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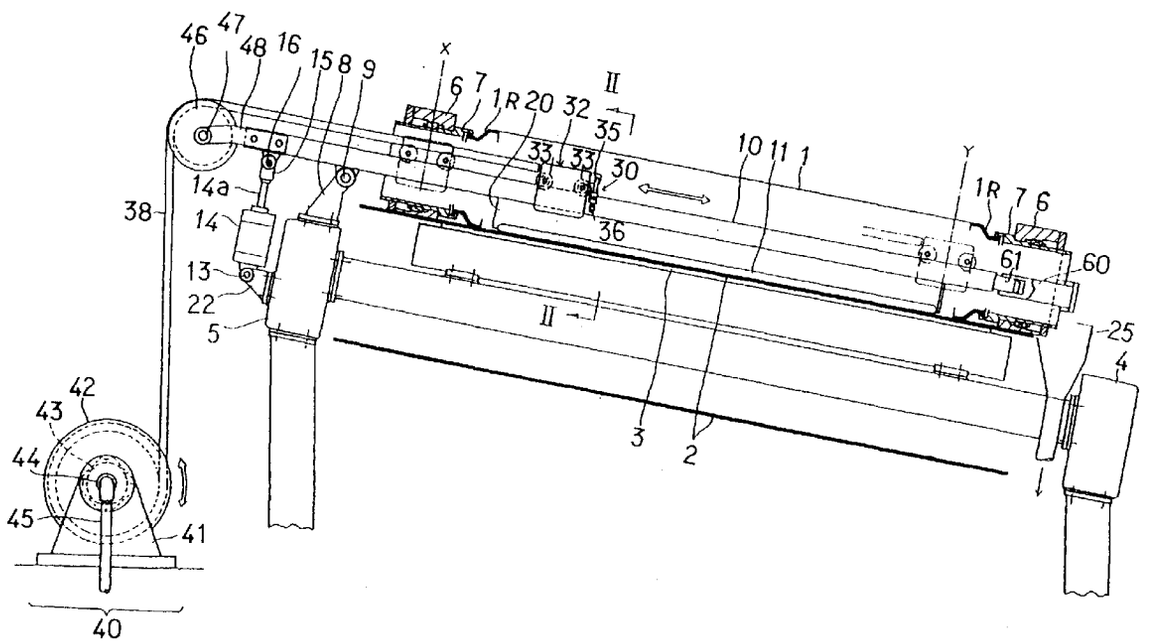
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(54) Rotary screen textile printing machine

(57) Disclosed is a rotary screen textile printing machine comprising a rotary screen inclined from its one end to the other end, characterized in that: a washing liquid sprayer disposed in the rotary screen reciprocally moves at least once through the substantially entire length of the rotary screen; and that the washing liquid sprayer has a nozzle oriented to the inner wall of the rotary screen.

F I G. 1



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Description

FIELD OF THE INVENTION

The present invention relates to a rotary screen textile printing machine.

DESCRIPTION OF PRIOR ART

According to the rotary screen textile printing technique, it is necessary to wash the rotary screen each time designs, colors or the like are changed.

In the case of using a conventional and typical rotary screen textile printing machine, it is necessary to detach a rotary screen from the machine for washing, which requires a lot of labor and time. After the washing, the dried rotary screen has to be re-mounted on the machine. This also requires a lot of labor and time, resulting in a reduced productivity and causing a serious problem in conducting a small-lot and multicolor printing.

As described above, prior to the washing, the rotary screen must be detached. This procedure is conducted with residual printing paste remaining on the rotary screen. Therefore, the paste is often dripped from the rotary screen and pollutes the environment.

Japanese Unexamined Patent Publication No. 276564/1996 discloses a rotary screen textile printing machine in an attempt to solve the above problems. The components of this machine, i.e., a rotary screen, an endless belt for transporting a textile to be printed and a printing table are inclined in the width direction of the endless belt.

The washing liquid supplied in the rotary screen is discharged from the lower end of the inclined rotary screen. The discharged liquid is collected in a trough. The rotary screen to be washed does not have to be detached from the printing machine.

