there is a possibility that the gloss of an image becomes uneven due to a temperature difference in the peripheral direction of the conveyance belt when the image forming job is executed.
SUMMARY OF THE INVENTION
(4) The present invention provides an image forming apparatus in which occurrence of gloss unevenness can be reduced.
(5) According to one aspect of the invention, an image forming apparatus includes a transfer portion configured to transfer a toner image onto a sheet, a fixing unit configured to heat the toner image transferred onto the sheet to fix the toner image to the sheet, a conveyance belt configured to convey the sheet from the transfer portion toward the fixing unit, a driving portion configured to drive the conveyance belt, and a controller configured to control the driving portion, wherein the controller is configured to in a case of switching the image forming apparatus to a standby state in which the image forming apparatus is ready to start an image forming operation and stands by for input of an image forming job, execute preheating in which the fixing unit is preliminarily heated, and cause the driving portion to rotate the conveyance belt while the preheating is executed.
(6) According to another aspect of the invention, an image forming apparatus includes a transfer portion configured to transfer a toner image onto a sheet, a fixing unit configured to heat the toner image transferred onto the sheet to fix the toner image to the sheet, a conveyance belt configured to convey the sheet from the transfer portion toward the fixing unit, a driving portion configured to drive the conveyance belt, and a controller configured to control the driving portion, wherein the controller is configured to in a case of switching the image forming apparatus to a standby state in which the image forming apparatus is ready to start an image forming operation and stands by for input of an image forming job, execute preheating in which the fixing unit is preliminarily heated, and cause the driving portion to rotate the conveyance belt in a period in which the image forming apparatus stands by in the standby state after the fixing unit has reached a target temperature of the preheating.
(7) According to still another aspect of the invention, an image forming apparatus includes a transfer portion configured to transfer a toner image onto a sheet, a fixing unit configured to heat the toner image transferred onto the sheet to fix the toner image to the sheet, a conveyance belt configured to convey the sheet from the transfer portion toward the fixing unit, a driving portion configured to drive the conveyance belt, and a controller configured to control the driving portion, wherein the controller is configured to in a standby state in which the image forming apparatus is ready to start an image forming operation and stands by for input of an image forming job, execute preheating in which the fixing unit is preliminarily heated, and cause the driving portion to rotate the conveyance belt during a preparation operation after the image forming job is input and before the image forming operation is started.
(8) Further features of the present invention will become apparent from the following description of exemplary embodiments with reference to the attached drawings.

Description

BRIEF DESCRIPTION OF THE DRAWINGS
(1) FIG. **1** is a schematic view of an image forming apparatus according to a first embodiment.
(2) FIG. **2** is a section view of a configuration from a transfer section to a fixing section according to the first embodiment.

(3) FIG. **3** is a block diagram illustrating a system configuration of the image forming apparatus according to the first embodiment.
(4) FIG. **4** is a graph illustrating measurement results of the surface temperature of a conveyance belt.
(5) FIG. **5**A illustrates an example of gloss unevenness appearing in a product.
(6) FIG. **5**B is a perspective view of a pre-fixing conveyance portion according to the first embodiment.
(7) FIG. **6** is a graph illustrating change in the surface temperature of the conveyance belt in a case where the conveyance belt is idled.
(8) FIG. **7** is a flowchart illustrating a control method according to the first embodiment.
(9) FIG. **8**A illustrates an example of glass unevenness appearing in a product.
(10) FIG. **8**B is a perspective view of a pre-fixing conveyance portion according to a second embodiment.
(11) FIG. **9** is a flowchart illustrating a control method according to the second embodiment.
(12) FIG. **10** is a flowchart illustrating a control method according to a modification example.
DESCRIPTION OF THE EMBODIMENTS
(13) Embodiments of the present disclosure will be described below with reference to drawings.
First Embodiment
(14) Image Forming Apparatus
(15) FIG. **1** is a schematic view of an image forming apparatus **100** according to a first embodiment. First, an overall configuration of the image forming apparatus **100** will be described with reference to FIG. **1**. The image forming apparatus **100** is an electrophotographic printer that forms an image on a sheet S by an electrophotographic process on the basis of image information received from an external device. As the sheet S serving as a recording material, various sheet materials of different sizes and different materials can be used. Examples of the sheet materials include paper sheets such as plain paper sheets and cardboards, plastic films, cloths, surface-treated sheet materials such as coated paper sheets, and sheet materials of irregular shapes such as envelopes and index sheets. In addition, the “image forming apparatus” is not limited to a printer (single-function printer), and may be a copier, a facsimile machine, or a multifunctional apparatus having functions of these.
(16) The image forming apparatus **100** includes a feeding portion **110** that feeds the sheet S, an image forming portion **920** that forms a toner image on the sheet S fed by the feeding portion **110**, and a pre-fixing conveyance portion **904** that conveys the sheet S to the fixing unit **50**. Further, the image forming apparatus **100** includes the fixing unit **50** that fixes the toner image to the sheet S received from the pre-fixing conveyance portion **904**, a post-fixing conveyance portion **903** that conveys the sheet S to which the toner image has been fixed by the fixing unit **50**, and a controller **170**.
(17) The feeding portion **110** includes a cassette **111** that accommodates sheets, a pickup roller **112** that picks up a sheet from the cassette **111**, and a separation unit **113** that, in the case where a plurality of sheets are picked up by the pickup roller **112**, separates a sheet from the plurality of sheets and feeds the separated sheet. That is, the feeding portion **110** has a function of feeding a plurality of sheets S set in the cassette **111** serving as an accommodating portion one by one while separating the sheets S from each other. Further, the feeding portion **110** includes a feeding path **901** in which the sheet S separated and fed by the separation unit **113** is conveyed, and send-out rollers **114** and registration rollers **115** that convey the sheet S via the feeding path **901**.
(18) The image forming portion **920** is an image forming portion of a tandem type in which stations **200**Y, **200**M, **200**C, and **200**K of an electrophotographic system that respectively form toner images of yellow, magenta, cyan, and black are arranged in series. In addition, the image forming portion **920** is an image forming portion of an intermediate transfer system that transfers toner images formed by the stations **200**Y to **200**K onto the sheet S via an intermediate transfer belt **125**

