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(54) **INK-JET PRINTER**

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CPC ***B41J 2/04515*** (2013.01); ***B41J 2/175*** (2013.01); ***B41J 2/1714*** (2013.01); ***B41J 2/18*** (2013.01);
(Continued)

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CPC . B41J 2/1714; B41J 2/175; B41J 2/245; B41J 29/377; B41J 2/28; B41J 2/04515;
(Continued)

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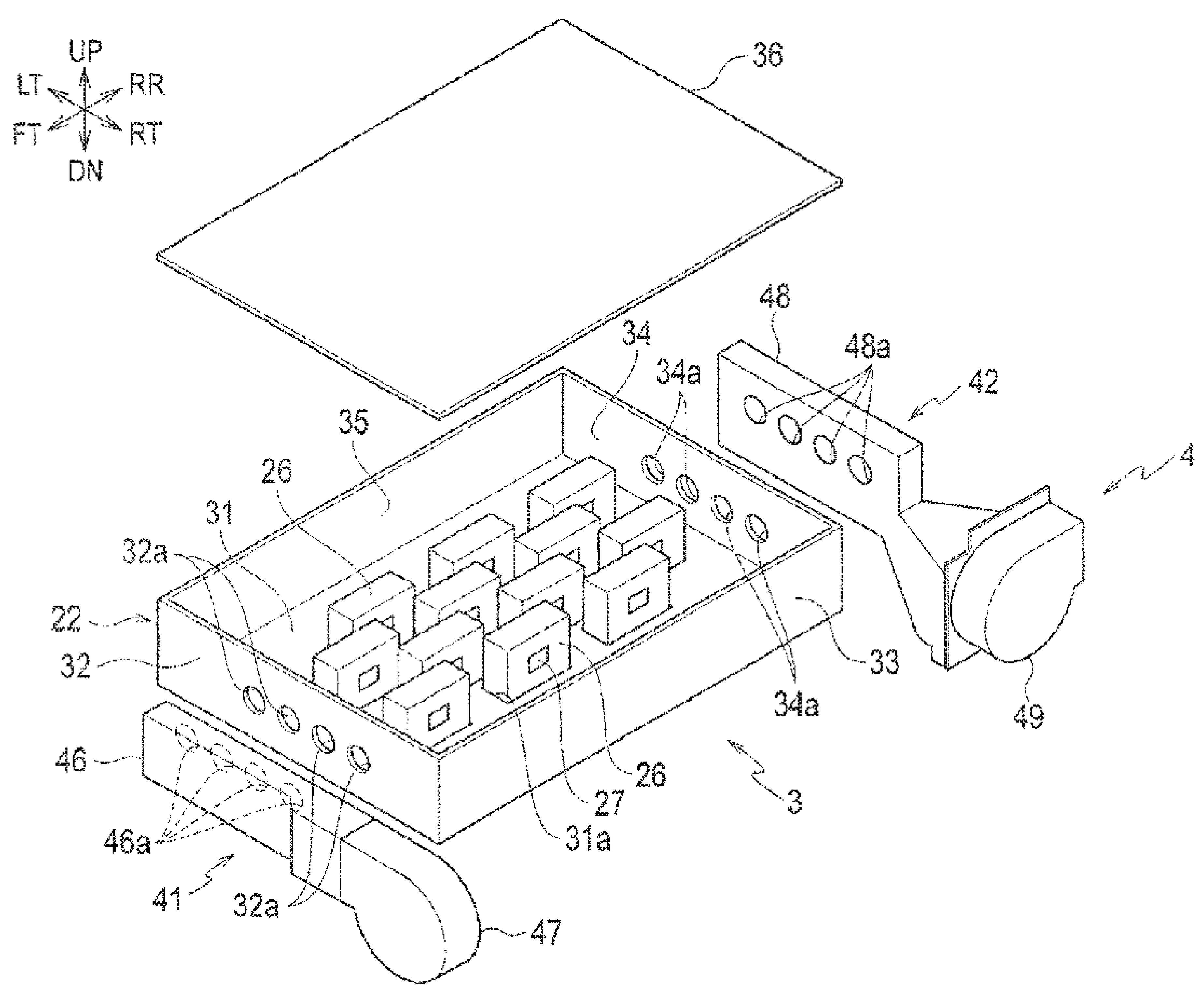
Primary Examiner — Minh Nguyen
(74) *Attorney, Agent, or Firm* — Greenblum & Bernstein, P.L.C.

(57) **ABSTRACT**

A head holder has an opening through which a space between the head holder and a conveyer communicates with an inside of the head holder. Ahead cooler includes a blower configured to blow air into the head holder from an outside of the head holder with a flow rate of blow air and a suction unit configured to suction air from the head holder with a flow rate of suction air. The head cooler generates cooling air for cooling an ink-jet head inside the head holder by the blower and the suction unit. A controller controls the flow rate of blow air and the flow rate of suction air such that air containing ink mist is suctioned into the head holder through the opening.

18 Claims, 12 Drawing Sheets



(51) **Int. Cl.**

B41J 29/38	(2006.01)
B41J 2/17	(2006.01)
B41J 29/377	(2006.01)
B41J 2/175	(2006.01)
B41J 2/245	(2006.01)
B41J 2/185	(2006.01)

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(58) **Field of Classification Search**
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See application file for complete search history.

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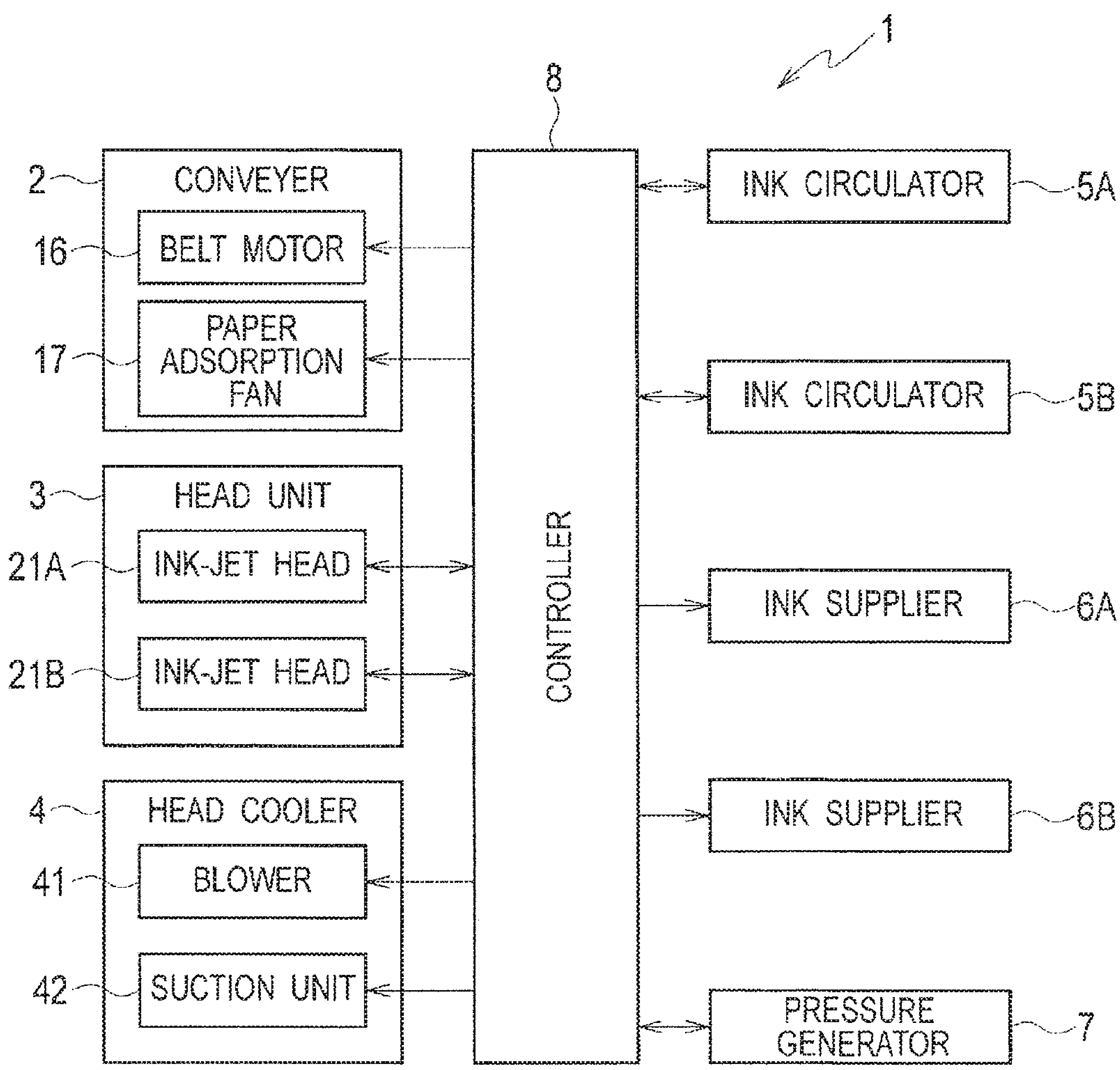
FIG. 1


1
8
2
CONVEYER
16
BELT MOTOR
17
PAPER ADSORPTION FAN
3
HEAD UNIT
21A
INK-JET HEAD
21B
INK-JET HEAD
4
HEAD COOLER
41
BLOWER
42
SUCTION UNIT
CONTROLLER
INK CIRCULATOR
5A
INK CIRCULATOR
5B
INK SUPPLIER
6A
INK SUPPLIER
6B
PRESSURE GENERATOR
7

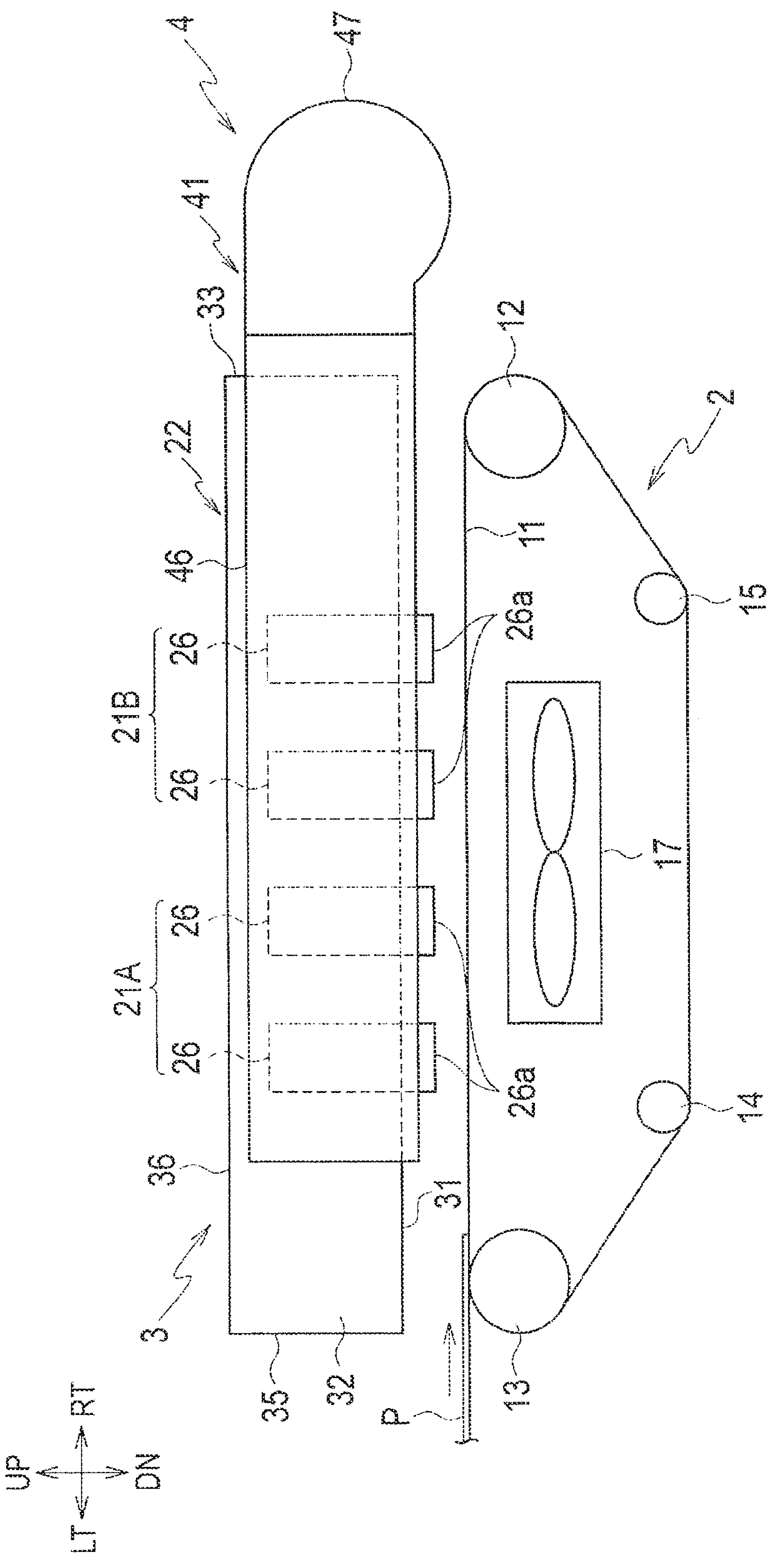
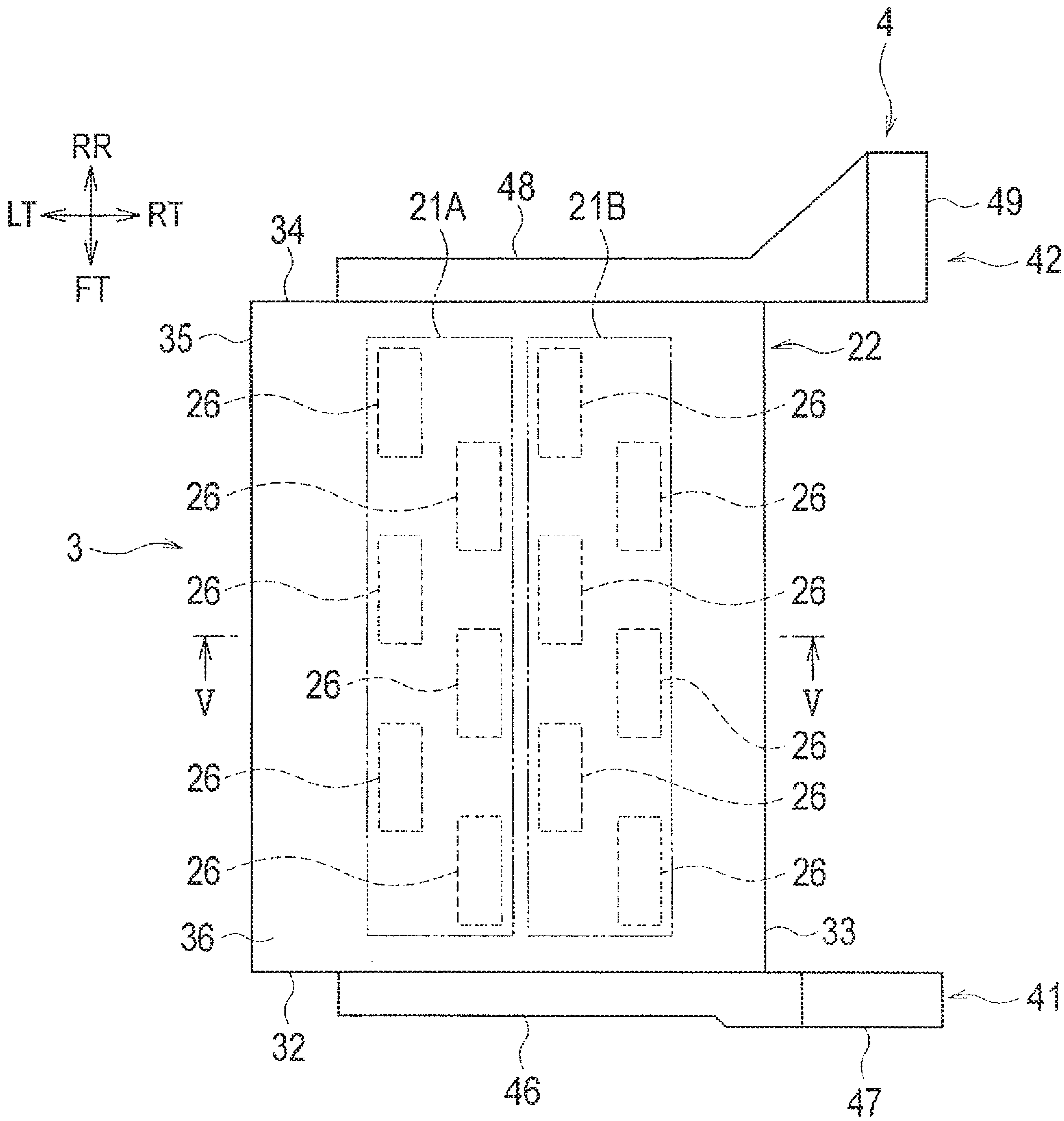
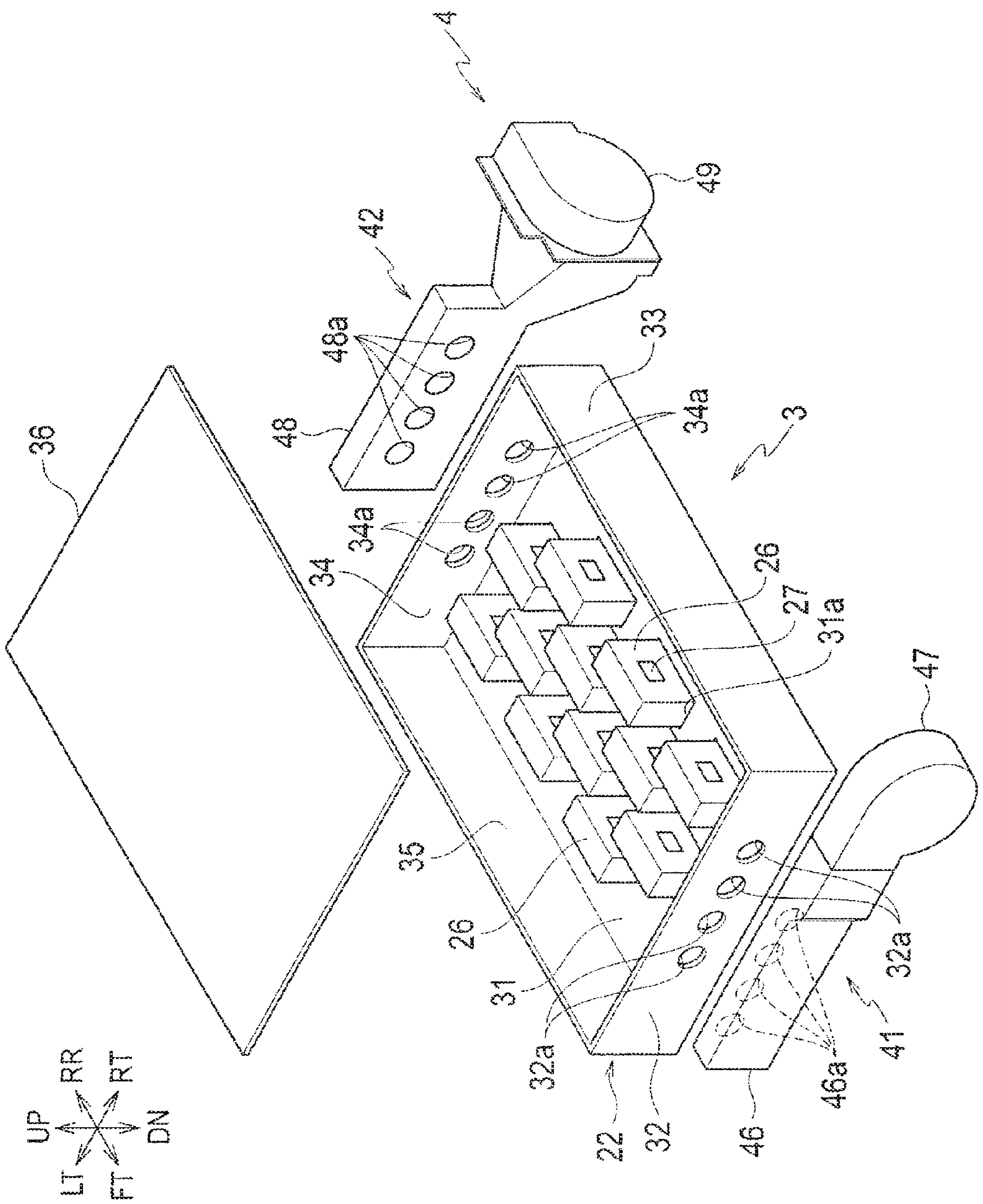