A hollow bar is disposed to extend through the rotary screen in a lengthwise direction. Formed in the wall of the hollow bar are a number of holes that are spaced in the lengthwise direction, through which holes washing liquid is passed and supplied to the rotary screen. This method, however, does not always attain a desirable washing effect for the following reasons.

a) Less liquid from the bar is likely to be supplied to the portions of the rotary screen facing the non-hole areas of the bar. This results in insufficient washing of the rotary screen.

b) The water pressure of washing liquid differs between the fore end portion and the rear end portion of the bar. That is, the washing effect differs between those portions. Therefore, if a screen mesh is washed to the extent that the portion receiving a weaker water pressure is washed to a suitable extent, the portion receiving a stronger water pressure is wastefully washed. Conversely, if the latter portion is washed to a suitable extent, the former portion is insufficiently washed.

c) It is difficult to wash the cone-shaped end rings attached at the opposite ends of a rotary screen.

d) Water scale or the like is likely to be clogged in the said holes of the bar, in which case washing liquid can not be supplied.

e) Inefficiently, the rotary screen has to be wiped for removal of the washing liquid remaining thereon, and thereafter, it has to be dried.

f) For the above reasons, it is difficult to wash the rotary screen and conduct the treatments related to the washing in a short time.

SUMMARY OF THE INVENTION

The main object of the present invention is to solve the above problems. More specifically, the object of the present invention is to more effectively wash a rotary screen of a rotary screen textile printing machine, shorten washing time, and make the washing process labor-saving, thereby improving the productivity of the printing machine.

The present invention relates to rotary screen textile printing machines 1, 2 and 3 constructed as follows:

1. A rotary screen textile printing machine comprising a rotary screen inclined from its one end to the other end, characterized in that: a washing liquid sprayer disposed in the rotary screen reciprocally moves at least once through the substantially entire length of the rotary screen; and that the washing liquid sprayer has a nozzle oriented to the inner wall of the rotary screen.

2. A rotary screen textile printing machine comprising a rotary screen inclined from its one end to the other end, characterized in that, the washing liquid sprayer has a supply pipe, the start end of which is connected to a washing liquid source and a compressed air source in a selectively switchable manner therebetween.

3. A rotary screen textile printing machine according to the above 1 or 2, characterized in that the washing liquid sprayer stops for a while at a start point and a turning point of its reciprocal movement through a rotary screen.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. **1** is a sectional view taken along the axis of a rotary screen, illustrating an example of the rotary screen textile printing machine according to the present invention;

Fig. **2** is a cross sectional view taken along Line II-II of Fig. **1**;

Fig. **3** is an enlarged side view of a washing liquid sprayer;

Fig. **4** is a piping diagram of the systems for supplying washing liquid and compressed air;

Fig. **5** is a block diagram of a control system according to an embodiment of the present invention;
Fig. **6** is a perspective view of an end ring formed at the mouth of the rotary screen; and
Fig. **7** is a perspective view of a base.

PREFERRED EMBODIMENTS OF THE INVENTION

Preferred embodiments will now be described with reference to the accompanying drawings.

The rotary screen textile printing machine of the present invention comprises a single or a plurality of rotary screens **1** spaced in parallel at a predetermined distance, an endless belt **2** for transporting a textile to be printed, a printing table **3** and a drive roller (not shown) for driving the endless belt **2** mounted on machine frames **4** and **5** of the textile-printing machine. These components **1**, **2** and **3** are inclined in the width direction of the endless belt **2**.

A washing liquid sprayer **30** is disposed within the rotary screen **1**. The washing liquid sprayer **30** is reciprocally moved at least once through the substantially entire length of the rotary screen **1** in a lengthwise direction. Nozzles **36** of the washing liquid sprayer **30** are oriented to the inner wall of the rotary screen **1**. In the illustrated example, the washing liquid sprayer **30** comprises a manifold **31** mounted on a carriage **32**. The manifold **31** has branch pipes **35, 35** that extend downwardly from the right and left ends of the manifold **31** in Fig. **2** relative to the inner surface of the rotary screen **1**. Attached at the ends of the branches **35, 35** are nozzles **36, 36,** respectively. Preferred examples of the nozzles **36** are of the type that can change its spraying direction. If the spraying direction of the nozzles **36** is changeable, it is possible to spray washing liquid and blow compressed air for removal of remaining liquid (later-described) in a desired direction relative to the inner surface of the rotary screen **1** according to various conditions. The nozzles **36** are preferably of the wide-range spraying/blowing type that can spray washing liquid and blow compressed air over a wide range of the rotary screen. The carriage **32** is mounted on a bar **10** of rectangular cross section, which bar extends through the rotary screen **1**. The carriage **32** can slide back and forth along the bar **10** as a guide rail, but cannot rotate about the axis of the rotary screen **1**. The carriage **32** comprises wheels **33** that move on the bar 10 and slide shoes **34** that slide along the bar **10**. Since the carriage **32**, i. e., the washing liquid sprayer **30** does not rotate about the axis of the rotary screen **1**, a hose **38** is not twisted in the rotary screen **1**, whereby the washing liquid sprayer **30** can perform a smooth reciprocal movement in the rotary screen **1**.