serving as an intermediate transfer member.
(19) The stations **200**Y to **200**K each have the same configuration except that developers (toners) of different colors are used for development. The stations **200**Y to **200**K each include a photosensitive drum **120** serving as an image bearing member, a charging unit **121**, an exposing unit **122**, and a developing unit **123**. The photosensitive drum **120** is, for example, constituted by an aluminum base body formed in a drum shape (cylindrical shape) and a layer of organic photoconductor (OPC) serving as an electrophotographic photoconductor formed on the outer peripheral surface of the aluminum body.
(20) The intermediate transfer belt **125** is supported in the state of being stretched over a driving roller **126**, a tension roller **127**, and a transfer inner roller **128**, and is rotated in an arrow R**2** direction of FIG. **1** by being driven by the driving roller **126**. A cleaning unit **129** includes a cleaning member such as a web that comes into contact with the outer peripheral surface of the intermediate transfer belt **125**. In addition, in a space on the inner peripheral side of the intermediate transfer belt **125**, primary transfer rollers **124** are disposed at positions respectively opposing the photosensitive drums **120** with the intermediate transfer belt **125** therebetween.
(21) A secondary transfer roller **131** is disposed at a position opposing the transfer inner roller **128** with the intermediate transfer belt **125** therebetween. A secondary transfer nip is formed between the secondary transfer roller **131** and the intermediate transfer belt **125**. The secondary transfer nip will be simply referred to as a transfer nip N**2**. The secondary transfer roller **131**, the intermediate transfer belt **125**, and the transfer inner roller **128** constitute a secondary transfer portion **130** serving as a transfer portion of the present embodiment.
(22) The pre-fixing conveyance portion **904** is disposed between the secondary transfer portion **130** and the fixing unit **50** in a sheet conveyance direction FD. The sheet conveyance direction FD is a direction following a conveyance path for the sheet S when an image is formed on the sheet S in an image forming operation that will be described below. The pre-fixing conveyance portion **904** of the present embodiment includes a first conveyance unit **10** and a second conveyance unit **20**. The configuration of the pre-fixing conveyance portion **904** will be described below.
(23) The fixing unit **50** is a fixing unit (fixing portion) of a thermal fixation system that heats a toner image transferred onto the sheet S to fix the toner image to the sheet S. The fixing unit **50** includes a heating roller **52** serving as a first rotary member, a pressurizing roller **53** serving as a second rotary member disposed to be capable of abutting the heating roller **52**, and a heater **51** serving as a heating portion. The heating roller **52** and the pressurizing roller **53** are in pressure contact by a predetermined pressurizing force, and thus a fixing nip Nf is formed between the heating roller **52** and the pressurizing roller **53**. For example, the heater **51** is a halogen lamp that is disposed inside the heating roller **52** and heats the heating roller **52** by radiant heat.
(24) The fixing unit **50** includes a cooling portion that cools the pressurizing roller **53**. The cooling portion includes a cooling fan, and a cooling duct for uniformly blowing wind from the cooling fan onto the pressurizing roller **53** in the longitudinal direction. Here, the longitudinal direction is a sheet width direction orthogonal to the sheet conveyance direction FD, that is, a main scanning direction of image formation. To maintain high image quality and high productivity, a cooling fan with a large air-blow amount is used. In addition, to suppress variation in the image quality (for example, degree of gloss) depending on the position in the main scanning direction, the cooling duct also has a sufficient size.
(25) In addition, the fixing unit **50** includes a first temperature sensor **70** for detecting the surface temperature of the heating roller **52**, and a second temperature sensor **71** for detecting the surface temperature of the pressurizing roller **53**. The controller **170** that will be described below performs control to maintain the surface temperatures of the heating roller **52** and the pressurizing roller **53** at appropriate values on the basis of detection signals from the first temperature sensor **70** and the second temperature sensor **71**. In addition, the controller **170** performs control to adjust the air-blow amount of the cooling fan to maintain the temperature of the pressurizing roller **53** constant in

accordance with the detection signal from the second temperature sensor **71**.

(26) The post-fixing conveyance portion **903** includes discharge rollers **911** serving as discharge portions, reverse conveyance rollers **912** serving as reverse conveyance portions, and a duplex conveyance portion **913**. The discharge rollers **911** discharge the sheet S discharged from the fixing unit **50** to the outside of the image forming apparatus **100**. In the case of duplex printing, the reverse conveyance rollers **912** reverse and convey the sheet S discharged from the fixing unit **50**. The duplex conveyance portion **913** conveys the sheet S reversed and conveyed by the reverse conveyance rollers **912** toward the image forming portion **920** again.

(27) In addition, the image forming apparatus **100** includes at least one door (opening/closing door) for removing a jam or for maintenance as an opening/closing member. The door is provided to be openable with respect to the image forming apparatus body so as to expose the sheet conveyance path inside the apparatus. In the case where a conveyance abnormality (sheet jam) of the sheet S has occurred, the user can open the door in accordance with an instruction displayed on an operation portion **210** illustrated in FIG. **3** and remove the sheet S jammed in the apparatus.

(28) To be noted, although an image forming portion **920** of an intermediate transfer system of a tandem type has been described as an example of an image forming portion in the present embodiment, for example, an image forming portion of a direct transfer system that transfers a toner image formed on a photosensitive drum (image bearing member) directly onto a sheet without using an intermediate transfer member may be used. In this case, the transfer portion is constituted by a photosensitive drum, a transfer roller opposing the photosensitive drum, and the like.

(29) In addition, the illustrated configuration of the fixing unit **50** is merely an example, and for example, a belt member stretched over a plurality of rollers may be used instead of the heating roller **52**. In addition, as a heating portion, a heating mechanism including a coil and a core for heating the heating roller **52** serving as a first rotary member by induction heating, or a heater board on which a pattern of a heat-generating resistor that generates Joule's heat may be used. Regardless of the heating system of the heater **51** serving as a heating portion, the fixing unit **50** heated by preheating that will be described below emits radiant heat.

(30) Image forming Operation

(31) Next, a series of operations (image forming operation) in which the image forming apparatus **100** forms an image on the sheet S will be described. When a job (image forming job) of instructing the image forming apparatus **100** to execute the image forming operation is input, the image forming operation is started. Then, in each of the stations **200**Y to **200**K, the photosensitive drum **120** is rotated, and the charging unit **121** uniformly charges the surface of the photosensitive drum **120**. The exposing unit **122** exposes the photosensitive drum **120** on the basis of image information included in the image forming job, and thus forms an electrostatic latent image on the surface of the photosensitive drum **120**. The developing unit **123** develops the electrostatic latent image on the photosensitive drum **120** with developer including charged toner, and thus visualizes the electrostatic latent image as a monochromatic toner image.

(32) The monochromatic toner images borne on the surface of the respective photosensitive drums **120** are transferred onto the intermediate transfer belt **125** by the primary transfer rollers **124** through primary transfer. At this time, the monochromatic toner images respectively formed on the surface of the photosensitive drums **120** are transferred onto the intermediate transfer belt **125** so as to be superimposed on one another (superimposed transfer), and thus a full-color toner image is formed on the intermediate transfer belt **125**. The full-color toner image will be hereinafter simply referred to as a toner image. To be noted, the intermediate transfer belt **125** is rotationally driven by the driving roller **126** rotating at a constant speed, and thus the peripheral speed of the intermediate transfer belt **125** is maintained at a constant value. The toner image borne on the intermediate transfer belt **125** is conveyed toward the transfer nip N**2** by the rotation of the intermediate transfer belt **125**.