4
47
41
33
12
2
22
46
11
15
26a
26
21B
26
17
26
21A
26
26a
14
36
31
3
35
32
P
13
UP
RT
DN
LT

FIG. 2

FIG. 3





4
49
42
48a
33
48
34a
3
36
34a
34
26
27
31a
47
35
26
31
32a
32a
22
32
46
46a
41
UP
RR
RT
LT
FT
DN

FIG. 4

FIG. 5

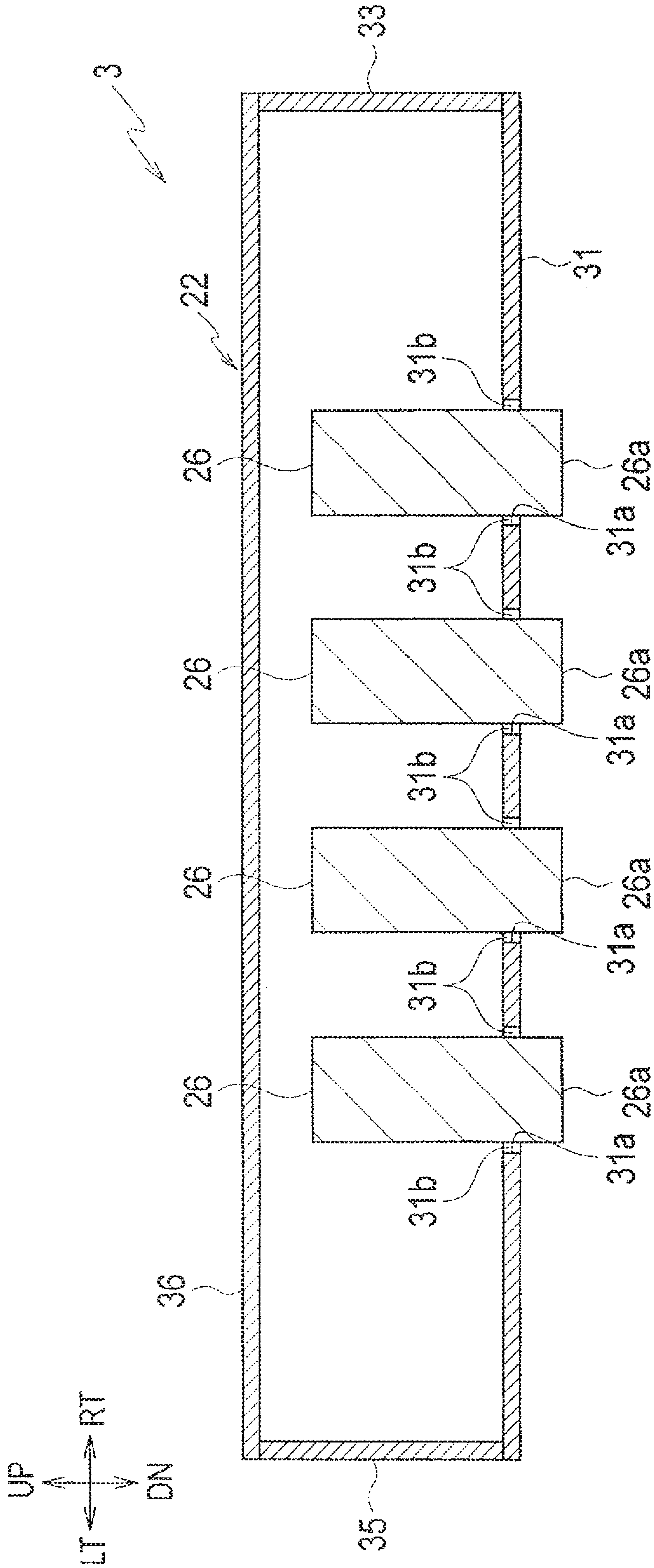


FIG. 6

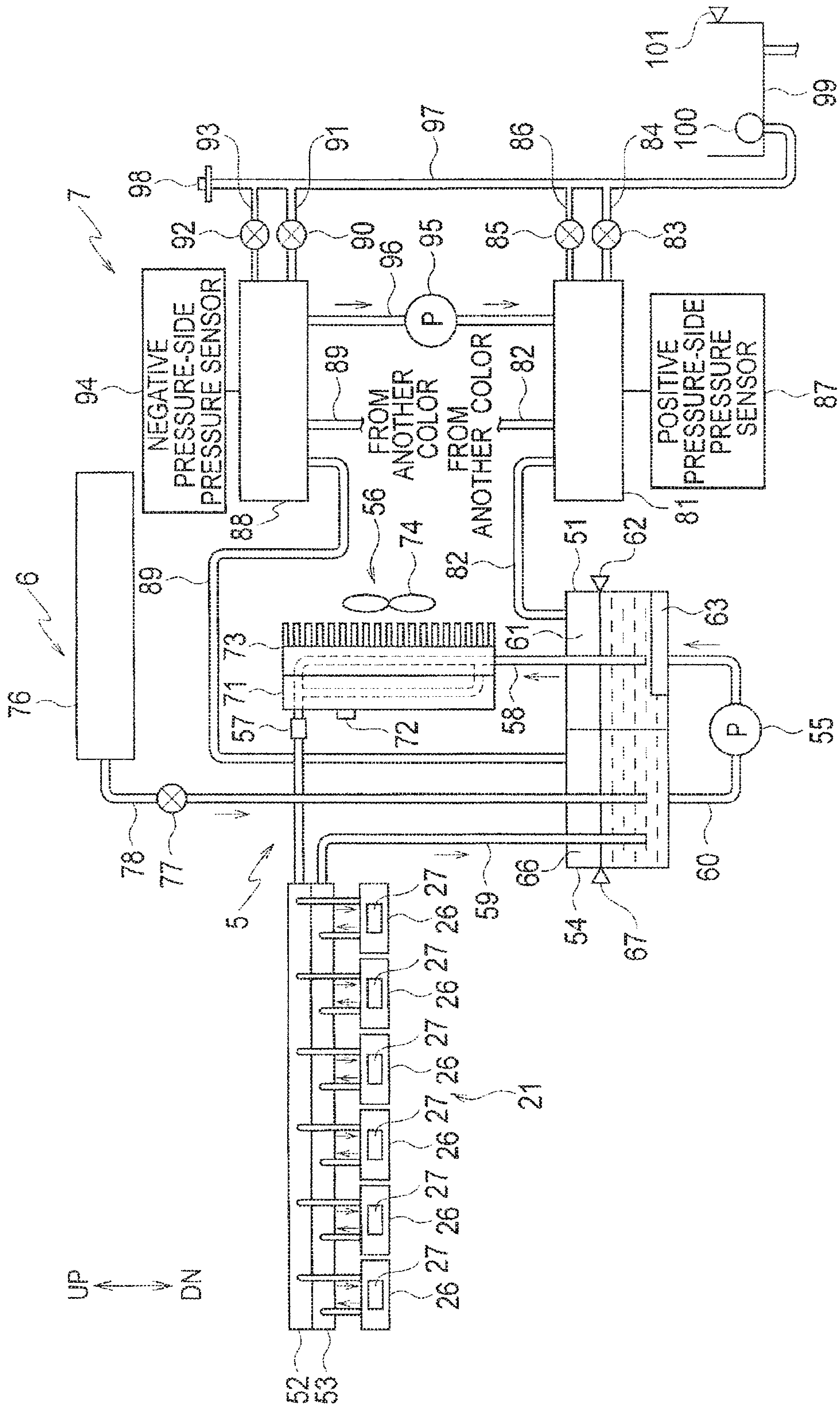

NEGATIVE PRESSURE-SIDE PRESSURE SENSOR
POSITIVE PRESSURE-SIDE PRESSURE SENSOR
FROM ANOTHER COLOR
FROM ANOTHER COLOR
P
P
UP
DN

FIG. 7

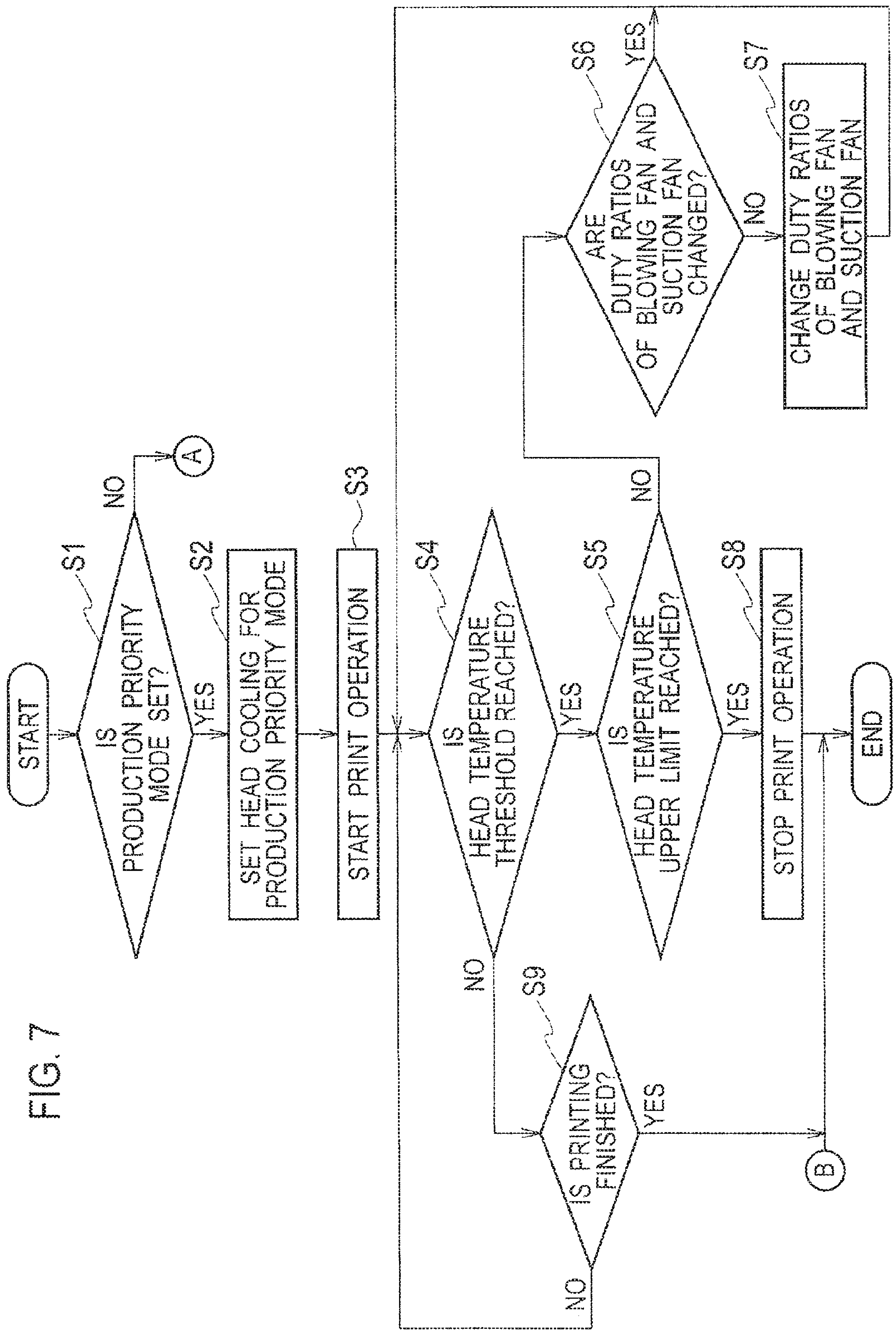

START
IS PRODUCTION PRIORITY MODE SET?
S1
YES
NO
A
SET HEAD COOLING FOR PRODUCTION PRIORITY MODE
S2
START PRINT OPERATION
S3
IS HEAD TEMPERATURE THRESHOLD REACHED?
S4
IS HEAD TEMPERATURE UPPER LIMIT REACHED?
S5
STOP PRINT OPERATION
S8
END
ARE DUTY RATIOS OF BLOWING FAN AND SUCTION FAN CHANGED?
S6
CHANGE DUTY RATIOS OF BLOWING FAN AND SUCTION FAN
S7
IS PRINTING FINISHED?
S9
B