A hose winder **40** is disposed aside of the machine frame **5**. The hose winder **40** comprises a mount **41**, a reel **42** supported thereby and a reversible geared motor **43** for rotating the reel **42**. It is preferable that the motor **43** be of the variable speed type to change the later-described travel speed of the washing liquid sprayer **30**, as necessary. Wound around the reel **42** is one end portion of the hose **38** that communicates at the other end with a liquid supply inlet **31a** via a connector **37**. The wound end of the hose **38** is connected to the wound-end-side mouth of a rotary joint **44**. The rotary joint **44** acts as a shaft for the reel **42**. Connected to the other end of the rotary joint **44** is a pipe **45**. Extending from the reel **42**, the hose **38** changes its advancing direction at an intermediate portion by a pulley **46** disposed at a position. The pulley **46** is supported via a pivot **47** by one end of an arm **48**, the other end of which is connected to the bar **10**.

Connected to the pipe **45** is one end of a pipe **50**. The other end of the pipe **50** is connected to the connecting point between a liquid supply pipe **Ia** and a compressed air supply pipe **IIa**. The start end of the liquid supply pipe **Ia** is connected to a source **I** of washing liquid, for example, a pump for supplying washing liquid via a solenoid valve **51**. The start end of the compressed air supply pipe **IIa** is connected to a source **II** of compressed air, for example, an air compressor via a solenoid valve **52**. The pipes **Ia** and **IIa** are provided with a check valve **53**, respectively.

The hose **38** is wound up around the reel **42** by positive rotation of the reel **42**, and is unwound by reverse rotation of the reel **42**. When the hose is unwound, the washing liquid sprayer **30** moves along the inclined bar 10 in the right direction of Fig. **1** because of gravity. The winding-up of the hose **38** makes the sprayer **30** move in the left direction of Fig. **1**.

According to a predetermined procedure, the washing liquid sprayer **30** reciprocally moves in the rotary screen **1**, wherein the higher end of the rotary screen **1**, e.g., the later-mentioned Point X is an origin or a start point of reciprocal movement, and the lower end, e.g., the later-mentioned Point Y is a turning point of reciprocal movement.

In washing the rotary screen, the solenoid valve **52** is closed, and the solenoid valve **51** is opened. The opening and closing of these valves is controlled by an appropriate manner, for example, the following means as well as the motor **43**.

The solenoid valves **51** and **52** and the motor **43** are connected to the output side of a control circuit **A**. When the control circuit **A** is switched on, an output enters the solenoid valves **51** and **52** and the motor **43** from the control circuit **A**, thereby opening the solenoid valve **51**, closing the solenoid valve **52** and actuating the motor **43**.

When the solenoid valve **51** is opened, the pipe **Ia** is opened so that a pressurized washing liquid is supplied from the washing liquid source **I** to the hose **38** through the pipes **Ia**, **50** and **45**. From the nozzles **36**, the washing liquid is sprayed to wash the inner wall of the rotary screen **1**. Waste washing liquid is collected in a trough **25** disposed on the lower side of the belt **2**.

On the other hand, the washing liquid sprayer **30**

reciprocally moves at least once through the substantially entire length of the inclined rotary screen **1**.

The reciprocal movement of the washing liquid sprayer **30** is not limited to a specific range. However, the washing liquid sprayer **30** generally moves in the range of from the left end (the flanged end) of the end ring **1R** at one end (the left-side end in Fig. **1**) of the rotary screen **1** to the intermediate portion of the end ring **1R** at the other end of the rotary screen **1**. To describe more specifically using vertical lines through the carriage **32**, it moves in the range of from Point X to Point Y as shown in Fig. **1**.

To set the range of movement of the washing liquid sprayer **30** from Point X to Point Y, a suitable manner, for example, the following means may be employed.

A counter is built in the control circuit **A**. The motor **43** is connected to the output side of this counter. The counter counts the number of rotation of the motor **43** during washing process, in other words, it counts the number of pulses transmitted from a pulse generator **PG** according to the amount of movement of the washing liquid sprayer **30**.