(33) In parallel with the formation of the toner image described above, the sheets S are fed one by one from the feeding portion **110**. The one sheet S fed from the cassette **111** by the pickup roller **112** and separated by the separation unit **113** is conveyed to the registration rollers **115** by the send-out rollers **114**. The registration rollers **115** correct the skew of the sheet S, and then conveys the sheet S to the transfer nip N**2**. At this time, the conveyance timing of the sheet S is adjusted such that entrance of the sheet S to the transfer nip N**2** and arrival of the toner image borne on the intermediate transfer belt **125** at the transfer nip N**2** are synchronized. Then, while the sheet S passes through the transfer nip N**2**, the toner image is transferred onto the sheet S from the intermediate transfer belt **125** through second transfer by an electric field formed at the transfer nip N**2** by the secondary transfer roller **131**.
(34) The sheet S having passed through the transfer nip N**2** is conveyed to the fixing unit **50** by the pre-fixing conveyance portion **904**. The fixing unit **50** heats and pressurizes the toner image on the sheet S to fix the toner image to the sheet S while nipping and conveying the sheet S at a fixing nip Nf. While the image forming operation is executed, the controller **170** controls the heater **51** on the basis of the detection signal from the first temperature sensor **70** such that the surface temperature of the heating roller **52** is maintained at a target temperature (fixing temperature) suitable for fixing of the toner image.
(35) In the case of forming an image on only one surface of the sheet S, the sheet S sent out from the fixing unit **50** is discharged to the outside of the image forming apparatus **100** by the discharge rollers **911**. In the case of forming an image on each surface of the sheet S, the sheet S sent out from the fixing unit **50** is reversed and conveyed by the reverse conveyance rollers **912**, and is conveyed to the feeding path **901** again through the duplex conveyance portion **913**. Then, the sheet S passes through the transfer nip N**2** and the fixing nip Nf again, thus an image is formed on a second surface of the sheet S opposite to a first surface of the sheet S on which an image has been already formed, and then the sheet S is discharged to the outside of the image forming apparatus **100** by the discharge rollers **911**.
(36) Pre-Fixing Conveyance Portion
(37) Next, the pre-fixing conveyance portion **904** will be described. FIG. **2** is a section view of the secondary transfer portion **130**, the pre-fixing conveyance portion **904**, and the fixing unit **50**. The pre-fixing conveyance portion **904** is a conveyance portion (sheet conveyance mechanism) of the preset embodiment that conveys a sheet from a transfer portion to a fixing unit.
(38) As illustrated in FIG. **2**, the pre-fixing conveyance portion **904** includes the first conveyance unit **10** and the second conveyance unit **20**. The first conveyance unit **10** and the second conveyance unit **20** are each a conveyance unit capable of conveying the sheet S by itself. In the present embodiment, the first conveyance unit **10** disposed on the upstream side in the sheet conveyance direction FD and the second conveyance unit **20** disposed on the downstream side in the sheet conveyance direction FD are arranged in series. That is, the first conveyance unit **10** is disposed downstream of the transfer nip N**2** and upstream of the second conveyance unit **20** in the sheet conveyance direction FD. The second conveyance unit **20** is disposed downstream of the first conveyance unit **10** and upstream of the fixing nip Nf in the sheet conveyance direction FD.
(39) The first conveyance unit **10** includes first conveyance belts **11** serving as conveyance belts, and a plurality of rollers rotatably stretching and supporting the first conveyance belts **11**. The first conveyance belts **11** of the present embodiment are stretched over a first driving roller **12** and three driven rollers **12***a*, **12***b*, and **12***c*. In addition, the first conveyance unit **10** includes a first driving motor **14** serving as a driving portion that drives the first conveyance belts **11**. The first driving motor **14** rotationally drives the first driving roller **12**, and thus rotates the first conveyance belts **11** in a rotation direction following the sheet conveyance direction FD. The rotation direction is a counterclockwise direction in FIG. **2**.
(40) The first conveyance belts **11** are each an endless belt member in which a plurality of holes penetrating from the outer peripheral surface to the inner peripheral surface are regularly arranged

as illustrated in FIG. **5**B. That is, the first conveyance belts **11** have breathability (air-permeability) in which air can be passed between the outer peripheral side and the inner peripheral side through the plurality of holes. The first conveyance unit **10** of the present embodiment includes four first conveyance belts **11** arranged in the sheet width direction as illustrated in FIG. **5**B.

(41) A first suction fan **15** serving as a suction portion is disposed in a space on the inner peripheral side of the first conveyance belts **11**. By sucking air from the outer peripheral side (outside) toward the inner peripheral side (inside) of the first conveyance belts **11** through a large number of holes provided in the first conveyance belts **11**, the first suction fan **15** generates a suction attraction force (negative pressure) for holding the sheet S on the outer peripheral surface of the first conveyance belts **11**.

(42) The second conveyance unit **20** has substantially the same configuration as the first conveyance unit **10**. That is, the second conveyance unit **20** includes second conveyance belts **21** serving as conveyance belts, and a plurality of rollers rotatably stretching and supporting the second conveyance belts **21**. The second conveyance belts **21** of the present embodiment are stretched over a second driving roller **22** and three driven rollers **22***a*, **22***b*, and **22***c*. In addition, the second conveyance unit **20** includes a second driving motor **24** serving as a driving portion that drives the second conveyance belts **21**. The second driving motor **24** rotationally drives the second driving roller **22**, and thus rotates the second conveyance belts **21** in a rotation direction following the sheet conveyance direction FD. The rotation direction is a counterclockwise direction in FIG. **2**.

(43) The second conveyance belts **21** are each an endless belt member in which a plurality of holes **21***a* penetrating from the outer peripheral surface to the inner peripheral surface are regularly arranged as illustrated in FIG. **5**B. That is, the second conveyance belts **21** have breathability (air-permeability) in which air can be passed between the outer peripheral side and the inner peripheral side through the plurality of holes. The second conveyance unit **20** of the present embodiment includes four second conveyance belts **21** arranged in the sheet width direction as illustrated in FIG. **5**B.

(44) A second suction fan **25** serving as a suction portion is disposed in a space on the inner peripheral side of the second conveyance belts **21**. By sucking air from the outer peripheral side (outside) toward the inner peripheral side (inside) of the second conveyance belts **21** through a large number of holes provided in the second conveyance belts **21**, the second suction fan **25** generates a suction attraction force (negative pressure) for holding the sheet S on the outer peripheral surface of the second conveyance belts **21**.

(45) The pre-fixing conveyance portion **904** conveys the sheet S from the transfer nip N**2** to the fixing nip Nf while passing the sheet S from the first conveyance unit **10** to the second conveyance unit **20**. More specifically, the first conveyance belts **11** of the first conveyance unit **10** convey the sheet S sent out from the transfer nip N**2** in the sheet conveyance direction FD by carrying the sheet S on the conveyance surface thereof. The second conveyance belts **21** of the second conveyance unit **20** convey the sheet S received from the first conveyance belts **11** in the sheet conveyance direction FD by carrying the sheet S on the conveyance surface thereof, and thus delivers out the sheet S toward the fixing nip Nf.