FIG. 8

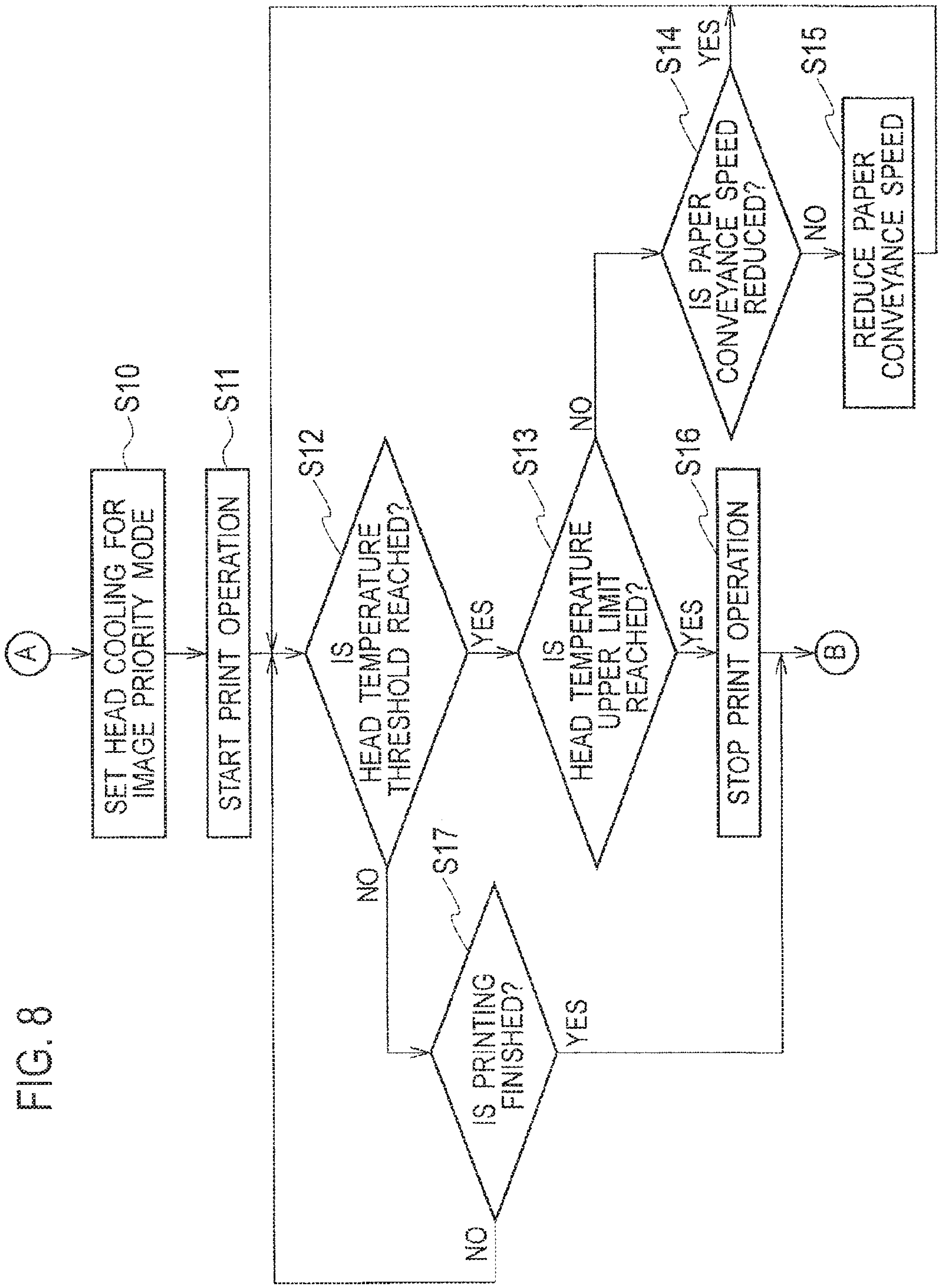
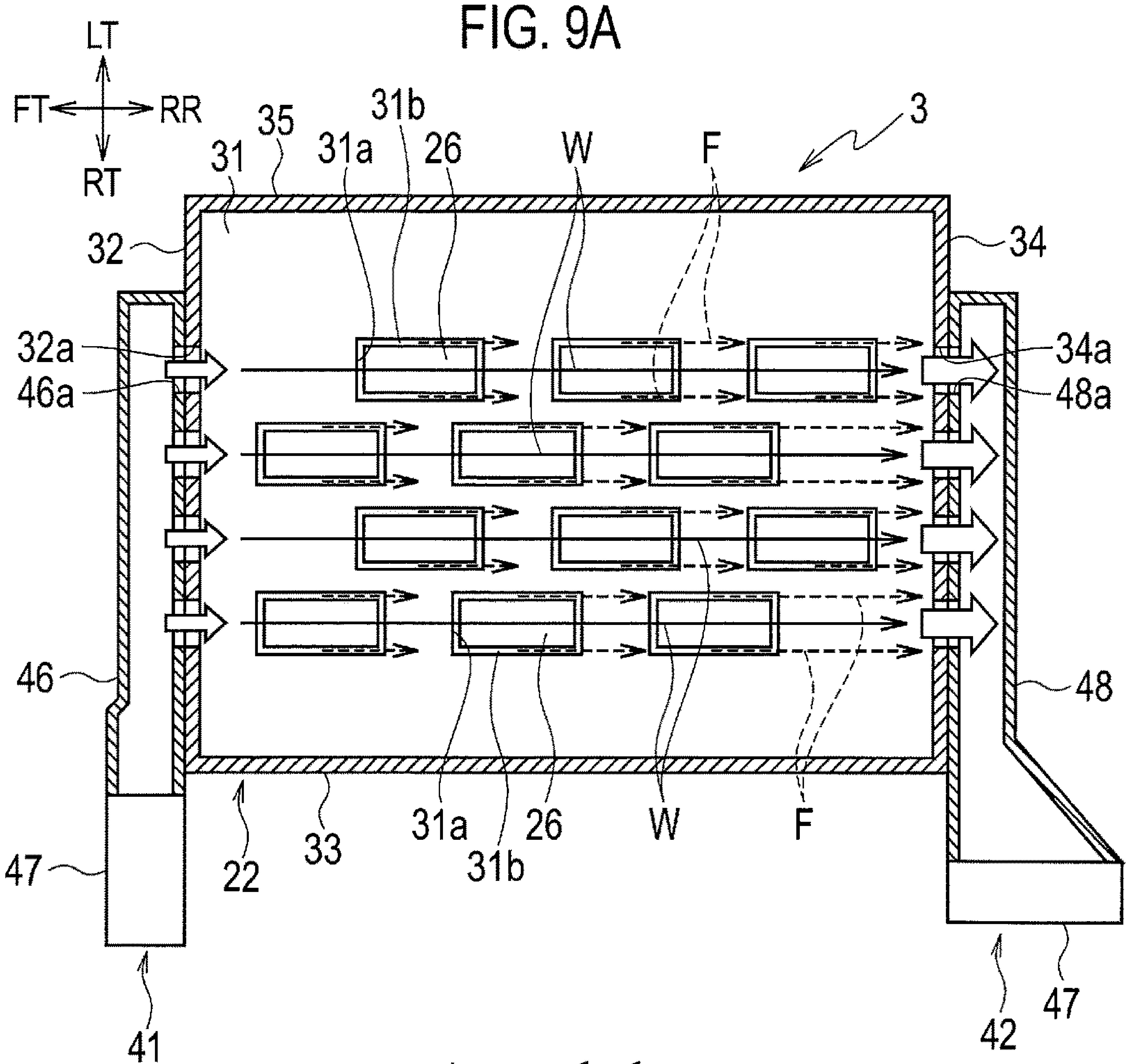
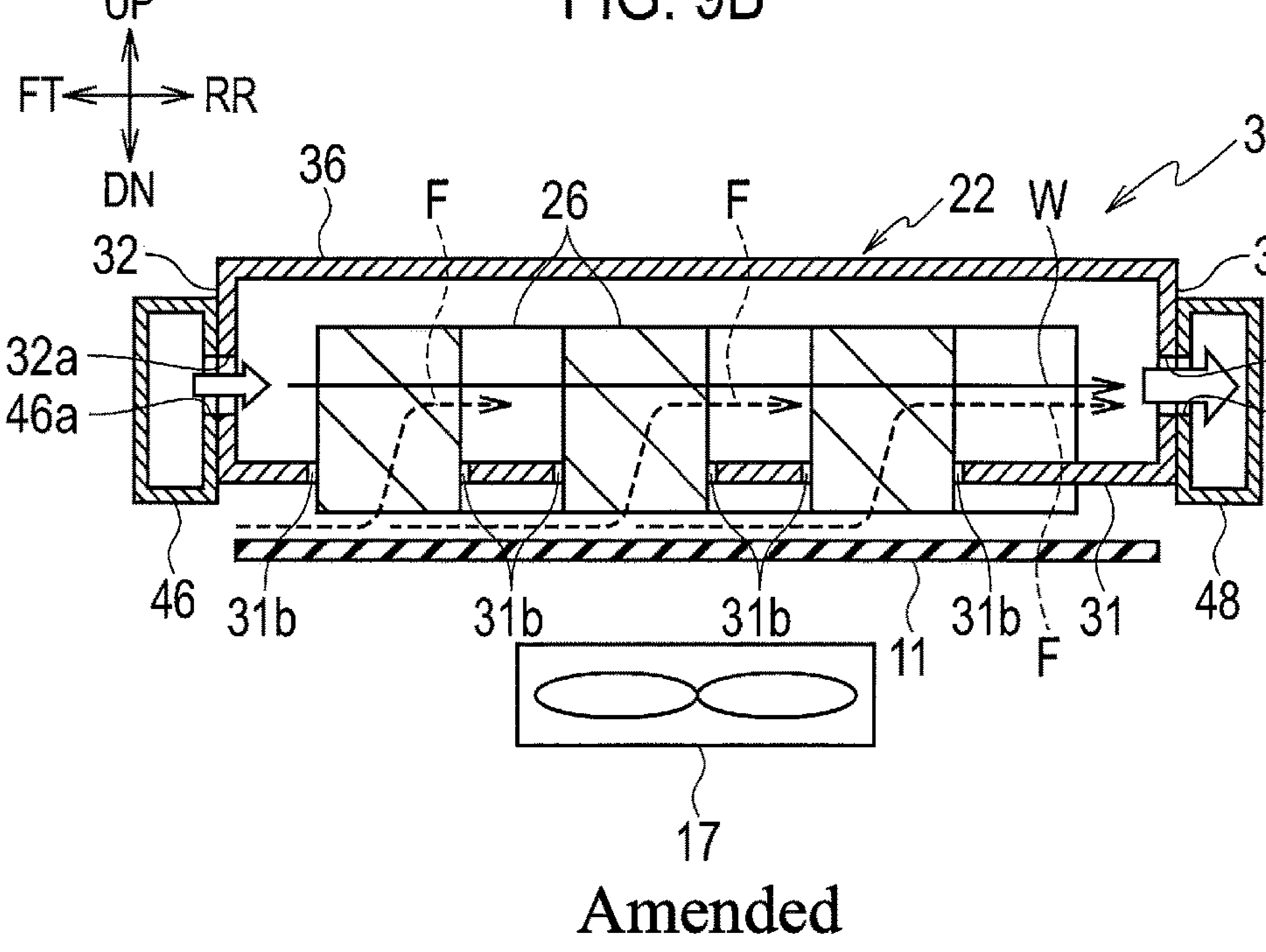

A
SET HEAD COOLING FOR IMAGE PRIORITY MODE
S10
START PRINT OPERATION
S11
IS HEAD TEMPERATURE THRESHOLD REACHED?
S12
YES
NO
IS HEAD TEMPERATURE UPPER LIMIT REACHED?
S13
YES
NO
IS PAPER CONVEYANCE SPEED REDUCED?
S14
YES
NO
REDUCE PAPER CONVEYANCE SPEED
S15
STOP PRINT OPERATION
S16
IS PRINTING FINISHED?
S17
YES
NO
B

FIG. 9A



Amended

FIG. 9B

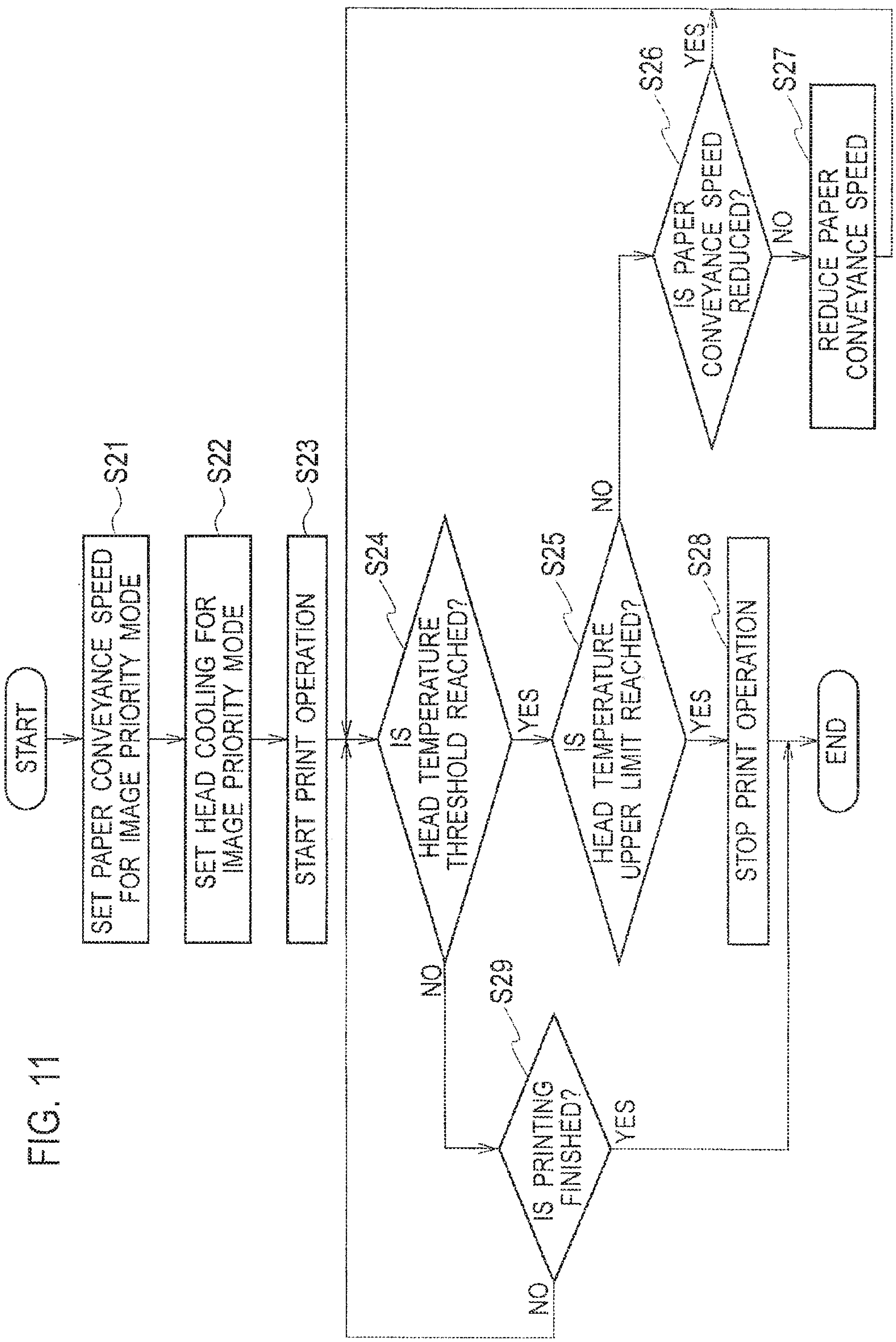


Amended

FIG. 10

		NEGATIVE-PRESSURE TANK INK LEVEL SENSOR	
		ON	OFF
POSITIVE-PRESSURE TANK INK LEVEL SENSOR	ON	INK PUMP: OFF INK SUPPLY VALVE: CLOSED	INK PUMP: OFF INK SUPPLY VALVE: CLOSED
	OFF	INK PUMP: ON INK SUPPLY VALVE: CLOSED	INK PUMP: OFF INK SUPPLY VALVE: OPEN