Starting from Point X, when the washing liquid sprayer **30** has reached Point Y, the count of the counter has reached a predetermined pulse number. Then, an output is forwarded from the control circuit **A** to the motor **43** for reverse rotation. This control is conducted according to the program pre-stored in the control circuit **A**. After the washing liquid sprayer **30** reciprocally moves predetermined times, the control circuit **A** sends an output to the solenoid valve **51** and the motor **43** to thereby close the solenoid valve **51** and stop the motor **43**. While the motor **43** stops, the washing liquid sprayer **30** is positioned at Point X according to a predetermined procedure. This control, too, is conducted according to the program pre-stored in the control circuit **A**. Fig. **5** is a block diagram showing the system for conducting the above-described controls.

During washing of the rotary screen **1**, the rotary screen **1** and the endless belt **2** are preferably rotated. Thus, a roller squeegee **11** in the rotary screen **1** rotates with the rotation of the rotary screen **1**, thereby contributing to the washing of the screen mesh of the rotary screen **1**, and the roller squeegee **11** itself being washed. In this case, if the printing table **3** is of the electromagnet type, more desirable effects can be obtained by exciting an electromagnet **3a**. When the electromagnet **3a** is excited, the roller squeegee **11** is pulled by the electromagnet **3a** and pressurizedly contacts the inner surface of the rotary screen to squeezingly remove color pastes or washing liquid remaining on the rotary screen **1**.

When the washing of the rotary screen **1** is finished, the remaining liquid on the rotary screen **1** is removed. The conversion of the washing mode to the liquid removal mode is controlled by an appropriate manner, for example, the following means.

When the washing process is finished, an output is transmitted from the control circuit **A** to a solenoid valve **52** so that the solenoid valve **52** is opened, and the pipe **IIa** is opened. This control is conducted according to the program pre-stored in the control circuit **A**. When the pipe **IIa** is opened, compressed air is supplied from a compressed air source **II** to the hose **38** via the pipes **IIa, 50** and **45** and is blown from the nozzles **36**. This blown compressed air blows off and remove moisture and droplets on the inner surface and the space of the rotary screen **1**. Accordingly, it is not necessary to wipe out remaining liquid unlike the conventional technique. Further, the blown compressed air also cleans the nozzles **36**, whereby the nozzles **36** is prevented from being clogged with water scale.

Another counter built in the control circuit **A** counts the number of rotation of the motor **43** during the said liquid removal process, i.e., it counts the number of pulses transmitted from the pulse generator **PG** according to the amount of movement of the washing liquid sprayer **30** (which is substantially a compressed air blower in the liquid removal process). Starting from Point X, when the washing liquid sprayer **30** has reached Point Y, the count of the counter has reached a predetermined number. At this time, an output enters the motor **43** from the control circuit **A**, thereby causing the motor **43** to rotate reversely. This control is conducted according to the program pre-stored in the control circuit **A**. After the washing liquid sprayer **30** reciprocally moves predetermined times, an output enters the solenoid valve **52** and the motor **43** from the control circuit **A**, thereby closing the solenoid valve **52** and stopping the motor **43**. While the motor **43** stops, the washing liquid sprayer **30** is positioned at Point X according to a predetermined procedure. These controls are also conducted by the program pre-stored in the control circuit **A**.

Fig. **5** shows a block diagram of the control system for converting the washing mode to the liquid removal mode, as well as the control system for determining the travel range of the washing liquid sprayer **30** from Point X to Point Y.

In Fig. **5**, **C1** denotes a setting device for setting the number of reciprocal movement of the washing liquid sprayer **30** during washing process, and **C2** denotes a setting device for setting the number of reciprocal movement of a compressed air blower (doubled by the washing liquid sprayer **30**) during liquid removal process.

Since the washing liquid sprayer **30** returns to Point X and stops there for a while, the sprayer **30** does not hinder the printing. Also, replacement of the rotary screen **1** is thereby facilitated.

Preferably, the preset number of reciprocal movement of the washing liquid sprayer **30** can suitably be changed according to various printing conditions such as the type or viscosity of color paste used, the shade of color, the condition of the screen mesh of the rotary screen or the like.

As described, according to the present invention, a washing liquid sprayer reciprocally moves at least once

through the substantially entire length of an inclined rotary screen to wash the rotary screen with the liquid sprayed from a nozzle of the sprayer. Accordingly, the rotary screen can effectively be washed over its substantially entire length with an uniform force of sprayed washing liquid, together with the fact that the nozzle of the washing liquid sprayer is oriented to the inner wall of the rotary screen. Further, every portion of the rotary screen including the end rings can be washed. If the washing liquid sprayer can stop at Point X and Y for a while, the end rings can more preferably be washed. In order to stop the washing liquid sprayer at Point X and Y for a while, an execution program may be stored in the control circuit **A** to conduct a programed control.