(46) To be noted, the center position of the second suction fan **25** in the sheet conveyance direction FD may be positioned downstream of the center position of the second conveyance belts **21** in the sheet conveyance direction FD. In this manner, the sheet S can be conveyed to the fixing nip Nf in a state in which the sheet S is closer to the outer peripheral surface of the second conveyance belts **21**.

(47) A sheet detection sensor **116** that detects a sheet is disposed between the registration rollers **115** and the transfer nip N**2** in the sheet conveyance direction FD. The sheet detection sensor **116** detects the presence or absence of a sheet at a detection position P**1** between the registration rollers **115** and the transfer nip N**2** in the sheet conveyance direction FD. A signal output from the sheet detection sensor **116** is transmitted to the controller **170** illustrated in FIG. **3**.

(48) A post-transfer guide **951** is disposed between the transfer nip N**2** and the first conveyance unit **10** in the sheet conveyance direction FD. The post-transfer guide **951** guides the sheet S sent out from the transfer nip N**2** to the conveyance surface of the first conveyance belts **11**. The conveyance surface is part of the outer peripheral surface constituting the conveyance path for the sheet S, and corresponds to the upper surface of the first conveyance belts **11** in FIG. **2**.
(49) A pre-fixing guide **952** is disposed between the second conveyance unit **20** and the pre-fixing conveyance portion **904** in the sheet conveyance direction FD. The pre-fixing guide **952** guides the sheet S curvature-separated from the conveyance surface of the second conveyance belts **21** to the fixing nip Nf. The conveyance surface is part of the outer peripheral surface constituting the conveyance path for the sheet S, and corresponds to the upper surface of the second conveyance belts **21** in FIG. **2**. The sheet S being curvature-separated means that the sheet S is separated from the conveyance surface at a curved portion at a downstream end of the conveyance surface of the conveyance belt due to the stiffness of the sheet S. The curved portion is a portion where the conveyance belt is rolled around the second driving roller **22**.
(50) In addition, a loop detection sensor **16** is disposed in the pre-fixing conveyance portion **904**. The loop detection sensor **16** detects the height of the sheet S that is being conveyed. The height detected here is the position in a direction orthogonal to the sheet conveyance direction FD and the sheet width direction, that is, the up-down direction in FIG. **2**. The loop detection sensor **16** of the present embodiment includes a detection flag **161** that swings in accordance with the height of the sheet S, and a sensor portion **162** that detects the angle of the detection flag **161**. The detection flag **161** projects upward from the conveyance surface of the first conveyance belts **11**, and swings by coming into contact with the sheet S. For example, the sensor portion **162** is a photo-interrupter that switches between a light-blocked state and a light-transmitted state in accordance with the angle of the detection flag **161**, and outputs an ON signal or OFF signal.
(51) The controller **170** illustrated in FIG. **3** adjusts the conveyance speed of the sheet S in the fixing unit **50** on the basis of the detection result of the loop detection sensor **16**, and thus controls the degree of warpage (loop amount) of the sheet S between the transfer nip N**2** and the fixing nip Nf. Specifically, in the case where the height of the sheet S detected by the detection flag **161** is equal to or larger than a predetermined height, that is, in the case where the loop amount is equal to or smaller than a predetermined amount, the driving speed of the fixing unit **50** by a fixing motor **54** illustrated in FIG. **3** is reduced to increase the loop amount. Conversely, in the case where the height of the sheet S detected by the detection flag **161** is equal to or smaller than a predetermined height, that is, in the case where the loop amount is equal to or larger than a predetermined amount, the driving speed of the fixing unit **50** by the fixing motor **54** is increased to reduce the loop amount. By performing such loop control, the orientation of the sheet S between the transfer nip N**2** and the fixing nip Nf can be maintained to be constant.
(52) System Configuration
(53) FIG. **3** is a block diagram illustrating a system configuration of the image forming apparatus **100**. The controller **170** serving as a controller that controls the operation of the image forming apparatus **100** includes an arithmetic processing portion including a central processing unit: CPU **171**, the memory **172**, and the timer **175**. In addition, the controller **170** has circuits for communicating data with the outside such as an input/output port: I/O port **173** and a communication interface **174**.
(54) The CPU **171** reads out a program stored in the memory **172** and executes the program, and thus controls the operation of the image forming apparatus **100**. The memory **172** stores the program and data necessary for executing the program, and provides a work area for the CPU **171** to execute the program. The memory **172** is a computer-readable non-transitory recording medium. In addition, the CPU **171** manages time on the basis of a signal from the timer **175**.
(55) The controller **170** grasps the state of the apparatus on the basis of detection results of various sensors such as the door opening/closing sensor **151**, the loop detection sensor **16**, the sheet

detection sensor **116**, the first temperature sensor **70**, and the second temperature sensor **71**. In addition, the controller **170** transmits a command to the control targets of the feeding portion **110**, the image forming portion **920**, the pre-fixing conveyance portion **904**, and the fixing unit **50**, and thus controls the operation of each component.

(56) For example, the controller **170** can detect the opening and closing of the door for jam removal or the like on the basis of the detection signal from the door opening/closing sensor **151** serving as an opening/closing sensor. In addition, the controller **170** controls the start/stop and rotation speed of the rotation of the first conveyance belts **11** and the second conveyance belts **21** by transmitting commands to the first driving motor **14** and the second driving motor **24** of the pre-fixing conveyance portion **904**. In addition, the controller **170** controls the start/stop of the rotation of and the suction amount of the first suction fan **15** and the second suction fan **25** of the pre-fixing conveyance portion **904** by transmitting commands to the first suction fan **15** and the second suction fan **25**. Further, the controller **170** controls the rotation speed (peripheral speed) of the heating roller **52** and the pressurizing roller **53** by a command to the fixing motor **54** of the fixing unit **50**, and controls the heat generation amount of the heater **51** by a command to a temperature adjusting portion **55**.

(57) In addition, the controller **170** is communicably connected the operation portion **210** serving as a user interface of the image forming apparatus **100**. The operation portion **210** includes a display device such as a liquid crystal panel, and an input device such as a touch panel function of the liquid crystal panel or numerical keys. The controller **170** can notify the user of paper jam or the like via the operation portion **210**, and receive an instruction from the user such as an instruction for mode selection or input of the material of the sheet.

(58) The controller **170** controls the feeding portion **110**, the image forming portion **920**, the pre-fixing conveyance portion **904**, and the fixing unit **50** in accordance with the image forming job received from an external device, and thus executes the image forming operation. In addition, the controller **170** performs control of preheating that will be described below and idling of the pre-fixing conveyance portion **904** in a state in which the image forming job is not input.

(59) Gloss Unevenness after Preheating

(60) Next, a case where gloss unevenness occurs when the image forming job is input after the image forming apparatus **100** enters the standby state will be described with reference to FIGS. **4** to **5**B.