FIG. 11


START
S21
SET PAPER CONVEYANCE SPEED FOR IMAGE PRIORITY MODE
S22
SET HEAD COOLING FOR IMAGE PRIORITY MODE
S23
START PRINT OPERATION
S24
IS HEAD TEMPERATURE THRESHOLD REACHED?
YES
NO
S25
IS HEAD TEMPERATURE UPPER LIMIT REACHED?
YES
NO
S26
IS PAPER CONVEYANCE SPEED REDUCED?
YES
NO
S27
REDUCE PAPER CONVEYANCE SPEED
S28
STOP PRINT OPERATION
S29
IS PRINTING FINISHED?
YES
NO
END

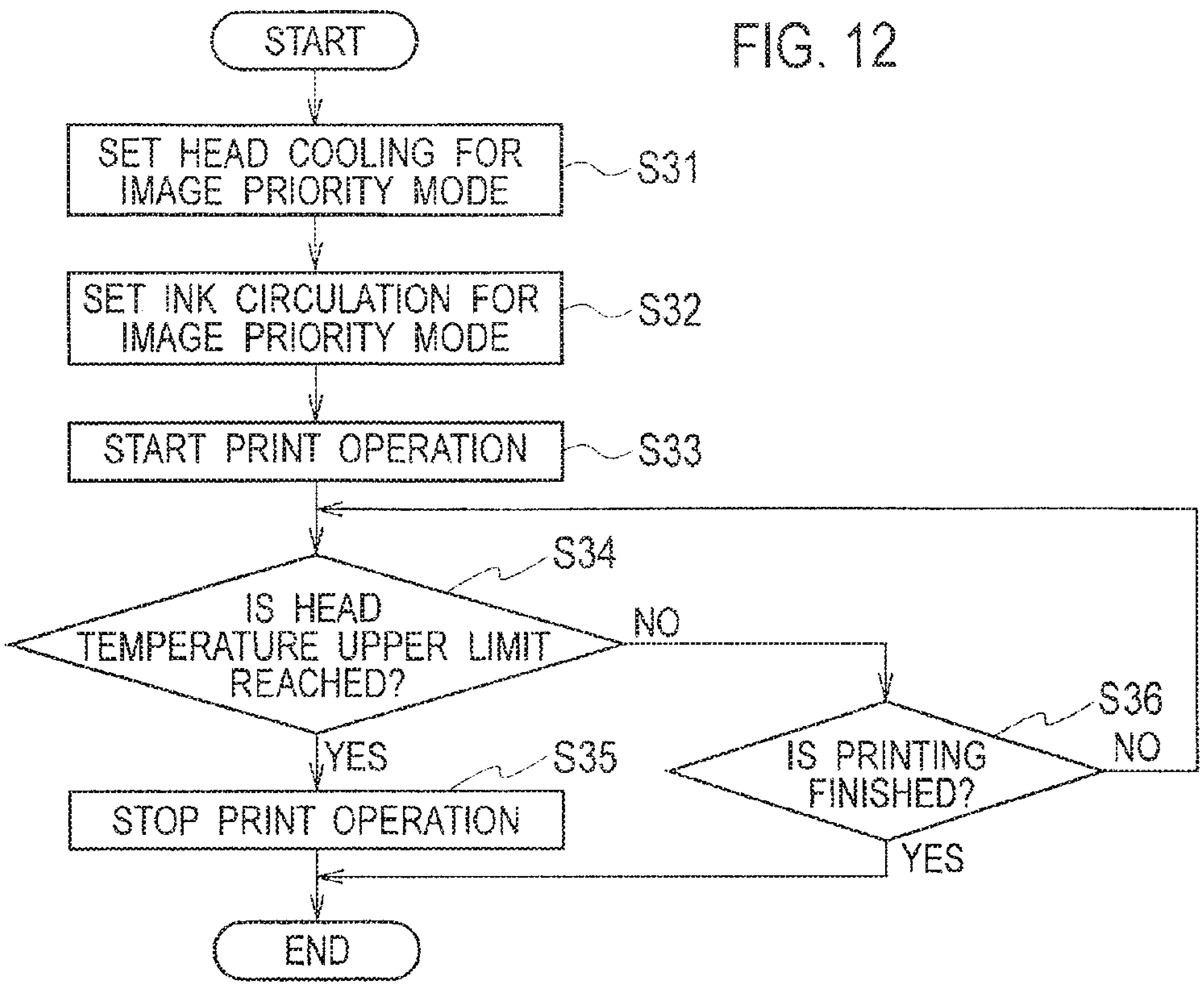

START
SET HEAD COOLING FOR IMAGE PRIORITY MODE
S31
SET INK CIRCULATION FOR IMAGE PRIORITY MODE
S32
START PRINT OPERATION
S33
S34
IS HEAD TEMPERATURE UPPER LIMIT REACHED?
NO
YES
S35
STOP PRINT OPERATION
S36
IS PRINTING FINISHED?
NO
YES
END

FIG. 12

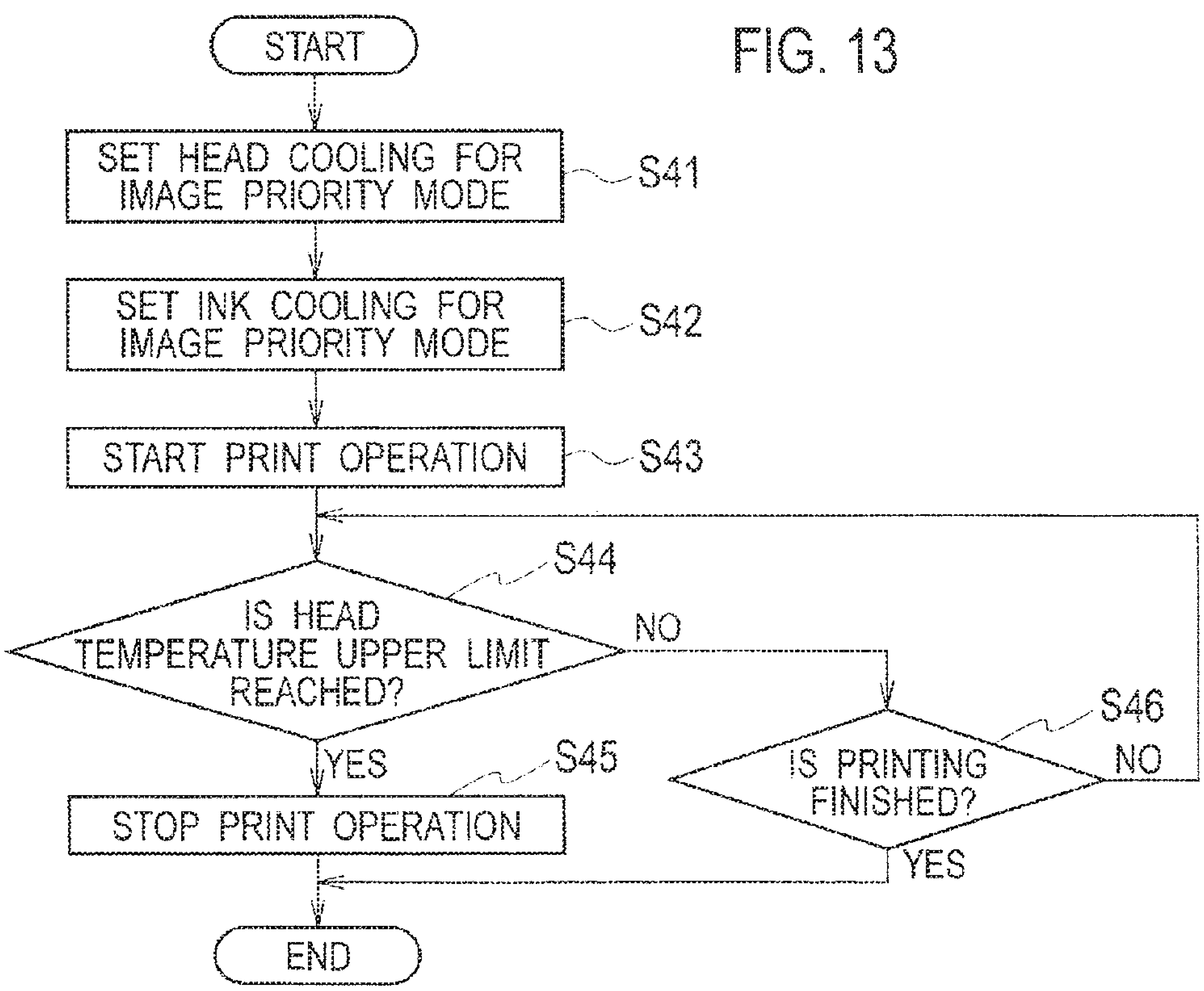

START
SET HEAD COOLING FOR IMAGE PRIORITY MODE
S41
SET INK COOLING FOR IMAGE PRIORITY MODE
S42
START PRINT OPERATION
S43
S44
IS HEAD TEMPERATURE UPPER LIMIT REACHED?
NO
YES
S45
STOP PRINT OPERATION
S46
IS PRINTING FINISHED?
NO
YES
END

FIG. 13

INK-JET PRINTER

Matter enclosed in heavy brackets [ ] appears in the original patent but forms no part of this reissue specification; matter printed in italics indicates the additions made by reissue; a claim printed with strikethrough indicates that the claim was canceled, disclaimed, or held invalid by a prior post-patent action or proceeding.

CROSS REFERENCE TO RELATED APPLICATION

This application *is an application for reissue of U.S. Pat. No. 9,586,412, which matured from U.S. application Ser. No. 15/040,325, which* is based upon and claims the benefit of priority from the prior Japanese Patent Application No. 2015-035087, filed on Feb. 25, 2015, the entire contents of which are incorporated herein by reference.

BACKGROUND

1. Technical Field

The present disclosure relates to an ink-jet printer configured to perform printing by ejecting ink from an inkjet head.

2. Related Art

In an ink-jet printer, ink mist is generated by ink ejection from an ink-jet head. The ink mist causes contamination inside the printer. Also, the ink mist may deteriorate print image quality by adhering to paper to be printed.

To counter this problem, Japanese Patent Application Publication No. 2004-284058 discloses an ink-jet printer including a mist collector. The mist collector in the ink-jet printer sets a collection duct at a negative pressure by a sirocco fan, and collects ink mist by suctioning air containing the ink mist through an opening of the collection duct.

SUMMARY

However, the inkjet printer disclosed in Japanese Patent Application Publication No. 2004-284058 is increased in size since the dedicated mist collector is provided to collect the ink mist.

It is an object of the present disclosure to provide an ink-jet printer capable of reducing contamination inside the printer and deterioration in print image quality due to ink mist while an increase in size of the printer is suppressed.

An ink-jet printer in accordance with some embodiments includes: a conveyer configured to convey a printing medium; an ink-jet head configured to eject ink onto the printing medium conveyed by the conveyer; a head holder in a box shape configured to hold the ink-jet head, the head holder having an opening through which a space between the head holder and the conveyer communicates with an inside of the head holder; a head cooler including a blower configured to blow air into the head holder from an outside of the head holder with a flow rate of blow air and a suction unit configured to suction air from the head holder with a flow rate of suction air, the head cooler configured to generate cooling air for cooling the ink-jet head inside the head holder by the blower and the suction unit; and a controller configured to drive the conveyer to convey the printing medium while driving the ink-jet head to eject the ink onto the printing medium to perform printing and driving the head cooler to generate die cooling air. The controller is configured to control the flow rate of blow air and the flow rate of suction air such that air containing ink mist is suctioned into the head holder through the opening.

According to the above configuration, the controller controls the blow air flow rate of the blower and the suction air flow rate of the suction unit such that the air containing ink mist can be suctioned into the head holder through the opening. Thus, the ink mist can be collected into the head holder. As a result, contamination inside the printer and deterioration in print image quality due to the ink mist can be reduced. Moreover, the ink mist is collected into the head holder by controlling the blow air flow rate of the blower and the suction air flow rate of the suction unit in the head cooler. Hence, there is no need to add a dedicated mechanism to collect the ink mist. Thus, an increase in size of the printer can be suppressed. Therefore, contamination inside the printer and deterioration in print image quality due to the ink mist can be reduced while an increase in size of the printer can be suppressed.

The controller may selectively use a first mode and a second mode. In the first mode, the controller may control the flow rate of blow air and the flow rate of suction air such that the cooling air in the head holder has an air volume required to cool the ink-jet head corresponding to a conveyance speed of the printing medium by the conveyer. In the second mode, the controller may control the flow rate of blow air and the flow rate of suction air such that the cooling air in the head holder has an air volume being smaller than the air volume of the cooling air in the head holder in the first mode and airflow flowing into the head holder through the opening has an air volume being smaller than an air volume of airflow flowing into the head holder through the opening in the first mode and capable of suctioning the ink mist.

According to the above configuration, the controller selectively uses the first mode capable of printing without reducing print productivity by ensuring cooling performance of the ink-jet head and the second mode capable of obtaining better print image quality than the first mode. Thus, convenience is improved since the printer can deal with the case where a user puts priority on the print productivity and the case where the user puts priority on the print image quality.

In the second mode, the controller may drive the conveyer to reduce the conveyance speed of the printing medium upon a temperature of the ink-jet head reaching a threshold.

According to the above configuration, an increase in temperature of the ink-jet head can be suppressed to reduce damage to the ink-jet head.

The ink-jet printer may further include an ink circulator configured to supply the ink to the ink-jet head while circulating the ink. The controller may drive the ink circulator such that an ink circulation flow rate in the second mode is higher than an ink circulation flow rate in the first mode.

According to the above configuration, an increase in temperature of the ink-jet head can be reduced in the second mode by increasing the ink circulation flow rate compared with the first mode. Thus, even in the second mode having a smaller flow rate of cooling air than the first mode, the damage to the ink-jet head can be reduced without a drop in print productivity.

The ink-jet printer may further include an ink circulator configured to supply the ink to the ink-jet head while circulating the ink. The ink circulator may include an ink cooler configured to cool the ink. In the first mode, the controller may drive the ink cooler to start cooling of the ink upon an ink temperature of the ink being a first temperature. In the second mode, the controller may drive the ink cooler to start cooling of the ink upon an ink temperature of the ink being second temperature lower than the first temperature.

According to the above configuration, in the second mode than, the ink temperature low to start cooling of the ink by the ink cooler is set lower than in the first mode, and thereby an increase in the temperature of the inkjet head can be reduced. Thus, even in the second mode having a smaller flow rate of the cooling air than the first mode, the damage to the ink-jet head can be reduced without a drop in print productivity.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a block diagram showing a configuration of an ink-jet printer according to a first embodiment.

FIG. **2** is a schematic configuration diagram of a conveyer, a head unit and a head cooler in the ink-jet printer shown in FIG. **1**.

FIG. **3** is a plan view of the bead unit and the head cooler in the ink-jet printer shown in FIG. **1**.

FIG. **4** is an exploded perspective view of the head unit and the head cooler in the ink-jet printer shown in FIG. **1**.

FIG. **5** is a cross-sectional view taken along the line V-V in FIG. **3**.

FIG. **6** is a schematic configuration diagram of an ink circulator, an ink supplier and a pressure generator in the ink-jet printer shown in FIG. **1**.

FIG. **7** is a flowchart showing operations of the ink-jet printer shown in FIG. **1**.

FIG. **8** is a flowchart showing operations of the ink-jet printer shown in FIG. **1**.

FIG. **9**A is a diagram showing an airflow inside a head holder as seen from above.

FIG. **9**B is a diagram showing an airflow inside the head holder as seen from **[**front**]** *right*.

FIG. **10** is an explanatory diagram of ink level maintenance control.

FIG. **11** is a flowchart showing operations of an image priority mode in a second embodiment.

FIG. **12** is a flowchart showing operations of an image priority mode in a third embodiment.

FIG. **13** is a flowchart showing operations of an image priority mode in a fourth embodiment.