During liquid removal process, the washing liquid sprayer acts as a compressed air blower, i.e., it reciprocally moves through the substantially entire length of the rotary screen at least once to blow compressed air, whereby liquid removal can effectively be conducted on the rotary screen, even on the end rings. Further, the blowing of the compressed air contributes to preventing the nozzle from being clogged with water scale or the like. If the washing liquid sprayer stops for a while at Point X and Y, remaining liquid on the rotary screen can more effectively be removed from the end rings.

According to the present invention, if the start end of a pipe, which communicates with a liquid supply inlet of the washing liquid sprayer, is connected to a washing liquid source and a compressed air source in a selectively switchable manner therebetween, the system for spraying washing liquid can double as the liquid removal system for blowing compressed air, whereby the usefulness of the invention would be further enhanced.

The illustrated support structure for the rotary screen **1** is as follows.

Bearings **6, 6** supporting the opposite ends of the rotary screen **1** are attached to a support (not shown) mounted on the frames **4** and **5** in such a manner that the right-side bearing in Fig. **1** is movable in the width direction of the textile printing machine (i.e., left and right directions of Fig. **1**). The end rings **1R, 1R** of the rotary screen **1** are detachably fitted in the bases **7, 7** that can rotate about the axes of the bearings **6, 6**. Engaging members **71** are finned at the mouth ends of the bases **7, 7,** respectively. Likewise, engaging members **12** are finned at the mouth ends of the end rings **1R, 1R,** respectively. The engaging members **71** and **12** are formed in plurality, as illustrated in Figs. **6** and **7**. When the engaging members **71** and **12** on one side of the screen engage with each other, the engaging members **71** and **12** on the opposite side engage with each other. After the rotary screen **1** is rotated relative to the bases **7, 7** so that the engaging members **12** and **71** are disengaged, the right-side bearing **6** in Fig. **1** is moved in the right direction of Fig. **1**, and then the rotary screen **1** is moved in the right direction of Fig. **1** relative to the opposite base **7**, thereby detaching the rotary screen **1** attached with end rings **1R, 1R** from the bases **7, 7**.

Connected to the slidable bearing **6** is a sleeve-shaped support member **60** in which a free end **61** of the bar **10**, i.e., the right-side end of the bar **10** is fitted. The free end **61** is detachably fitted in and supported by the support member **60**. A bracket **8** is provided on the machine frame **5**. The bar **10** is vertically rotatably supported via a pivot **9** at a point outside of the rotary screen **1**.

When the slidable bearing **6** is moved in the right direction and detached from the end ring **1R**, the support member **60** is withdrawn from the bar **10**. The end ring **1R** is detached from the right-side base **7**. When the bar **10** is upwardly rotated by the air cylinder **14** with a pivot 9 being a point of support, the front end of the bar **10** contact the end ring **1R** on the front end side. When the bar **10** is further rotated upwardly, the rotary screen **1**, which is disconnected from the bearings **6, 6,** follows the upward rotation of the bar **10**. When the rotary screen **1** is upwardly rotated to a predetermined level, the air cylinder **14** stops so that the rotary screen **1** can be withdrawn in the right direction of Fig. **1** relative to the bar **10**. In this case, since the rotary screen **1** has followed the rotation of the bar **10**, i.e., has been raised to the said level, the rotary screen **1** can readily be withdrawn using the bar **10** as a guide or a jig. The lower end of the air cylinder **14** is connected to a bracket **22** via a pivot **13** on the frame **5**. The top end of a plunger **14a** is connected to the bar **10** via a pivot **16**.

As clear from the above description, the present invention can improve the washing capability of a rotary screen printing machine, reduce washing time, and lower the washing labor, thereby increasing the productivity of the printing machine.

Claims

1. A rotary screen textile printing machine comprising a rotary screen **1** inclined from its one end to the other end, characterized in that: a washing liquid sprayer **30** disposed in the rotary screen **1** reciprocally moves at least once through the substantially entire length of the rotary screen **1**; and that the washing liquid sprayer **30** has a nozzle **36** oriented to the inner wall of the rotary screen **1**.