(61) First, the preheating of the fixing unit **50** and local temperature rise of the second conveyance belts **21** occurring after the preheating will be described with reference to FIG. **4**. The second conveyance belts **21** will be hereinafter simply referred to as conveyance belts **21**. The “preheating” refers to preliminarily heating the fixing unit to a preset temperature in a state before the image forming apparatus receives the image forming job. The preheating is executed in a series of preliminary operations performed for switching the image forming apparatus to the standby state, for example, when the power of the image forming apparatus is turned on or after the door is opened and closed for jam removal. The series of preliminary operations is also called an initial sequence or a preliminary multi-rotation operation.

(62) To be noted, the standby state is a state of the image forming apparatus **100** in which the image forming apparatus **100** is ready to start the image forming operation and stands by for input of the image forming job, and a state of the controller **170** corresponding to this state. In addition, in the initial sequence, in addition to the preheating of the fixing unit **50**, the stations **200**Y to **200**K of the image forming portion **920** are each caused to form a patch image to adjust the density, and/or the photosensitive drums **120** are caused to rotate to clean the surface thereof.

(63) In contrast with the preheating performed in the initial sequence, in a preliminary operation (pre-rotation) in a period from input of the image forming job to actual start of fixing of the toner image, the controller **170** raises the temperature of the fixing unit **50** to a target temperature (fixing temperature) suitable for fixation of the toner image. The target temperature (pre-heating

temperature) of the fixing unit **50** in the preheating may be lower than the target temperature (fixing temperature) of heating of the fixing unit **50** for fixing the toner image to the sheet during execution of the image forming job.

(64) After the initial sequence is finished, the controller **170** enters the standby state in which the controller **170** stands by for input of the image forming job in a state in which the image forming operation can be started. In addition, the controller **170** also enters the standby state in the case where the next image forming job is not input when the previous image forming job is finished. To be noted, while the standby state is continued, the controller **170** can control the heat generation of the heater **51** so as to maintain the fixing unit **50** at the pre-heating temperature on the basis of the detection signal from the first temperature sensor **70**.

(65) In the standby state, the fixing unit **50** is already heated by the preheating. Therefore, while part of the conveyance belts **21** close to the fixing unit **50** is heated by radiant heat from the fixing unit **50**, the temperature of the other part of the conveyance belts **21** gradually becomes closer to the environmental temperature of the environment in which the image forming apparatus **100** is installed. If the standby state continues for a long period, the difference between the surface temperature of the part of the conveyance belts **21** near the fixing unit **50** and the surface temperature of the other parts thereof increases. For example, in some cases, the surface temperature of the part of the conveyance belts **21** near the fixing unit **50** is 60° C. or higher, and the surface temperature at a position far away from the fixing unit **50** is about 30° C.

(66) FIG. **4** illustrates results of measurement of the surface temperature of the conveyance belts **21** at a predetermined detection position St illustrated in FIG. **2** by using a surface thermometer in a case where the image forming job is input and driving of the conveyance belts **21** is started after the image forming apparatus **100** has entered the standby state. The horizontal axis t [s] of FIG. **4** represents elapsed time from the start of the job, and the vertical axis T [° C.] represents the measured surface temperature of the conveyance belts **21**.

(67) FIG. **4** illustrates measurement results of the case where the driving of the conveyance belts **21** is stopped in the standby state. As described above, as a result of the conveyance belts **21** being driven in a state in which there is difference in the surface temperature in the peripheral direction of the conveyance belts **21** in the standby state, peaks periodically appear in the transition of the surface temperature measured at the detection position St. Here, T**0** represents the surface temperature of the conveyance belts **21** at the start of the job, T**1** represents the first peak temperature, and Ti (i=2 to 5) represents the second to fifth peak temperatures. ts represents a section in which the sheet S is passing the detection position St, and ΔT represents the difference between the maximum value (peak temperature) and minimum value of the surface temperature while the first sheet S is passing the detection position St.

(68) In such a circumstance, the sheet S conveyed in each section ts is conveyed in a state in which part of the sheet S is in contact with a high-temperature portion of the conveyance belts **21**. The toner image in a region where the sheet S has been in contact with the high-temperature portion of the conveyance belts **21** enters the fixing nip Nf in a state of being heated in advance by heat transmitted from the conveyance belts **21**, and as a result, has a higher degree of gloss than the toner image in other regions in a state after the fixing. As a result of this, gloss unevenness occurs in a part of the product corresponding to the high-temperature portion of the conveyance belts **21**. In other words, in the case where ΔTs is large, gloss unevenness is more likely to occur. In addition, gloss unevenness is more likely to occur in the case where the peak temperature Ti is higher.

(69) FIG. **5**A illustrates an example of the gloss unevenness appearing in the product. FIG. **5**B is a perspective view of the pre-fixing conveyance portion **904**. Here, as a case where the gloss unevenness becomes more likely to be noticeable, a case where a halftone image is formed on the entirety of one surface of the sheet S will be described as an example.

(70) In FIG. **5**B, a high-temperature portion **21**H of the conveyance belts **21** heated by radiant heat from the fixing unit **50** is indicated by a broken line. In FIG. **5**A, the region of the sheet S having

been in contact with the high-temperature portion **21**H of the conveyance belts **21** is indicated by a broken line. In FIG. **5**A, gloss unevenness that is visually recognizable and looks like a trace of the belt is generated in the portion having been in contact with the high-temperature portion **21**H of the conveyance belts **21**.
(71) As illustrated in FIG. **4**, in accordance with the elapse of time after the start of the image forming job, the peak temperature decreases from the peak temperature T**2** to the peak temperature T**5**, and the difference ΔTs between the maximum value and minimum value of the surface temperature in the section ts in which the sheet S is conveyed also decreases. Therefore, the gloss unevenness is likely to occur in the product immediately after the start of the image forming job, and the gloss unevenness becomes gradually less noticeable.
(72) Idling of Conveyance Belts
(73) To reduce the possibility of occurrence of the gloss unevenness described above, it is effective to idle the conveyance belts receiving the radiant heat from the fixing unit **50** in at least one of (1) preheating of the fixing unit **50**, and (2) standby state of the image forming apparatus **100** after the preheating. That is, it is preferable to rotate the conveyance belts in at least one of the period in which preheating is executed and the period in which the image forming apparatus **100** is standing by in the standby state after the fixing unit has reached the target temperature for the preheating. In the present embodiment, among the two sets of the conveyance belts **11** and **21**, the set of conveyance belts closer to the fixing unit **50**, that is, the second conveyance belts **21** are idled in both the preheating of the fixing unit **50** and the standby state.
(74) Here, the idling of the conveyance belts refers to rotating the conveyance belts in a non-image forming period. The non-image forming period is a period other than the period (image forming period) in which image formation is performed on the sheet in response to input of the image forming job. The image forming job typically includes a pre-rotation step (preparation operation before image formation), an image forming step, and a post-rotation step (finishing operation after image formation). In the pre-rotation, rising of various voltages used for image formation and the like are performed. In the image forming step, transfer and fixation of an image onto the sheet is performed while conveying the sheet as described above. The non-image forming period includes, in addition to the pre-rotation step and the post-rotation step, periods in which the image forming job is not input such as the standby state and the sleep state, the execution period of the initial sequence after the power is turned on, and the like.
(75) FIG. **6** illustrates the transition of the surface temperature of the conveyance belts **21** in the case where the conveyance belts **21** are idled after the preheating. The measurement method for the surface temperature is substantially the same as that described with reference to FIG. **4**.
(76) As illustrated in FIG. **6**, even in the case where the standby state of the image forming apparatus **100** continues in a state in which the fixing unit **50** is preliminarily heated, the surface temperature of the conveyance belts **21** settles at a certain temperature, and the temperature distribution in the peripheral direction becomes more uniform by idling the conveyance belts **21**. That is, the change amount ΔT of the surface temperature in each cycle of rotation of the conveyance belts is the largest (ΔT**0**) in the first cycle, and then decreases as time passes. That is, $\Delta T0 > \Delta Ta > \Delta Tb$ holds where $0 < ta < tb$ holds. Here, ΔT is the difference between the maximum value and minimum value of the surface temperature of the conveyance belts **21** measured at the detection position St illustrated in FIG. **2** in a period in which the conveyance belts **21** rotate once. In addition, the peak temperature of the surface temperature also decreases as time passes. That is, $Tamx > Tbmx$ holds.
(77) The occurrence of the gloss unevenness caused by the temperature difference in the peripheral direction of the conveyance belts **21** can be reduced as illustrated in FIGS. **5**A and **5**B if the change amount ΔT of the surface temperature has become sufficiently small (for example, ΔT≤6° C.) before the first sheet S reaches the conveyance belts **21** when the image forming job is executed. In addition, the gloss unevenness is less likely to occur when the peak temperature after the first sheet