DETAILED DESCRIPTION

In the following detailed description, for purposes of explanation, numerous specific details are set forth in order to provide a thorough understanding of the disclosed embodiments. It will be apparent, however, that one or more embodiments may be practiced without these specific details. In other instances, well-known structures and devices are schematically shown in order to simplify the drawing.

Description will be hereinbelow provided for embodiments of the present invention by referring to the drawings. It should be noted that the same or similar parts and components throughout the drawings will be denoted by the same or similar reference signs, and that descriptions for such parts and components will be omitted or simplified. In addition, it should be noted that the drawings are schematic and therefore different from the actual ones.

First Embodiment

FIG. **1** is a block diagram showing a configuration of an ink-jet printer according to a first embodiment of the present invention. FIG. **2** is a schematic configuration diagram at a conveyer, a head unit and a head cooler in the ink-jet printer shown in FIG. **1**. FIG. **3** is a plan view of the head unit and the head cooler. FIG. **4** is an exploded perspective view of the head unit and the head cooler. FIG. **5** is a cross-sectional view taken along the line V-V in FIG. **1**. FIG. **6** is a schematic configuration diagram of an ink circulator, an ink supplier and a pressure generator in the ink-jet printer shown in FIG. **1**.

In the following description, it is assumed that a direction perpendicular to the page surface in FIG. **2** is a longitudinal direction and a page surface front direction is the front. In FIGS. **2** to **6**, **9**A and **9**B, the right direction, left, direction, up direction, down direction, front direction and rear direction are denoted by RT, LT, UP, DN, FT and RR, respectively. The direction from left to right is the conveyance direction of paper P that is a printing medium.

As shown in FIG. **1**, an ink-jet printer **1** according to the first embodiment includes a conveyer **2**, a head unit **3**, a head cooler **4**, ink circulators **5**A and **5**B, ink suppliers **6**A and **6**B, a pressure generator **7** and a controller **8**. Note that the alphabetical letters (A and B) in reference numerals of the ink circulators **5**A and **5**B and the ink suppliers **6**A and **6**B may be omitted for collective notation.

The conveyer **2** conveys the paper P. As shown in FIGS. **1** and **2**, the conveyer **2** includes a conveyer belt **11**, a drive roller **12**, driven rollers **13**, **14** and **15**, a belt motor **16** and a paper adsorption fan **17**.

The conveyer belt **11** conveys the paper P while holding the paper by adsorption. The conveyer belt **11** is a looped belt wound around the drive roller **12** and the driven rollers **13** to **15**. The conveyer belt **11** has a number at belt holes (not shown) formed therein. The conveyer belt **11** holds the paper P by adsorption force generated in the belt holes by driving the paper adsorption fan **17**. The conveyer belt **11** conveys the paper P, which is held by adsorption, rightward by rotating in a clockwise direction in FIG. **2**.

The drive roller **12** rotates the conveyer belt **11** in the clockwise direction in FIG. **2**.

The driven rollers **13** to **15** support the conveyer belt **11** together with the drive roller **12**. The driven rollers **13** to **15** follow the drive roller **12** through the conveyer belt **11**. The driven roller **13** is arranged to the left of the drive roller **12** at the same height as the drive roller **12**. The driven rollers **14** and **15** are arranged at the same height at a distance from each other in a horizontal direction below the drive roller **12** and the driven roller **13**.

The belt motor **16** rotationally drives the drive roller **12**.

The paper adsorption fan **17** generates downward airflows. Thus, the paper adsorption fan **17** generates a negative pressure in the belt holes by suctioning air through the belt holes in the conveyer belt **11**, thereby adsorbing the paper P on the conveyer belt **11**. The paper adsorption fan **17** is arranged in a region surrounded by the looped conveyer belt **11**.

The head unit **3** prints an image by ejecting ink onto the paper P conveyed by the conveyer **2**. The head unit **3** includes ink-jet heads **21**A and **21**B and a head holder **22**. Note that the alphabetical letters (A and B) in reference numerals of the ink-jet heads **21**A and **21**B may be omitted for collective notation.

The ink-jet heads **21**A and **21**B elect ink onto the paper P. The ink-jet heads **21**A and **21**B elect different colors of ink. The ink-jet heads **21**A and **21**B are arranged in parallel to each other along the conveyance direction (horizontal direction) of the paper P. Each of the ink jet heads **21**A and **21**B has six head modules **26**.

The head modules **26** are arranged in a zigzag pattern as shown in FIGS. **3** and **4**. More specifically, in the ink-jet head **21**. two head module arrays, each including three head modules **26** arranged to be equally spaced apart along the longitudinal direction, are arranged to be shifted from each other by a half pitch in the longitudinal direction.

Each of the head modules **26** has an ink ejection surface **26**a. The ink ejection surface **26**a is a lower surface of the head module **26** facing the conveyer belt **11**. The ink election surface **26**a has a number of nozzles (not shown) provided therein, which are arranged along the longitudinal direction (main scanning direction). The head module **26** ejects ink, which is supplied from the ink circulator **5**, through the nozzles.

Each of the head modules **26** is provided with a head temperature sensor **27**. The head temperature sensor **27** measures the temperature of the head module **26**.

The head holder **22** holds the ink-jet heads **21**A and **21**B. The head holder **22** is formed in a box shape having a hollow rectangular parallelepiped shape. As shown in FIGS. **4** and **5**, the head holder **22** has a bottom plate **31**, side plates **32** to **35** and a top plate **36**.

The bottom plate **31** holds and fixes the head modules **26** in the ink-jet heads **21**A and **21**B. The bottom plate **31** is formed in a rectangular shape. As shown in FIG. **5**, the bottom plate **31** has attachment openings **31**a formed therein. The same number of the attachment openings **31**a as that of the head modules **26** are formed.

Each of the head modules **26** is inserted into one of the attachment openings **31**a and fixed therein such that the ink ejection surface **26**a protrudes downward from the lower surface of the bottom plate **31**. The attachment opening **31**a is a through-hole larger than the cross-section or the head module **26** along the horizontal plane. Thus, the attachment position and angle of the head module **26** can be adjusted. Since the attachment openings **31**a are thus formed, the head modules **26** are attached to the attachment openings **31**a through gaps (openings) **31**b. A space between the bottom plate **31** of the head holder **2** and the conveyer belt **11** in the conveyer **2** is communicated with the inside of the head holder **22** by the gaps **31**b.

The side plates **32**, **33**, **34** and **35** form front, right, rear and left sidewalls of the head holder **22**, respectively. The side plates **32** to **35** are integrally formed and provided upright around the bottom plate **31**.

The front side plate **32** has four vent holes **32**a formed therein. The vent holes **32**a are inlets of air when the air is blown into the head holder **22** by a blower **41** to be described later. The four vent holes **32**a are formed on extension lines of the four head module arrays including the head modules **26** in the ink-jet heads **21**A and **21**B, one vent hole **32**a for each array.

The rear side plate **34** has four vent holes **34**a formed therein. The vent holes **34**a are outlets of air when the air is suctioned from the head holder **22** by a suction unit **42** to be described later. The four vent holes **34**a are arranged at positions opposite to the respective four vent holes **32**a in the front side plates **32**. In other words, the four vent holes **34**a are formed on extension lines of the four head module arrays including the head modules **26** in the ink-jet heads **21**A and **21**B, one vent hole **34**a for each array.

The top plate **36** is a cover that closes an upper opening of the sidewall formed of the side plates **32** to **35**. The top plate **36** is formed in a rectangular shape.

The head cooler **4** cools the ink-jet head **21** by generating cooling air in the head holder **22**. The head cooler **4** includes the blower **41** and the suction unit **42**.

The blower **41** blows air into the head holder **22** from outside. The blower **41** is arranged at the front of the head holder **22**. The blower **41** includes a blowing chamber **46** and a blowing fan **47**.

The blowing chamber **46** forms an airflow path between the blowing fan **47** and the head holder **22**. The blowing chamber **46** is formed in a hollow shape that is elongated in the right-left direction. The blowing chamber **46** is arranged on the front side plate **32** of the head holder **22**. In a surface of the blowing chamber **46** that comes into contact with the side plate **32**, four blowing holes **46**a are formed.

The blowing holes **46**a are outlets of air from the blowing chamber **46** when the air is blown into the head holder **22**. The blowing holes **46**a are arranged at positions corresponding to the vent holes **32**a in the side plate **32**. In other words, the four blowing holes **46**a are formed on extension lines of the four head module arrays including the head modules **26** in the ink-jet heads **21**A and **21**B, one blowing hole **46**a for each array.

The blowing fan **47** sends air into the blowing chamber **46** from one end of the blowing chamber **46**. Thus, air is blown into the head holder **22** through the blowing holes **46**a in the blowing chamber **46**.

The suction unit **42** suctions air from the head holder **22**. The suction unit **42** is arranged at the rear of the head holder **22**. The suction unit **42** includes a suction chamber **48** and a suction fan **49**.

The suction chamber **48** forms an airflow path between the head holder **22** and the suction fan **49**. The suction chamber **48** is formed in a hollow shape that is elongated in the right-left direction. The suction chamber **48** is arranged on the rear side plate **34** of the head holder **22**. In a surface of the suction chamber **48** that comes into contact with the side plate **34**, four suction holes **48**a are formed.

The suction holes **48**a are inlets of air into the suction chamber **48** when the air is suctioned from the head holder **22**. The suction holes **48**a are arranged at positions corresponding to the vent holes **34**a in the side plate **34**. In other words, the four suction holes **48**a are formed on extension lines of the four head module arrays including the head modules **26** in the ink-jet heads **21**A and **21**B, one suction hole **48**a for each array.

The suction fan **49** suctions air from one end of the suction chamber **48**. Thus, air is suctioned from the head holder **22** through the suction holes **48**a in the suction chamber **48** and the vent holes **34**a in the side plate **34**.

The ink circulator **5** supplies ink to the ink-jet head **21** while circulating the ink. The ink circulators **5**A and **5**B supply ink to the ink-jet heads **21**A and **21**B, respectively. As shown in FIG. **6**, the ink circulator **5** includes a positive-pressure tank **51**, an ink distributor **52**, a collector **53**, a negative-pressure tank **54**, an ink pump **55**, an ink temperature regulator **56**, an ink temperature sensor **57** and ink circulation pipes **58** to **60**.

The positive-pressure tank **51** stores ink to be supplied to the ink-jet head **21**. The ink in the positive-pressure tank **51** is supplied to the ink-jet head **21** through the ink circulation pipe **58** and the ink distributor **52**. Inside the positive-pressure tank **51**, an air layer **61** is formed on the ink surface. The positive-pressure tank **51** is connected to a positive-pressure common air chamber **81** to he described later through a positive pressure-side communicating pipe **82** to be described later. The positive-pressure tank **51** is arranged at a position lower than the ink-jet head **21**.

The positive-pressure tank **51** is provided with a positive-pressure ink level sensor **62** and an ink filter **63**.

The positive-pressure ink level sensor **62** is configured to detect whether or not the ink level in the positive-pressure tank **51** has reached a reference level. The positive-pressure ink level sensor **62** outputs a signal indicating "on" when the ink level in the positive-pressure tank **51** is not less than the reference level, and outputs a signal indicating "off" when the ink level is less than the reference level.

The ink filter **63** removes unwanted material and the like in the ink.

The ink distributor **52** distributes the ink, which is supplied from the positive-pressure tank **51** through the ink circulation pipe **58**, to the head modules **26** in the ink-jet head **21**.

The collector **53** collects ink left unconsumed by the ink-jet head **21** from the head modules **26**. The ink collected by the collector **53** flows into the negative-pressure tank **54** through the ink circulation pipe **59**.

The negative-pressure tank **54** stores the ink left unconsumed by the ink-jet head **21** after receiving the ink from the collector **53**. The negative-pressure tank **54** also stores ink supplied from an ink cartridge **76** in an ink supplier **6** to be described later. Inside the negative-pressure tank **54**, an air layer **66** is formed on the ink surface. The negative-pressure tank **54** communicated with a negative-pressure common air chamber **88** to be described later through a negative pressure-side communicating pipe **89** to be described later. The negative-pressure tank **54** is arranged at the same height as the positive-pressure tank **51**.

The negative-pressure tank **54** is provided with a negative-pressure tank ink level sensor **67**. The negative-pressure tank ink level sensor **67** is configured to detect whether or not the ink level in the negative-pressure tank **54** has reached a reference level. The negative-pressure tank ink level sensor **67** outputs a signal indicating "on" when the ink level in the negative-pressure tank **54** is not less than the reference level, and outputs a signal indicating "off" when the ink level is less than the reference level.

The ink pump **55** sends ink to the positive-pressure tank **51** from the negative-pressure tank **54**. The ink pump **55** is provided in the ink circulation pipe **60**.

The ink temperature regulator **56** regulates the temperature of the ink in the ink circulator **5**. The ink temperature regulator **56** is provided in the ink circulation pipe **58**. The ink temperature regulator **56** includes a heater **71**, a heater temperature sensor **72**, a heat sink **73** and an ink cooling fan (ink cooler) **74**.

The heater **71** heats the ink passing inside the ink circulation pipe **58**. The heater temperature sensor **72** measures the temperature of the heater **71**. The heat sink **73** receives and releases heat from the ink passing inside the ink circulation pipe **58**. The ink cooling fan **74** sends air to the heat sink **73** to cool the ink passing inside the ink circulation pipe **58**.

The ink temperature sensor **57** measures the temperature of the ink in the ink circulator **5**. The ink temperature sensor **57** is provided in the ink circulation pipe **58**.

The ink circulation pipe **58** connects the positive-pressure tank **51** to the ink distributor **52**. A part of the ink circulation pipe **58** is divided into a portion passing through the heater **71** and a portion passing through the heat sink **73**. In the ink circulation pipe **58**, the ink flows toward the ink distributor **52** from the positive-pressure tank **51**. The ink circulation pipe **59** connects the collector **53** to the negative-pressure tank **54**. In the ink circulation pipe **59**, the ink flows toward the negative-pressure tank **54** from the collector **53**. The ink circulation pipe **60** connects the negative-pressure tank **54** to the positive-pressure tank **51**. In the ink circulation pipe **60**, the ink flows toward the positive-pressure tank **51** from the negative-pressure tank **54**.

The ink suppliers **6**A and **6**B supply ink to the ink circulators **5**A and **5**B, respectively. The ink supplier **6** includes the ink cartridge **76**, an ink supply valve **77** and an ink supply pipe **78**.

The ink cartridge **76** houses ink to be used for printing by the ink-jet head **21**. The ink in the ink cartridge **76** is supplied to the negative-pressure tank **54** in the ink circulator **5** through the ink supply pipe **78**.

The ink supply valve **77** opens and closes an ink flow path inside the ink supply pipe **78**. The ink supply valve **77** is opened to supply the ink to the negative-pressure tank **54**.

The ink supply pipe **78** connects the ink cartridge **76** to the negative-pressure tank **54**. In the ink supply pipe **78**, the ink flows toward the negative-pressure tank **54** from the ink cartridge **76**.

The pressure generator **7** generates pressures for ink circulation in the positive-pressure tank **51** and the negative-pressure tank **54** in the ink circulator **5**. The pressure generator **7** is shared by the ink circulators **5**A and **5**B. The pressure generator **7** includes the positive-pressure common air chamber **81**, two positive pressure-side communicating pipes **82**, a positive pressure-side atmospheric air open valve **83**, a positive pressure-side atmospheric air open pipe **84**, a positive pressure-side pressure regulating valve **85**, a positive pressure-side pressure regulating pipe **86**, a positive pressure-side pressure sensor **87**, the negative-pressure common air chamber **88**, two negative pressure-side communicating pipes **89**, a negative pressure-side atmospheric air open valve **90**, a negative pressure-side atmospheric air open pipe **91**, a negative pressure-side pressure regulating valve **92**, a negative pressure-side pressure regulating pipe **93**, a negative pressure-side pressure sensor **94**, an air pump **95**, an air pump pipe **96**, a junction pipe **97**, an air filter **98** and an overflow pan **99**.

The positive-pressure common air chamber **81** is an air chamber configured to equalize the pressures in the positive-pressure tank **51** in the ink circulator **5**A and the positive-pressure tank **51** in the ink circulator **5**B. The positive-pressure common air chamber **81** is communicated with air layers **61** in the positive-pressure tanks **51** in the two ink circulators **5**A and **5**B through the two positive pressure-side communicating pipes **82**. Thus, the positive-pressure tanks **51** in the ink circulators **5**A and **5**B are communicated with each other through the positive-pressure common air chamber **81** and the positive pressure-side communicating pipes **82**.