S has reached the conveyance belts **21** is lower. Therefore, idling of the conveyance belts **21**, that is, the rotation of the conveyance belts **21** in the non-image forming period is preferably continued for a predetermined time or longer, for example, 60 seconds or longer.
(78) Flowchart
(79) In the present embodiment, in the flowchart illustrated in FIG. **7**, idling of the conveyance belts **21** is performed. Each step of the following control is performed by the CPU **171** of the controller **170** illustrated in FIG. **3** executing a program while the power of the image forming apparatus **100** is on.
(80) In the case where the power of the image forming apparatus **100** is turned on, that is, in the case where the result of step S**101** is Y, the initial sequence is started and preheating of the fixing unit **50** is executed in step S**102**. Also in the case where an event indicating that the door of the image forming apparatus **100** has been closed from the open state, that is, door closing is detected, the result of step S**101** also becomes Y, the initial sequence is started and preheating of the fixing unit **50** is executed in step S**102**. In the present embodiment, the conveyance belts **21** are idled while the preheating is executed. That is, the controller **170** rotates the conveyance belts **21** by the second driving motor **24** serving as a driving portion in parallel with power supply to the heater **51** in the fixing unit **50** while the initial sequence is executed.
(81) As described above, by rotating (idling) the conveyance belts **21** while the preheating of the fixing unit **50** is executed, local heating of the conveyance belts **21** by radiant heat from the fixing unit **50** can be reduced.
(82) Here, the conveyance speed (peripheral speed) at the time of idling the conveyance belts **21** does not need to be equal to the conveyance speed (process speed) of the conveyance belts **21** at the time of image formation. In the present embodiment, whereas the conveyance speed of the conveyance belts **21** at the time of image formation is 300 mm/s, the conveyance speed of the conveyance belts **21** at the time of idling is set to 200 mm/s. That is, the peripheral speed of the conveyance belts **21** in the case of rotating the conveyance belts **21** while the preheating is executed is lower than the peripheral speed of the conveyance belts **21** while the image forming operation is executed. As a result of this, occurrence of a noise and decrease in the durability of the driving system caused by the idling of the conveyance belts **21** can be reduced. The driving system mentioned herein includes the second driving motor **24** and a drive transmission path from the second driving motor **24** to the conveyance belts **21**.
(83) To be noted, there is a case where, if the conveyance speed is set to a value lower than 200 mm/s, the conveyance speed falls within the resonance range of the second driving motor **24** and the noise and the vibration increases, and therefore the conveyance speed at the time of idling is set to 200 mm/s to avoid the resonance range.
(84) In addition, when idling the conveyance belts **21**, the first conveyance belts **11** that are upstream conveyance belts are not idled. As a result of this, occurrence of a noise and decrease in the durability of the driving system caused by the idling of the first conveyance belts **11** can be reduced.
(85) In the case where the fixing unit **50** has reached the target temperature of the preheating and the other steps of the initial sequence are finished, that is, in the case where the result of step S**103** is Y, the controller **170** enters the standby state in step S**104**. Also in the standby state, the idling of the conveyance belts **21** is continued. To be noted, the first conveyance belts **11** serving as upstream conveyance belts are not idled.
(86) As described above, by rotating (idling) the conveyance belts **21** in the standby state, local heating of the conveyance belts **21** by radiant heat from the fixing unit **50** can be reduced.
(87) In the case where the image forming job is input in the standby state, that is, in the case where the result of step S**105** is Y, the controller **170** starts execution of the image forming operation. To be noted, in the case where the image forming job is input before the initial sequence is finished, after the initial sequence is finished, the controller **170** starts execution of the image forming job.