The positive pressure-side communicating pipes **82** communicate the positive-pressure common air chamber **81** with the air layers **61** in the positive-pressure tanks **51**. The two positive pressure-side communicating pipes **82** are provided to correspond one by one to the two ink circulators **5**A and **5**B. Each of the positive pressure-side communicating pipes **82** has one end connected to the positive-pressure common air chamber **81** and the other end connected to the air layer **61** in the positive-pressure tank **51**.

The positive pressure-side atmospheric air open valve **83** opens and closes an airflow path inside the positive pressure-side atmospheric air open pipe **84** to switch the positive-pressure tank **51** between a sealed state (a state of being cut off from the atmosphere) and an atmospheric air open state (a state of being communicated with the atmosphere) through the positive-pressure common air chamber **81** and the positive pressure-side communicating pipe **82**. The positive pressure-side atmospheric air open valve **83** is provided on the positive pressure-side atmospheric air open pipe **84**.

The positive pressure-side atmospheric air open pipe **84** forms an airflow path for releasing the inside of the pressurized tank to the atmosphere through the positive-pressure common air chamber **81** and the positive pressure-side communicating pipe **82**. The positive pressure-side atmospheric air open pipe **84** has one end connected to the positive-pressure common air chamber **81** and the other end connected to the junction pipe **97**.

The positive pressure-side pressure regulating valve **85** opens and closes an airflow path inside the positive pressure-side pressure regulating pipe **86** to regulate the pressures in the positive-pressure common air chamber **81** and the positive-pressure tank **51**. The positive pressure-side pressure regulating valve **85** is provided on the positive pressure-side pressure regulating pipe **86**.

The positive pressure-side pressure regulating pipe **86** forms an airflow path for regulating the pressures in the positive-pressure common air chamber **81** and the positive-pressure tank **51**. The positive pressure-side pressure regulating pipe **86** has one end connected to the positive-pressure common air chamber **81** and the other end connected to the junction pipe **97**.

The positive pressure-side pressure sensor **87** measures the pressure in the positive-pressure common air chamber **81**. The pressure in the positive-pressure common air chamber **81** is equal to the pressures in the positive-pressure tanks **51** in the ink circulators **5**A and **5**B. This is because the positive-pressure common air chamber **81** is communicated with the air layers **61** in the positive-pressure tanks **51** in the ink circulators **5**A and **5**B.

The negative-pressure common air chamber **88** is an air chamber configured to equalize the pressures in the negative-pressure tank **54** in the ink circulator **5**A and the negative-pressure tank **54** in the ink circulator **5**B. The negative-pressure common air chamber **88** is communicated with air layers **66** in the negative-pressure tanks **54** in the two ink circulators **5**A and **5**B through the two positive pressure-side communicating pipes **89**. Thus, the negative-pressure tanks **54** in the ink circulators **5**A and **5**B are communicated with each other through the negative-pressure common air chamber **88** and the negative pressure-side communicating pipes **89**.

The negative pressure-side communicating pipes **89** communicate the negative-pressure common air chamber **88** with the air layers **66** in the negative-pressure tanks **54**. The two negative pressure-side communicating pipes **89** are provided to correspond one by one to the two ink circulators **5**A and **5**B. Each of the negative pressure-side communicating pipes **89** has one end connected to the negative-pressure common air chamber **88** and the other end connected to the air layer **66** in the negative-pressure tank **54**.

The negative pressure-side atmospheric air open valve **90** opens and closes an airflow path inside the negative pressure-side atmospheric air open pipe **91** to switch the negative-pressure tank **54** between the sealed state and the atmospheric air open state through the negative-pressure common air chamber **88** and the negative pressure-side communicating pipe **89**. The negative pressure-side atmospheric air open valve **90** is provided on the negative pressure-side atmospheric air open pipe **91**.

The negative pressure-side atmospheric air open pipe **91** forms an airflow path for releasing the negative pressure tank **54** to the atmosphere through the negative-pressure common air chamber **88** and the negative pressure-side communicating pipe **89**. The negative pressure-side atmospheric air open pipe **91** has one end connected to the negative-pressure common air chamber **88** and the other end corrected to the junction pipe **97**.

The negative pressure-side pressure regulating valve **92** opens and closes an airflow path inside the negative pressure-side pressure regulating pipe **93** to regulate the pressures in the negative-pressure common air chamber **88** and the negative-pressure tank **54**. The negative pressure-side pressure regulating valve **92** is provided on the positive pressure-side pressure regulating pipe **93**.

The negative pressure-side pressure regulating pipe **93** forms an airflow path for regulating the pressures in the negative-pressure common air chamber **88** and the negative-pressure tank **54**. The negative pressure-side pressure regulating pipe **93** has one end connected to the negative-pressure common air chamber **88** and the other end connected to the junction pipe **97**.

The negative pressure-side pressure sensor **94** measures the pressure in the negative-pressure common air chamber **88**. The pressure in the negative-pressure common air chamber **88** is equal to the pressures in the negative-pressure tanks **54** in the ink circulators **5**A and **5**B. This is because the negative-pressure common air chamber **88** is communicated with the air layers **66** in the negative-pressure tanks **54** in the ink circulators **5**A and **5**B.

The air pump **95** suctions air from the negative-pressure tanks **54** in the ink circulators **5**A and **5**B through the negative-pressure common air chamber **88**, and sends air to the positive-pressure tanks **51** in the ink circulators **5**A and **5**B through the positive-pressure common air chamber **81**. The air pump **95** is provided in the air pump pipe **96**.

The air pump pipe **96** forms an airflow path to be sent to the positive-pressure common air chamber **81** from the negative-pressure common air chamber **88** by the air pump **95**. The air pump pipe **96** has one end connected to the positive-pressure common air chamber **81** and the other end connected to the negative-pressure common air chamber **88**.

The junction pipe **97** has one end connected to the overflow pan **99** and the other end (upper end) communicated with the atmosphere through the air filter **98**. The end of the junction pipe **97** on the overflow pan **99** side is closed by an overflow ball **100** to be described later during a normal operation. The positive pressure-side atmospheric air open pipe **84**, the positive pressure-side pressure regulating pipe **86** the negative pressure-side atmospheric air open pipe **91** and the negative pressure-side pressure regulating pipe **93** are connected to the junction pipe **97**. Thus, the positive pressure-side atmospheric air open pipe **84**, the positive pressure-side pressure regulating pipe **86**, the negative pressure-side atmospheric air open pipe **91** and the negative pressure-side pressure regulating pipe **93** are communicated with the atmosphere.

The air filter **98** prevents unwanted material and the like in the air from entering the junction pipe **97**. The air filter **98** is provided at the upper end of the junction pipe **97**.

The overflow pan **99** receives ink overflowing from the positive-pressure tank **51** and the negative-pressure tank **54** due to abnormality in the ink supply valve **77**, for example, and also overflowing into the function pipe from the positive-pressure common air chamber **81** and the negative-pressure common air chamber **88**.

The overflow pan **99** is provided with the overflow ball **100**. The overflow ball **100** prevents external air from flowing into the junction pipe **97** by losing the end of the junction pipe **97** having an opening at the bottom of the overflow pan **99** when there is no ink in the overflow pan **99**. When the ink flows into the overflow pan **99** from the junction pipe **97**, the overflow ball **100** floats to enable the ink to flow into the overflow pan **99**.

The overflow pan **99** is also provided with an overflow ink level sensor **101**. The overflow ink level sensor **101** is configured to detect whether or not the ink level inside the overflow pan **99** has reached a predetermined level.

The overflow pan **99** is connected to a waste tank (not shown) and configured to discharge the ink to the waste tank when the ink surface is detected by the overflow ink level sensor **101**.

The controller **8** controls operations of the respective units in the ink-jet printer **1**. The controller **8** includes a CPU, a RAM, a ROM, a hard disk and the like.

To be more specific, the controller **8** performs control to print on the paper P by ejecting ink from the ink-jet head **21** while convey in the paper P the conveyer **2**.

Also, during printing, the controller **8** controls the blower **41** and the suction unit **42** in the head cooler **4** to generate cooling air inside the head holder **22**. In this event, the controller **8** controls a flow rate of air (flow rate of blow air) of the blower **41** and a flow rate of air (flow rate of suction air) of the suction unit **42** to suction air containing ink mist into the head holder **22** from a space between the bottom plate **31** of the head holder **22** and the conveyer belt **11** through the gaps **31**b around the head modules **26**.

Moreover, the controller **8** selectively uses a production priority mode (first mode) and an image priority mode (second mode) as print modes. The production priority mode is a print mode for printing without reducing print productivity by ensuring cooling performance of the ink-jet head **21**. On the other hand, the image priority mode is a print mode that puts higher priority an print image quality compared with the production priority made. The print made is selected in advance and set by the user operating an operation panel (not shown), for example. The controller **8** controls the flow rate of blow air and the flow rate of suction air according to the print mode.

Next, operations of the ink-jet printer **1** are described.

FIGS. **7** and **8** are flowcharts showing the operations of the ink-jet printer **1**. The processing shown in the flowcharts of FIGS. **7** and **8** is started when a print job is inputted to the ink-jet printer **1**.

In Step S1 of FIG. **7**, the controller **8** determines whether or not the print mode to be executed is the production priority mode.

After determining that the print mode to be executed is the production priority mode (Step S1: YES), the controller **8** make head cooling settings for the production priority mode. To be more specific, as duty ratios for driving the blowing fan **47** and the suction fan **49**, the controller **8** sets a duty ratio Dsf of the blowing fan **47** and a duty ratio Dsk of the suction fan **49** for the production priority mode.

The duty ratios Dsf and Dsk are determined. In advance such that the flow rate of cooling air W (see FIGS. **9**A and **9**B) inside the head holder **22**, which is determined based on the flow rate of blow air and the flow rate of suction air, is the flow rate of air required for cooling of the ink-jet head **21** according to a paper conveyance speed by the conveyer **2**, and are stored in the controller **8**. Here, as the paper conveyance speed becomes higher, the drive frequency of the head module **26** becomes higher and an amount of heat generated in the head module **26** is increased. Accordingly, the higher the paper conveyance speed, the larger the flow rate of the cooling air W required for cooling of the ink-jet head **21**.

Moreover, the duty ratios Dsf and Dsk take values such that the flow rate of suction air is larger than the flow rate of blow air. When the flow rate of suction air is larger than the flow rate of blow air, a shortfall in the flow rate of blow air s covered by air from the space between the bottom plate **31** of the head holder **22** and the conveyer belt **11**. More specifically, airflows F (see FIGS. **9**A and **9**B) are generated, which flow into the head holder **22** from the space between the bottom plate **31** and the conveyer belt **11** through the gaps **31**b in the bottom plate **31**. These airflows F collect ink mist together with the air into the head holder **22**.

Assuming that a printing rate of print images is constant the higher the print productivity, the larger the amount of ink mist generated per unit time. Here, the print productivity is increased as the paper conveyance speed is increased. Accordingly, the higher the paper conveyance speed, the larger the amount of ink mist generated per unit time. Therefore, the duty ratios Dsf and Dsk are determined such that, in order to collect more ink mist, the amount of the airflow F flowing into the head holder through the gaps **31**b is increased as the paper conveyance speed is increased. Here, the air volume of the airflows F flowing into the head holder **22** through the gaps **31**b is determined by a difference between the flow rate of suction air and the flow rate of blow air.

Moreover, the duty ratios Dsf and Dsk are determined such that, as for the amount of the airflows F flowing into the head holder **22** through the gaps **31**b, a landing shift amount due to the airflows F is within an allowable range. The landing shift amount is an amount of shift in landing position of the ink elected from the head module **26** on the paper P.

Following Step S2, the controller starts a print operation in Step S**3**. To be more specific, the controller **8** first closes the positive pressure-side atmospheric air open valve **83** and the negative pressure-side atmospheric air open valve **90**.

Thus, the positive-pressure tanks **51** in the ink circulators **5**A and **5**B are set in the sealed state through the positive-pressure common air chamber **81** and the like, and the negative-pressure tanks **54** are set in the sealed state through the negative-pressure common air chamber **88** and the like. Note that, during standby when the ink-jet printer **1** does not operate, the positive pressure-side atmospheric air open valve **83** and the negative pressure-side atmospheric air open valve **90** are open and the positive pressure-side pressure regulating valve **85** and the negative pressure-side pressure regulating valve **92** are closed.

Next, the controller **8** starts the air pump **95**. Thus, air is sent into the positive-pressure common air chamber **81** from the negative-pressure common air chamber **88**, thereby reducing the pressures in the negative-pressure common air chamber **88** and the negative-pressure tank **54** and increasing the pressures in the positive-pressure common air chamber **81** and the positive-pressure tank **51**. Thus, the ink flows toward the ink-jet head **21** from the positive-pressure tank **51**.

When the pressure (positive pressure-side pressure) of the positive-pressure common air chamber **81** and the positive-pressure tank **51**, which is measured by the positive pressure-side pressure sensor **87**, and the pressure (negative pressure-side pressure) of the negative-pressure common air chamber **88** and the negative-pressure tank **54**, which is measured by the negative pressure-side pressure sensor **94**, reach set pressures Pk and Pf, respectively, the controller **8** stops the air pump **95**. Here, the controller **8** controls opening and closing of the positive pressure-side pressure regulating valve **85** and the negative pressure-side pressure regulating valve **92** according to the measured values by the positive pressure-side pressure sensor **87** and the negative pressure-side pressure sensor **94**, so that the positive pressure-side pressure and the negative pressure-side pressure are set to the set pressures Pk and Pf after the start of the air pump **95**.

The set pressures Pk and Pf are set in advance as pressure values for setting the nozzle pressure of the head modules **26** at a proper value (negative pressure) while circulating the ink at a predetermined ink circulation flow rate in the ink circulators **5**A and **5**B.

When the positive pressure-side pressure and the negative pressure-side pressure reach the set pressures Pk and Pf, the controller **8** starts the drive roller **12** by the belt motor **16**. Thus, circling drive of the conveyer belt **11** is started. The controller **8** controls the belt motor **16** such that the paper conveyance speed is set to a predetermined print conveyance speed.

The controller **8** also starts the paper adsorption fan **17**. Thus, the paper adsorption fan **17** suctions air through the belt holes in the conveyer belt **11**, thereby generating adsorption force in the belt holes.

Moreover, the controller **8** starts the blowing fan **47** and the suction fan **49**. The controller **8** drives the blowing fan **47** and the suction fan **49** at the duty ratios Dsf and Dsk for the production priority mode set in Step S2, respectively.

By driving the blowing fan **47**, air is blown into the head holder **22** through the blowing holes **46**a in the blowing chamber **46** and the vent holes **32**a in the side plate **32** of the head holder **22**. Meanwhile, by driving the suction fan **49**, air is suctioned from the head holder **22** through the vent holes **34**a in the side plate **34** of the head holder **22** and the suction holes **48**a in the suction chamber **48**.

Thus, as shown in FIGS. **9**A and **9**B, cooling air W is generated in the head holder **22**, which flows from the front toward the rear. Also, airflows F are generated, which flow into the head holder **22** from the space between the bottom plate **31** and the conveyer belt **11** through the gaps **31**b.

When the paper P is supplied to the conveyer **2** from an unillustrated paper feeder, the paper P is conveyed while being, adsorbed to and held by the conveyer belt **11**. The controller **8** controls the head unit **3** to print an image by ejecting ink from the ink-jet heads **21**A and **21**B, based on the print job, onto the paper P conveyed below the head unit **3**. When the specified number of sheets to he printed is more than one, the controller **8** performs control to print images by electing ink from the ink-jet heads **21**A and **21**B onto the sheets of the paper P, which are sequentially fed and conveyed on the conveyance belt **11**.

During such a print operation, the controller **8** performs ink level maintenance control. The ink level maintenance control is control of the ink pump **55** and the ink supply valve **77** for circulating the ink while maintaining the ink levels in the positive-pressure tank **51** and the negative-pressure tank **54** at the reference level.