While the image forming job is executed, before the first sheet S in the job reaches the pre-fixing conveyance portion **904**, the conveyance speed of the conveyance belts **21** is increased to the process speed in step S**106**, and driving of the first conveyance belts **11** is also started.
(88) When the image forming job is finished in step S**107**, the controller **170** returns to the standby state in step S**104**, and stands by for input of the next job while idling the conveyance belts **21**.
(89) As described above, according to the present embodiment, the conveyance belts **21** are idled in the preheating of the fixing unit **50** and the standby state. As a result of this, occurrence of gloss unevenness caused by the temperature difference of the conveyance belts **21** in the peripheral direction can be reduced.
(90) As a specific case, in the case where the initial sequence is executed after the power of the image forming apparatus **100** is turned on, since the idling of the conveyance belts **21** is performed in parallel with the preheating in the present embodiment, local temperature rise of the conveyance belts **21** can be reduced. As a result of this, occurrence of gloss unevenness in the first job after the power is turned on can be reduced.
(91) As another case, in the case where the previous job is stopped due to a conveyance abnormality, local temperature rise of the conveyance belts **21** can be caused by radiant heat from the fixing unit **50** in a period before jam removal is performed. Also in this case, according to the present embodiment, idling of the conveyance belts **21** is performed in the initial sequence, therefore the temperature difference of the conveyance belts **21** in the peripheral direction can be reduced, and occurrence of gloss unevenness in the first job after the power is turned on can be reduced. Since the initial sequence normally takes 1 minute or longer, the conveyance belts **21** idle for 1 minute or longer after the door closing. Therefore, the temperature difference of the conveyance bels **21** in the peripheral direction can be sufficiently reduced. For example, ΔT can be reduced to 6° C. or less.
(92) As yet another case, in the case where the conveyance belts **21** are stopped in a standby period between the end of the previous job and the input of the next job, local temperature rise of the conveyance belts **21** can be caused by radiant heat from the fixing unit **50**. According to the present embodiment, since the conveyance belts **21** are continuously idled in the standby state, occurrence of gloss unevenness in the next job can be reduced.
(93) To be noted, in the case of a recording material having a higher fixing temperature than typical recording materials or the like, the gloss unevenness caused by the temperature difference of the conveyance belts **21** in the peripheral direction can be more likely to be noticeable. For example, in the case of a coated paper sheet or an overhead transparency: OHT (sheet for projectors), gloss unevenness caused by the temperature difference of the conveyance belts **21** in the peripheral direction is easily visually recognizable. According to the present embodiment, occurrence of gloss unevenness can be reduced even in the case of using such a recording material.
Second Embodiment
(94) An image forming apparatus according to another embodiment serving as a second embodiment will be described. In the present embodiment, a mode determining which of the productivity and the image quality is to be prioritized can be selected, and the time (predetermined time) for idling the conveyance belts changes depending on the mode. In addition, in the present embodiment, the configuration of the pre-fixing conveyance portion **904** is different from that of the first embodiment. In the description below, it is assumed that elements denoted by the same reference signs as in the first embodiment have substantially the same configurations and effects as those described in the first embodiment, and elements different from the first embodiment will be described.
(95) FIG. **8**A illustrates an example of gloss unevenness appearing in the product in the case where the pre-fixing conveyance portion **904** of the present embodiment is used, and FIG. **8**B is a perspective view of the pre-fixing conveyance portion **904** according to the present embodiment.
(96) As illustrated in FIG. **8**B, the pre-fixing conveyance portion **904** of the present embodiment is

constituted by one conveyance unit **30**. In addition, the conveyance unit **30** includes only one conveyance belt **31** disposed at the center in the sheet width direction. A plurality of holes are provided in the conveyance belt **31**, and the conveyance belt **31** carries and conveys the sheet S by a suction attraction force generated by a suction fan therein.

(97) Also in the case of using the conveyance unit **30** having such a configuration, gloss unevenness can occur in part of the sheet S having been in contact with a high-temperature region **31**H of the conveyance belt **31** when the image forming operation is performed in a state in which there is a temperature difference in the conveyance belt **31** in the peripheral direction as illustrated in FIGS. **8**A and **8**B.

(98) FIG. **9** is a flowchart illustrating a control method of the image forming apparatus according to the present embodiment. The controller **170** of the present embodiment is configured to be capable of selecting a productivity-prioritized mode serving as a first mode in which productivity is prioritized and an image quality-prioritized mode serving as a second mode in which image quality is prioritized as compared with the productivity-prioritized mode while the image forming job is executed. The mode can be switched by, for example, the user operating the operation portion **210** or operating a setting screen of a host computer connected to the image forming apparatus **100**.

(99) In the image quality-prioritized mode, output of an image having high gloss is desired. The image quality-prioritized mode is applied to a case of forming an image close to a full-coverage image such as a photograph, or a case of forming an image on a coated paper sheet or the like. In the productivity-prioritized mode, mainly output of a text is desired, and the productivity is more prioritized than the gloss. The image quality-prioritized mode and the productivity-prioritized mode are different in which of the image quality and the productivity is prioritized in the case of a mixed job in which images are successively formed on sheets of a plurality of types having different grammages.

(100) As illustrated in FIG. **9**, in the present embodiment, the lower limit of the idling time (rotation time) in the productivity-prioritized mode, which is 30 seconds, is set to be shorter than the lower limit of the idling time (rotation time) in the image quality-prioritized mode, which is 60 seconds, as indicated by steps S**111** to S**113**. That is, in the productivity-prioritized mode, since the conveyance belt **31** is idled for at least 30 seconds in the initial sequence, increase in the FPOT can be suppressed while reducing the gloss unevenness as compared with the case where the conveyance belt **31** is not idled. In contrast, in the image quality-prioritized mode, since the conveyance belt **31** is idled for at least 60 seconds in the initial sequence, the temperature difference of the conveyance belt **31** in the peripheral direction can be further reduced, and the gloss unevenness can be reduced more than in the productivity-prioritized mode.

(101) In FIG. **9**, processing other than steps S**111** to S**113** is substantially the same as in the first embodiment illustrated in FIG. **7**.

(102) To be noted, in some cases, the initial sequence takes 60 seconds or longer. Therefore, the initial sequence can finish and the result of step S**103** can become Y after the idling is performed for 60 seconds or longer eventually, regardless of which of the productivity-prioritized mode and the image quality-prioritized mode is selected.

Modification Example

(103) As a modification example, as illustrated in FIG. **10**, the conveyance belt **31** may be idled in step S**110** during the preparation operation (pre-rotation) after input of the image forming job. In this case, it is preferable that the idling of the conveyance belt **31** is started at least before the image forming operation is started, that is, at least before the feeding of the first sheet is started, and that the idling time of the conveyance belt **31** in steps S**111** to S**113** is secured in accordance with which of the productivity-prioritized mode and the image quality-prioritized mode is selected. In the present modification example, a configuration in which the conveyance belt **31** is not idled in the preheating of the fixing unit **50** and in the standby state may be employed.

(104) According to the present modification example, even if there is a temperature difference of

the conveyance belt **31** in the peripheral direction at the time of input of the job, since the temperature distribution is gradually uniformized by the idling during pre-rotation, the gloss unevenness can be reduced similarly to the embodiments described above. In addition, by changing the idling time (predetermined time) in accordance with the mode, high productivity and high image quality can be achieved simultaneously.

Other Embodiments

(105) In the embodiments described above, since a configuration in which the sheet S is attracted to the conveyance belt provided with a plurality of holes by the suction attraction force of a suction fan and is thus conveyed has been described as an example, the shape of the holes of the conveyance belt is reflected on the gloss unevenness. However, also in the case where a conveyance belt not having a hole is used, gloss unevenness can occur if there is a temperature difference in the peripheral direction in the conveyance belt due to radiant heat from the fixing unit. Therefore, the present technique is also applicable to an image forming apparatus including a conveyance belt that electrostatically attracts and conveys the sheet S. In addition, the entirety of the conveyance belt does not have to be disposed between the transfer portion and the fixing unit, and the present technique is also applicable to an image forming apparatus including a conveyance belt (transfer belt) extending toward the fixing unit side beyond the transfer portion from the upstream side of the transfer portion.

(106) In the embodiments described above, the air-blow amount of the suction fan may be changed in accordance with the material of the sheet S. For example, in the case of using a recording material having at least a surface formed from a synthetic resin material such as an OHT film, a coated paper sheet, or a synthetic paper sheet, the gloss unevenness is more likely to occur than in a plain paper sheet. Therefore, in the case of using such a recording material, the air-blow amount of the suction fan may be reduced as compared with the case of using a plain paper sheet to suppress temperature reduction at the holes of the conveyance belt. As a result of this, temperature difference between the vicinity of the holes and the other parts in the surface of the conveyance belt can be reduced, and thus occurrence of gloss unevenness can be further reduced.

(107) In the embodiments described above, in the case of entering the standby state, the fixing unit **50** is preliminarily heated and the conveyance belt is idled. In the case of an image forming apparatus having an energy-saving mode in which power consumption is lower than in a normal mode, a configuration in which idling of the conveyance belt is not idled in the energy-saving mode may be employed. In the energy-saving mode, the preheating of the fixing unit **50** is not performed, or at least the target temperature of the preheating is set to be lower than that in the standby state of the normal mode. Therefore, by not idling the conveyance belt, the power consumption can be reduced and the quietness can be improved.

(108) In the embodiments described above, a configuration in which the conveyance belt is continuously idled during the initial sequence and in the standby state has been described as an example. The method for idling the conveyance belt is not limited to this, and for example, idling and temporary stop may be intermittently repeated.

(109) In addition, also a configuration in which, for example, the idling of the conveyance belt is not performed while the temperatures detected by the temperature sensors **70** and **71** of the fixing unit **50** are equal to or lower than predetermined threshold values even in parts of the embodiments described above where the conveyance belt is described to be idled may be employed. This is because local temperature rise of the conveyance belt caused by radiant heat is not likely to occur if the temperature of the fixing unit **50** is not high.

(110) Embodiment(s) of the present invention can also be realized by a computer of a system or apparatus that reads out and executes computer executable instructions (e.g., one or more programs) recorded on a storage medium (which may also be referred to more fully as a ‘non-transitory computer-readable storage medium’) to perform the functions of one or more of the above-described embodiment(s) and/or that includes one or more circuits (e.g., application specific

integrated circuit (ASIC)) for performing the functions of one or more of the above-described embodiment(s), and by a method performed by the computer of the system or apparatus by, for example, reading out and executing the computer executable instructions from the storage medium to perform the functions of one or more of the above-described embodiment(s) and/or controlling the one or more circuits to perform the functions of one or more of the above-described embodiment(s). The computer may comprise one or more processors (e.g., central processing unit (CPU), micro processing unit (MPU)) and may include a network of separate computers or separate processors to read out and execute the computer executable instructions. The computer executable instructions may be provided to the computer, for example, from a network or the storage medium. The storage medium may include, for example, one or more of a hard disk, a random-access memory (RAM), a read only memory (ROM), a storage of distributed computing systems, an optical disk (such as a compact disc (CD), digital versatile disc (DVD), or Blu-ray Disc (BD)™), a flash memory device, a memory card, and the like.
(111) While the present invention has been described with reference to exemplary embodiments, it is to be understood that the invention is not limited to the disclosed exemplary embodiments. The scope of the following claims is to be accorded the broadest interpretation so as to encompass all such modifications and equivalent structures and functions.
(112) This application claims the benefit of Japanese Patent Application No. 2022-041687, filed on Mar. 16, 2022, which is hereby incorporated by reference herein in its entirety.

Claims

1. An image forming apparatus comprising: a transfer portion configured to transfer a toner image onto a sheet; a fixing unit configured to heat the toner image transferred onto the sheet to fix the toner image to the sheet; a conveyance belt configured to convey the sheet from the transfer portion toward the fixing unit; a driving portion configured to drive the conveyance belt; and a controller configured to control the driving portion, wherein the controller is configured to, in a standby state in which the image forming apparatus stands by for input of an image forming job, cause the driving portion to rotate the conveyance belt and cause the fixing unit to be heated.
2. The image forming apparatus according to claim 1, wherein the controller is configured to, in the standby state, cause the driving portion to rotate the conveyance belt while the fixing unit is being heated.
3. The image forming apparatus according to claim 1, wherein the controller is configured to, in the standby state, cause the driving portion to rotate the conveyance belt for at least 30 seconds.
4. The image forming apparatus according to claim 1, wherein in the standby state, the controller is configured to execute preheating in which the fixing unit is preliminarily heated to a preliminary temperature, and wherein after the image forming job is input, the controller is configured to execute heating in which the fixing unit is heated to a fixing temperature higher than the preliminary temperature.
5. The image forming apparatus according to claim 4, further comprising: an upstream conveyance belt disposed upstream of the conveyance belt in a sheet conveyance direction and configured to convey the sheet from the transfer portion to the conveyance belt, wherein, while the preheating is executed, the controller is configured to cause the driving portion to rotate the conveyance belt and not rotate the upstream conveyance belt.
6. The image forming apparatus according to claim 4, wherein a peripheral speed of the conveyance belt in a case where the conveyance belt is rotated while the preheating is executed is lower than the peripheral speed of the conveyance belt while an image forming operation is executed.
7. The image forming apparatus according to claim 4, wherein the controller is configured to cause the driving portion to rotate the conveyance belt in a period in which the image forming apparatus

stands by in the standby state after the fixing unit has reached the preliminary temperature.
8. The image forming apparatus according to claim 7, further comprising: an upstream conveyance belt disposed upstream of the conveyance belt in a sheet conveyance direction and configured to convey the sheet from the transfer portion to the conveyance belt, wherein, in the period in which the image forming apparatus stands by in the standby state, the controller is configured to cause the driving portion to rotate the conveyance belt and not rotate the upstream conveyance belt.
9. The image forming apparatus according to claim 7, wherein a peripheral speed of the conveyance belt in a case where the conveyance belt is rotated in the period in which the image forming apparatus stands by in the standby state is lower than the peripheral speed of the conveyance belt while the image forming operation is executed.
10. The image forming apparatus according to claim 4, wherein the controller is configured to start the preheating in a case where power of the image forming apparatus is turned on.
11. The image forming apparatus according to claim 4, further comprising: an opening/closing member configured to be opened to expose a sheet conveyance path provided in the image forming apparatus; and a sensor configured to detect opening and closing of the opening/closing member, wherein the controller is configured to start the preheating in a case where closing of the opening/closing member from an open state is detected on a basis of a detection signal from the sensor.
12. The image forming apparatus according to claim 1, wherein the controller is configured to cause the driving portion to rotate the conveyance belt in a period in which the image forming apparatus stands by for input of a next image forming job after a previous image forming job is finished.
13. The image forming apparatus according to claim 1, wherein the controller is configured to cause the driving portion to rotate the conveyance belt during a preparation operation after the image forming job is input and before an image forming operation based on the image forming job is started.
14. The image forming apparatus according to claim 1, wherein, in a case where rotation of the conveyance belt is started in a non-image forming period, the controller is configured to continue the rotation of the conveyance belt at least until a rotation time of the conveyance belt exceeds a predetermined time.
15. The image forming apparatus according to claim 1, wherein the conveyance belt has a plurality of holes, and wherein the image forming apparatus further includes a suction portion configured to suck air from an outer space of the conveyance belt to an inner space of the conveyance belt via the plurality of holes such that the sheet is held on a surface of the conveyance belt.