To be more specific, as shown in FIG. **10**, the controller **8** turns off the ink pump **55** and closes the ink supply valve **77** in a state where the positive-pressure ink level sensor **62** and the negative-pressure tank ink level sensor **67** are both on. Likewise, the controller **8** turns off the ink pump **55** and closes the ink supply valve **77** in a state where the positive-pressure ink level sensor **62** is on and the negative-pressure tank ink level sensor **67** is off.

In a state where the positive-pressure ink level sensor **62** is off and the negative-pressure tank ink level sensor **67** is on, the controller **8** turns on the ink pump **55** and closes the ink supply valve **77**.

In a state where the positive-pressure ink level sensor **62** and the negative-pressure tank ink level sensor **67** are both off, the controller **8** turns off the ink pump **55** and opens the ink supply valve **77**.

During execution of the print job, the ink is supplied to the ink-jet head **21** from the positive-pressure tank **51**, and the ink left unconsumed by the ink-jet head **21** is collected to the negative-pressure tank **54**. When the positive-pressure ink level sensor **62** is turned off and the negative-pressure tank ink level sensor **67** is turned on, the ink pump **55** sends the ink to the positive-pressure tank **51** from the negative-pressure tank **54** under the ink level maintenance control. Thus, printing is performed while the ink is being circulated.

When the positive-pressure ink level sensor **62** and the negative-pressure tank ink level sensor **67** arc both turned off as the ink is consumed and the amount of ink circulated is reduced, the ink supply valve **77** is opened to supply the ink to the negative-pressure tank **54** under the ink level maintenance control.

Even with the ink level maintenance control as described above, minute changes in ink level occurs in the positive-pressure tank **51** and the negative-pressure tank **54**. For example, the ink levels in the positive-pressure tank **51** and the negative-pressure tank **54** change due to outflow of the ink to the ink-jet head **21** from the positive-pressure tank **51** and return of the ink left unconsumed by the ink-jet head **21** to the negative-pressure tank **54**. Also, ink supply from the ink cartridge **76** changes the ink level in the negative-pressure tank **54**. Moreover, sending of the ink by the ink pump **55** changes the ink levels in the positive-pressure tank **51** and the negative-pressure tank **54**.

The ink level changes in the positive-pressure tank **51** and the negative-pressure tank **54** cause changes in the positive pressure-side pressure and the negative pressure-side pressure. To cope with such changes, the controller **8** appropriately performs driving of the air pump **95** and opening and closing of the positive pressure-side pressure regulating valve **85** and the negative pressure-side pressure regulating valve **92** according to the measured values by the positive pressure-side pressure sensor **87** and the negative pressure-side pressure sensor **94** to maintain the set pressures Pk and Pf of the positive pressure-side pressure and the negative pressure-side pressure.

Incidentally, the ink has a printable temperature range. The printable temperature range is a temperature range within which normal ink ejection by the ink-jet head **21** can be ensured. When the ink temperature measured by the ink temperature sensor **57** is outside the printable temperature range at the start of the print operation, the controller **8** controls the ink temperature regulator **56** to regulate the ink temperature while circulating the ink by the ink circulator **5**.

When the head modules **26** in the ink-jet head **21** are driven in the print operation, the head modules **26** generate heat. Although the head modules **26** are cooled by the cooling air W, the temperature of the head modules **26** may become higher than the ink temperature and the ink temperature may be increased. To counter this situation, the controller **8** starts the ink cooling fan **74** when the ink temperature measured by the ink temperature sensor **57** reaches an ink cooling start temperature Tk within the printable temperature range, to prevent the ink temperature from deviating from the printable temperature range. Thus, the ink temperature in the ink circulator **5** is lowered. When the ink temperature is lowered by a predetermined temperature from the ink cooling start temperature Tk, the controller **8** stops the ink cooling fan **74**.

During the print operation, ink mist is generated by ink ejection by the head modules **26**. Some of the ink mist is collected to the paper adsorption fan **17** through the belt holes in the conveyer belt **11**. Also, part of the remaining ink mist is collected into the head holder **22** by the airflows F flowing into the head holder **22** through the gaps **31**b in the bottom plate **31**.

Referring back to FIG. **7**, following Step S**3**, the controller **8** determines in Step S**4** whether or not at least one of the ink-jet heads **21**A and **21**B has reached a head temperature threshold Th, based on the temperature measured by each head temperature sensor **27**. Here, when the ink-jet head **21** includes a head module **26** in which the temperature measured by the head temperature sensor **27** has reached the head temperature threshold Th, the controller **8** determines that the ink-jet head **21** has reached the head temperature threshold Th.

The head temperature threshold Th is a threshold for determining whether or not cooling of the ink-jet head **21** is insufficient. The head temperature threshold Th is set to a temperature lower than a head temperature upper limit Tu. The head temperature upper limit Tu is an upper limit of a usable temperature range of the head modules **26**.

After determining that at least one of the ink-jet heads **21**A and **21**B has reached the head temperature threshold Th (Step S**4**: YES), the controller **8** determines in Step S**5** whether or not at least one of the ink-jet heads **21**A and **21**B has reached the head temperature upper limit Tu. Here, when the ink-jet head **21** includes a head module **26** in which the temperature measured by the head temperature sensor **27** has reached the head temperature upper limit Tu, the controller **8** determines that the ink-jet head **21** has reached the head temperature upper limit Tu.

After determining that neither of the ink-jet heads **21**A and **21**B has reached the head temperature upper limit Tu (Step S**5**: NO), the controller **8** determines in Step S**6** whether or not the duty ratios of the blowing fan **47** and the suction fan **49** have been changed. After determining that the duty ratios of the blowing fan **47** and the suction fan **49** have been changed (Step S**6**: YES), the controller **8** returns to Step S**4**.

After determining that the duty ratios of the blowing fan **47** and the suction fan **49** are not changed (Step S**6**: NO), the controller **8** changes the duty ratios of the blowing fan **47** and the suction fan **49** in Step S**7** to increase the flow rate of the cooling air W. For example, the controller **8** changes the duty ratios of the blowing fan **47** and the suction fan **49** to the maximum value (100%). Thereafter, the controller **8** returns to Step S**4**.

After determining in Step S**5** that at least one of the ink-jet heads **21**A and **21**B has reached the head temperature upper limit Tu (Step S**5**: YES), the controller **8** stops the print operation in Step S**8**. To be more specific, the controller **8** stops the ink-jet heads **21**A an **21**B, the drive roller **12**, the paper adsorption fan **17**, the blowing fan **47** and the suction fan **49**. The controller **8** opens the positive pressure-side atmospheric air open valve **83** and the negative pressure-side atmospheric air open valve **90**. Thus, a series of operations are finished.

After determining in Step S**4** that neither of the ink-jet heads **21**A and **21**B has reached the head temperature threshold Th (Step S**4**: NO), the controller **8** determines in Step S**9** whether or not the printing is finished for the specified number of sheets to be printed. After determining that the printing, is not finished for the specified number of sheets to be printed. (Step S**9**: NO), the controller **8** returns to Step S**4**.

After determining that the printing is finished for the specified number of sheets to be printed (Step S**9**: YES), the controller **8** stops the drive roller **12**, the paper adsorption fan **17**, the blowing fan **47** and the suction fan **49**, and opens the positive pressure-side atmospheric air open valve **83** and the negative pressure-side atmospheric air open valve **90** to finish the series of operations.

After determining in Step S**1** that the print mode to be executed is the Image priority mode (Step S**1**: NO), the controller **8** make head cooling settings for the image priority mode in Step S**10** of FIG. **8**. To be more specific, as duty ratios for driving the blowing fan **47** and the suction fan **49**, the controller **8** sets a duty ratio Dgf of the blowing fan **47** and a duty ratio Dgk of the suction fan **49** for the image priority mode.

The duty ratios Dgf and Dgk are determined in advance such that the flow rate of blow air and the flow rate of suction air are set to those that put higher priority on print image quality than on the cooling of the ink-jet head **21**, and are stored in the controller **8**.

To be more specific, the duty ratios Dgf and Dgk take such values that the flow rate of the cooling air W becomes smaller than that in the production priority mode. Thus, excessive cooling of the ink-jet head **21** can be suppressed. The excessive cooling of the ink-jet head **21** lowers the temperature of the ink in the head modules **26** and therefore increases the viscosity. Thus, the print image quality may be deteriorated by reduction in ink ejection amount and the like.

The duty ratios Dgf and Dgk take such values that the flow rate of suction air is larger than the flow rate of blow air. Moreover, the values of the duty ratios Dgf and Dgk are set such that the flow rate of the airflows F flowing into the head holder **22** through the gaps **31**b in the bottom plate **31** is smaller than that in the production priority mode and enables suction of ink droplets (ink mist) of a predetermined size or less. Furthermore, the values of the duty ratios Dgf and Dgk are set such that the flow rate of the airflows F does not bend the flight trajectory of main droplets of ink elected from the head modules. Thus, ink landing shift due to the airflows F is reduced, while the ink mist is suctioned into the head holder **22** by the airflows F.

The controller **8** advances to Step S**11** after Step S**10**. The processing in Steps S**11** to S**13** is the same as the processing in Steps S**3** to S**5** of FIG. **7** described above.

When a print opera is started in Step S**11**, cooling air W and airflows F shown in FIGS. **9**A and **9**B are also generated in the image priority mode. In the image priority mode, the flow rates of the cooling air W and the airflows F smaller than those in the production priority mode. The cooling air W is set to the flow rate that prevents excessive cooling of the in jet head **21**. The airflows F are set to the flow rate that enables the ink mist to he suctioned into the head holder **2** while suppressing landing shift on the paper P.

After determining in Step S**13** that neither of the ink-jet heads **21**A and **21**B has reached the head temperature upper limit Tu (Step S**13**: NO), the controller **8** determines in Step S**14** whether or not the paper conveyance speed by the conveyer **2** has been reduced. After determining that the paper conveyance speed has been reduced (Step S**14**: YES), the controller **8** returns to Step S**12**.

After determining that the paper conveyance speed is not reduced (Step S**14**: NO), the controller **8** reduces the paper conveyance speed to a preset speed by controlling the belt motor **16** in Step S**15**. Thereafter, the controller **8** returns to Step S**12**.

After the paper conveyance speed is reduced, the controller **8** drives the head modules **26** at a drive frequency corresponding to the reduced paper conveyance speed. Thus, the amount of heat generated in the head modules **26** is reduced to suppress temperature rise.

After determining in Step S**13** that at least one of the ink-jet heads **21**A and **21**B has reached the head temperature upper limit Tu (Step S**13**: YES), the controller **8** stops the print operation in Step S**16**. Thus, a series of operations are finished.

After determining in Step S**12** that neither of the ink-jet heads **21**A and **21**B has reached the head temperature threshold Th (Step S**12**: NO), the controller **8** determines in Step S**17** whether or not the printing is finished for the specified number of sheets to he printed. After determining that the printing is not finished for the specified number of sheets to be printed (Step S**17**: NO), the controller **8** returns to Step S**12**.

After determining that the printing is finished for the specified number of sheets to be primed (Step S**17**: YES), the controller **8** stops the drive roller **12**, the paper adsorption fan **17**, the blowing fan **47** and the suction fan **49**, and opens the positive pressure-side atmospheric air open valve **83** and the negative pressure-side atmospheric air open valve **90** to finish the series of operations.

In the ink-jet primer **1**, as described above, the controller **8** controls the flow rate of blow air and the flow rate of suction air to suction air containing ink mist into the head holder **22** from the space between the bottom plate **31** and the conveyer belt **11** through the gaps **31**b in the bottom plate **31** of the head holder **22**. Thus, the in mist can be collected into the head holder **22**. As a result, contamination inside the printer and deterioration in print image quality due to the ink mist can be reduced.

Moreover, in the ink-jet printer **1**, the ink mist is collected into the head holder **22** by controlling the flow rate of blow air and the flow rate of suction air of the head cooler **4**. This eliminates the need to add a dedicated mechanism to collect the ink mist, thus suppressing an increase in size of the printer.

Therefore, the ink-jet printer **1** can reduce the contamination inside the printer and deterioration in print image quality due to the ink mist while suppressing an increase in size of the printer.

Moreover, in the ink-jet printer **1**, the controller **8** controls the flow rate of blow air and the flow rate of suction air in the production priority mode such that the cooling air W has an air volume required for cooling or the ink-jet head **21** corresponding to the paper conveyance speed. Thus, in the production priority mode, printing can be performed without reducing the print productivity by ensuring cooling performance of the ink-jet head **21**.

Meanwhile, in the image priority mode, the controller **8** controls the flow rate of blow air and the flow rate of suction air such that the cooling air W has an air volume which is smaller than that in the production priority mode, and makes the flow rate of airflows F flowing into the head holder **22** through the gaps **31**b in the bottom plate **31** smaller than that in the production priority mode, so that the ink mist can be suctioned. Thus, excessive cooling of the ink-jet head **21** is reduced in the image priority mode compared with the production priority mode. At the same time, the ink mist can be collected into the head holder **22** while reducing the ink landing shift. As a result, better print image quality can he obtained in the image priority mode compared with the production priority mode.

The controller **8** selectively uses the production priority mode and the image priority mode as described above. Thus, convenience is improved since the printer can deal with the case where the user puts priority on the print productivity and the case where the user puts priority on the print image quality.

Moreover, the controller **8** reduces the paper conveyance speed when the temperature of the ink-jet head **21** reaches the head temperature threshold Th in the image priority mode. Thus, the amount of heat generated in the head modules **26** in the ink-jet head **21** is reduced to suppress temperature rise. As a result, damage to the ink-jet head **21** can be reduced.

Note that, in the image priority mode, the flow rate of blow air may be set to 0 (zero). In this case, the controller **8** drives the suction fan **49** only without driving the blowing fan **47** in the head cooler **4** during the print operation.

In this case, the cooling air N shown in FIGS. **9**A and **9**B is not generated but the airflows F are generated. The controller **8** drives the suction fan **49** at the duty ratios such that the flow rate of the airflows F enables suction of ink droplets (ink mist) of a predetermined size or less without suctioning main droplets of ink ejected from the had modules. Thus, the ink mist can be collected into the head holder **22** while reducing the ink landing shift.

Note that, although the cooling air W is not generated, a cooling effect of the airflows F on the ink-jet head **21** can be obtained.

Moreover, in the production priority mode, the flow rate of blow air and the flow rate of suction air may be set equal. In this case, a s generated by the blowing fan **62** and the suction fan **67** cancel out inside the head holder **22**. Thus, the airflows F flowing into the head holder **22** through the gaps **31**b in the bottom plate **31** are not generated. Thus, although the ink mist cannot be collected into the head holder **22**, ink landing shift due to the airflows F can be suppressed.

Second Embodiment

Next, description is given of a second embodiment in which changes are made to the operation of the image priority mode in the first embodiment described above. Note that an inkjet printer of the second embodiment has the same structure as that of the ink-jet printer **1** of the first embodiment. Also, operations in a production priority mode according to the second embodiment are the same as those in the first embodiment, i.e., the operations in Steps S**2** to S**9** of FIG. **7**.

FIG. **11** is a flowchart showing operations in an image priority mode in the second embodiment.

In Step S**21** of FIG. **11**, the controller **8** sets a paper conveyance seed for the image priority mode. To be more specific, the controller **8** sets a paper conveyance speed Vg for the image priority mode as a paper conveyance speed by the conveyer **2** during a print operation in the image priority mode. The paper conveyance speed Vg for the image priority mode is determined in advance to be lower than that in the production priority mode, and is stored in the controller **8**.

Next, in Step S**22**, the controller **8** makes head cooling settings for the image priority mode. To be more specific, as duty ratios for driving the blowing fan **47** and the suction fan **49**, the controller **8** sets a duty ratio Dgf of the blowing fan **47** and a duty ratio Dgk of the suction fan **49** for the image priority mode.

As in the case of the first embodiment, the duty ratios Dgf and Dgk take such values that the flow rate of the cooling air W becomes smaller than that in the production priority mode. Moreover, as in the case of the first embodiment, the values of the duty ratios Dgf and Dgk are set such that the flow rate of the airflows F flowing into the head holder **22** through the gaps **31**b in the bottom plate **31** is smaller than that in the production priority mode and enables suction of ink droplets (ink mist) of a predetermined size or less. Furthermore, the values of the duty ratios Dgf and Dgk are set such that the flow rate of the airflows F does not bend the flight trajectory of main droplets of ink ejected from the head modules. The duty ratios Dgf and Dgk are determined in advance and stored in the controller **8**.

Here, in the image priority mode of the second embodiment, since the paper conveyance speed Vg is lower than that in the production priority mode, the amount of ink mist generated per unit time is reduced. Thus, in the image priority mode of the second embodiment, the values of the duty ratios Def and Dgk can he set such that a difference between the flow rate of blow air and the flow rate of suction air is reduced and the flow rate of the airflows F is reduced compared with the first embodiment.

The controller **8** advances to Step S**23** after Step S**22**. The processing in Steps S**23** to S**29** is the same as the processing in Steps S**11** to S**17** of FIG. **8** described above.

As described above, in the second embodiment, the paper conveyance speed Vg for the image priority mode is set lower than that in the production priority mode. Thus, the drive frequency of the head modules **26** is reduced in the image priority mode compared with the production mode. The amount of heat generated in the head modules **26** is therefore reduced to suppress temperature rise. As a result, damage to the ink-jet head **21** can be reduced.

Third Embodiment

Next, description is given of a third embodiment in which changes are made to the image priority mode in the first embodiment described above. Note that an ink-jet printer of the third embodiment has the same structure as that of the ink-jet printer **1** of the first embodiment. Also, operations in the production priority mode according to the second embodiment are the same as those in the first embodiment, i.e., the operations in Steps S**2** to S**9** of FIG. **7**.

FIG. **12** is a flowchart showing operations in an image priority mode in the third embodiment.

The processing in Step S**31** of FIG. **12** is the same as that in Step S**10** of FIG. **8** described above.

Following Step S**31**, the controller **8** makes ink circulation settings for the image priority mode in Step S**32**. To be more specific, as set pressures by the pressure generator **7**, the controller **8** sets a set pressure Pkg of a positive pressure-side pressure and a set pressure Pfg of a negative pressure-side pressure for the image priority mode. The controller **8** also sets a duty ratio Dig of the ink pump **55** for the image priority mode, as a duty ratio for driving the ink pump **55**.

The set pressures Pkg and Pfg and the duty ratio Dig are set in advance as values that set an ink circulation flow rate in the ink circulator **5** in the image priority mode to be higher than that in the production priority mode, and are stored in the controller **8**.

To be more specific, the set pressure Pkg of the positive pressure-side pressure for the image priority mode is larger than the set pressure Pk of the positive pressure-side pressure in the production priority mode. Meanwhile, the set pressure Pfg of the negative pressure-side pressure for the image priority mode has an absolute value larger than that of the set pressure Pf of the negative pressure-side pressure in the production priority mode. The duty ratio Dig of the ink pump **55** for the image priority mode is larger than that of the ink pump **55** in the production priority mode.

Next, the controller **8** starts a print operation in Step S**33**. During the print operation, the controller **8** controls the pressure generator **7** such that the positive pressure-side pressure and the negative pressure-side pressure are set to the set pressures Pkg and Pfg, respectively. Moreover, the controller **8** drives the ink pump **55** at the duty ratio Dig under ink level maintenance control. Thus, the ink circulator **5** circulates ink at the ink circulation flow rate larger than that in the production priority mode.

The controller **8** advances to Step S**34** after the print operation is started in Step S**33**. The processing in Steps S**34** and S**35** is the same as the processing in Steps S**5** and S**8** of FIG. **7** described above.

After determining in Step S**34** that neither of the ink-jet heads **21**A and **21**B has reached the head temperature upper limit Tu (Step S**34**: NO), the controller **8** determines in Step S**36** whether or not the printing is finished for the specified number of sheets to be printed. After determining that the printing is not finished for the specified number of sheets to be printed (Step S**36**: NO), the controller **8** returns to Step S**34**.

After determining that the printing is finished for the specified number of sheets to be printed (Step S**36**: YES), the controller **8** stops the drive roller **12**, the paper adsorption fan **17**, the blowing fan **47** and the suction fan **49**, and opens the positive pressure-side atmospheric air open valve **83** and the negative pressure-side atmospheric air open valve **90** to finish a series of operations.

As described above, in the third embodiment, the ink circulation flow rate in the ink circulator **5** in the image priority mode is set larger than that in the production priority mode. Thus, the ink flow rate in the head modules **26** per unit time is increased in the image priority mode compared with the production priority mode. Thus, heat transfer from the head modules **26** to the ink can be facilitated. Thus, even in the image priority mode having a smaller flow rate of the cooling air W than the production priority mode, an increase in temperature of the head modules **26** can be reduced without decreasing the print conveyance speed. Therefore, also in the image priority mode, damage to the ink-jet head **21** can be reduced without deteriorating the print productivity.

In the image priority mode of the third embodiment, an increase in ink circulation flow rate increases load on the air pump **95** and the ink pump **55**. However, since such an increase is only in the image priority mode, reduction in product life can be suppressed.

Fourth Embodiment

Next, description is given of a fourth embodiment in which changes are made to the image priority mode in the first embodiment described above. Note that an ink-jet printer of the fourth embodiment has the same structure as that of the ink-jet printer **1** of the first embodiment. Also, operations in a production priority mode according to the fourth embodiment are the same as those in the first embodiment, i.e., the operations in Steps S**2** to S**9** of FIG. **7**.

FIG. **13** is a flowchart showing operations in an image priority mode in the fourth embodiment.

The processing in Step S**41** of FIG. **13** is the same as that in Step S**10** of FIG. **8** described above.

Following Step S**41**, the controller **8** makes ink cooling settings for the image priority mode in Step S**42**. To be more specific, the controller **8** sets an ink cooling start temperature

Tkg for the image priority mode, as a temperature to start cooling of ink by the ink temperature regulator **56** during a print operation.

The ink cooling start temperature Tkg is lower than the ink cooling start temperature Tk in the production priority mode within the printable temperature range. The value of the ink cooling start temperature Tkg is determined in advance and stored in the controller **8**.

Next, the controller **8** starts a print operation in Step S**43**. During the print operation, the controller **8** starts the ink cooling fan **74** when the ink temperature measured by the ink temperature sensor **57** reaches the ink cooling start temperature Tkg. Then, when the ink temperature is lowered by a predetermined temperature from the ink cooling start temperature Tkg, the controller **8** stops the ink cooling fan **74**.

The controller **8** advances to Step S**44** after the print operation is started in Step S**43**. The processing in Steps S**44** to S**46** is the same as that in Steps S**34** to S**36** of FIG. **12** described above.

As described above, in the fourth embodiment, the ink cooling start temperature Tkg for the image priority mode is set lower than the ink cooling start temperature Tk in the production priority mode. Thus, the temperature of the ink flowing into the head modules **26** can be suppressed low in the image priority mode compared with the production priority mode. Accordingly, heat exchange efficiency can be increased in the image priority mode by increasing a temperature difference between the head modules **26** and the ink, compared with the production priority mode. Thus, even in the image priority mode having a smaller flow rate of the cooling air W than the production priority mode, an increase in temperature of the head modules **26** can be reduced without decreasing the print conveyance speed. Therefore, also in the image priority mode, damage to the ink-jet head **21** can be reduced without deteriorating the print productivity.

Other Embodiments

As described above, the present invention has been described through the first to fourth embodiments. However, it should be understood that the present invention is not limited to the description and drawings which constitute a part of this disclosure. From this disclosure, various alternative embodiments, examples and operational techniques will become apparent to those skilled in the art.

In the first to fourth embodiments described above, the gaps **31**b between the attachment openings **31**a and the head modules **26** form the openings in the bottom plate **31** of the head holder **22**. However, the openings may be formed at any other positions.

Moreover, in the first to fourth embodiments described above, the ink head **21** includes a number of the head modules **26**. However, the ink-jet head may be a single elongated one.

Embodiments of the present invention have been described above. However the invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present embodiments are therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein.

Moreover, the effects described in the embodiments of the present invention are only a list of optimum effects achieved by the present invention. Hence, the effects of the present invention are not to those described in the embodiment of the present invention.

What is claimed is:

1. An ink-jet printer comprising:

a conveyer configured to convey a printing medium;

an ink-jet head configured to eject ink onto the printing medium conveyed by the conveyer;

a head holder in a box shape configured to hold the ink-jet head, the head holder having an opening through which a space between the head holder and the conveyer communicates with an inside of the head holder;

a head cooler including:

a blower configured to blow air into the head holder from an outside of the head holder toward the ink-jet head with a flow rate of blow air; and

a suction unit configured to suction air from the head holder with a flow rate of suction air, the head cooler being configured to generate cooling air for cooling the ink-jet head inside the head holder by the blower and the suction unit such that the cooling air generated by the head cooler flows into the head holder in a flow direction parallel to a conveying **[**direction**]** *surface* of the conveyer; and

a controller configured to drive the conveyer to convey the printing medium while driving the ink-jet head to eject the ink onto the printing medium to perform printing and driving the head cooler to generate the cooling air,

wherein the controller is configured to control the flow rate of blow air and the flow rate of suction air such that air containing ink mist *generated by ink ejection by the ink-jet head* is suctioned into the head holder through the opening*, and*

the flow direction is perpendicular to a conveying direction of the printing medium along the conveying surface.

2. The ink-jet printer according to claim **1**, wherein

the controller selectively uses a first mode and a second mode,

in the first mode, the controller controls the flow rate of blow air and the flow rate of suction air such that the cooling air in the head holder has an air volume required to cool the ink-jet head corresponding to a conveyance speed of the printing medium by the conveyer, and

in the second mode, the controller controls the flow rate of blow air and the flow rate of suction air such that the cooling air in the head holder has an air volume that is smaller than the air volume of the cooling air in the head holder in the first mode and airflow flowing into the head holder through the opening has an air volume that is smaller than an air volume of airflow flowing into the head holder through the opening in the first mode and capable of suctioning the ink mist.

3. The ink-jet printer according to claim **2**, wherein, in the second mode, the controller drives the conveyer to reduce the conveyance speed of the printing medium upon a temperature of the ink-jet head reaching a threshold.

4. The ink-jet printer according to claim **2**, further comprising an ink circulator configured to supply the ink to the ink-jet head while circulating the ink,

wherein the controller drives the ink circulator such that an ink circulation flow rate in the second mode is higher than an ink circulation flow rate in the first mode.

5. The ink-jet printer according to claim 2, further comprising an ink circulator configured to supply the ink to the ink-jet head while circulating the ink, wherein

the ink circulator includes an ink cooler configured to cool the ink,

in the first mode, the controller drives the ink cooler to start cooling of the ink upon an ink temperature of the ink being a first temperature, and

in the second mode, the controller drives the ink cooler to start cooling of the ink upon an ink temperature of the ink being a second temperature lower than the first temperature.

6. The ink-jet printer according to claim 1, wherein

the ink-jet head comprises a plurality of head modules each configured to eject the ink, and

the head holder has a hollow interior space for housing the plurality of head modules inside the head holder.

7. The ink-jet printer according to claim 1, wherein

the opening of the head holder includes openings arranged along **[**the**]** *a* conveying direction *of the printing medium*.

8. The ink-jet printer according to claim 1, wherein

the ink-jet head comprises a head module configured to eject the ink,

the conveyer comprises a conveyer belt,

the head holder comprises a bottom plate having the opening and a lower surface facing the conveyer belt, and

the head module has an ink ejection surface arranged in between the conveyer belt and the lower surface.

9. An ink-jet printer comprising:

a conveyer configured to convey a printing medium;

an ink-jet head configured to eject ink onto the priming medium conveyed by the conveyer;

a head holder in a box shape configured to hold the ink-jet head, the head holder having an opening through which a space between the head holder and the conveyer communicates with an inside of the head holder;

a head cooler including:

a blower configured to blow air into the head holder from an outside of the head holder with a flow rate of blow air; and

a suction unit configured to suction air from the head holder with a flow rate of suction air, the head cooler being configured to generate cooling air for cooling the ink-jet head inside the head holder by the blower and the suction unit; and

a controller configured to drive the conveyer to convey the printing medium while driving the ink-jet head to eject the ink onto the printing medium to perform printing and driving the head cooler to generate the cooling air, wherein

the controller is configured to control the flow rate of blow air and the flow rate of suction air such that air containing ink mist is suctioned into the head holder through the opening,

the controller selectively uses a first mode and a second mode,

in the first mode, the controller controls the flow rate of blow air and the flow rate of suction air such that the cooling air in the head holder has an air volume required to cool the ink-jet head corresponding to a conveyance speed of the printing medium by the conveyer, and

in the second mode, the controller controls the flow rate of blow air and the flow rate of suction air such that the cooling air in the head holder has an air volume that is smaller than the air volume of the cooling air in the head holder in the first mode and airflow flowing into the head holder through the opening has an air volume that is smaller than an air volume of airflow flowing into the head holder through the opening in the first mode and capable of suctioning the ink mist.

10. The ink-jet printer according to claim 1, wherein

the suction unit is arranged to face the blower with the ink-jet head therebetween, and

the head cooler is configured to generate the cooling air such that the cooling air flows from the blower to the suction unit.

11. The ink-jet printer according to claim 1, wherein the controller is configured to control an air volume of airflow flowing into the head holder through the opening depending on a difference between the flow rate of blow air and the flow rate of suction air.

12. The ink-jet printer according to claim 1, further comprises a plurality of the ink-jet heads,

wherein the head holder holds the plurality of the ink-jet heads.

13. The ink-jet printer according to claim 1, wherein, during printing, the controller controls the flow rate of the blow air and the flow rate of the suction air such that the air containing the ink mist generated by the ink ejected by the ink-jet head is suctioned into the head holder through the opening.

14. An ink-jet printer comprising:

a conveyer configured to convey a printing medium;

an ink-jet head configured to eject ink onto the printing medium conveyed by the conveyer;

a head holder in a box shape configured to hold the ink-jet head, the head holder having an opening through which a space between the head holder and the conveyer communicates with an inside of the head holder;

a head cooler including:

a blower mounted to the head holder and configured to blow air into the head holder from an outside of the head holder toward the ink-jet head with a flow rate of blow air; and

a suction unit mounted to the head holder and configured to suction air from the head holder with a flow rate of suction air, the head cooler being configured to generate cooling air for cooling the ink-jet head inside the head holder by the blower and the suction unit such that the cooling air generated by the head cooler flows into the head holder in a flow direction parallel to a conveying surface of the conveyer; and

a controller configured to drive the conveyer to convey the printing medium while driving the ink-jet head to eject the ink onto the printing medium to perform printing and driving the head cooler to generate the cooling air, wherein

the controller is configured to control the flow rate of blow air and the flow rate of suction air such that air containing ink mist generated by ink ejection by the ink-jet head is suctioned into the head holder through the opening.

15. The inkjet printer according to claim 1, wherein

the head holder comprises:

a first sidewall with at least one first vent hole; and

a second sidewall with at least one second vent hole,

the first sidewall and the second sidewall face each other in the flow direction,

the blower comprises a blowing chamber with at least one blowing hole arranged at a position corresponding to *the at least one first vent hole, the blower being configured to blow the air into the head holder through the at least one blowing hole and the at least one first vent hole, and*

the suction unit comprises a suction chamber with at least one suction hole arranged at a position corresponding to the at least one second vent hole, the suction unit being configured to suction the air from the head holder through the at least one second vent hole and the at least one suction hole.

16. The ink-jet printer according to claim 9, wherein

the blower is configured to blow the air toward the ink-jet head,

the suction unit is arranged to face the blower with the ink-jet head therebetween, and

the head cooler is configured to generate the cooling air such that the cooling air flows from the blower to the suction unit.

17. The ink-jet printer according to claim 9, wherein the controller is configured to control an air volume of airflow flowing into the head holder through the opening depending on a difference between the flow rate of blow air and the flow rate of suction air.

18. The ink-jet printer according to claim 9, further comprises a plurality of the ink-jet heads

wherein the head holder holds the plurality of the ink-jet heads.

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UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : RE48,686 E
APPLICATION NO. : 16/293352
DATED : August 17, 2021
INVENTOR(S) : S. Otsuka et al.

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

On the Title Page

Item [57], (Line 3), change "Ahead" to -- A head --.

In the Claims

Column 23, Line 33 (Claim 9), change "priming" to -- printing --.
Column 25, Line 25 (Claim 18), change "heads" to -- heads, --.

Signed and Sealed this
Fifteenth Day of February, 2022

Drew Hirshfeld
Performing the Functions and Duties of the
Under Secretary of Commerce for Intellectual Property and
Director of the United States Patent and Trademark Office