2. A rotary screen textile printing machine according to claim 1, characterized in that the washing liquid sprayer **30** has a liquid supply pipe **50**, the start end of which is connected to a washing liquid source **I** and a compressed air source **II** in a selectively switchable manner therebetween.

3. A rotary screen textile printing machine according to claim 1, characterized in that: the washing liquid sprayer stops for a while at a start point X and a turning point Y of its reciprocal movement.

FIG. 1

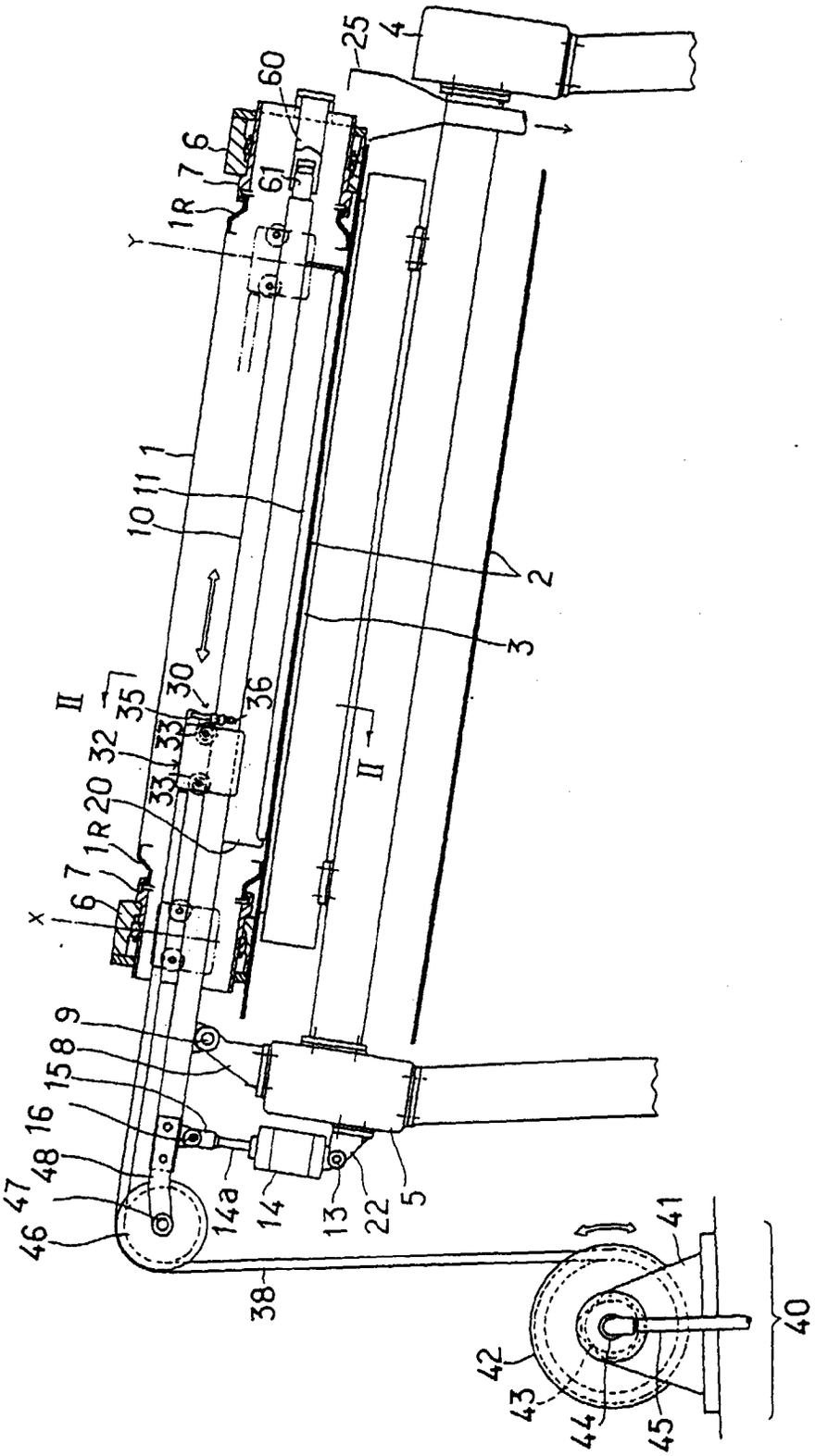

25
4
60
6
61
7
1R
Y
10
11
1
2
3
II
30
35
36
32
33
20
X
9
8
15
16
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47
46
14a
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13
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42
43
44
45

FIG. 2

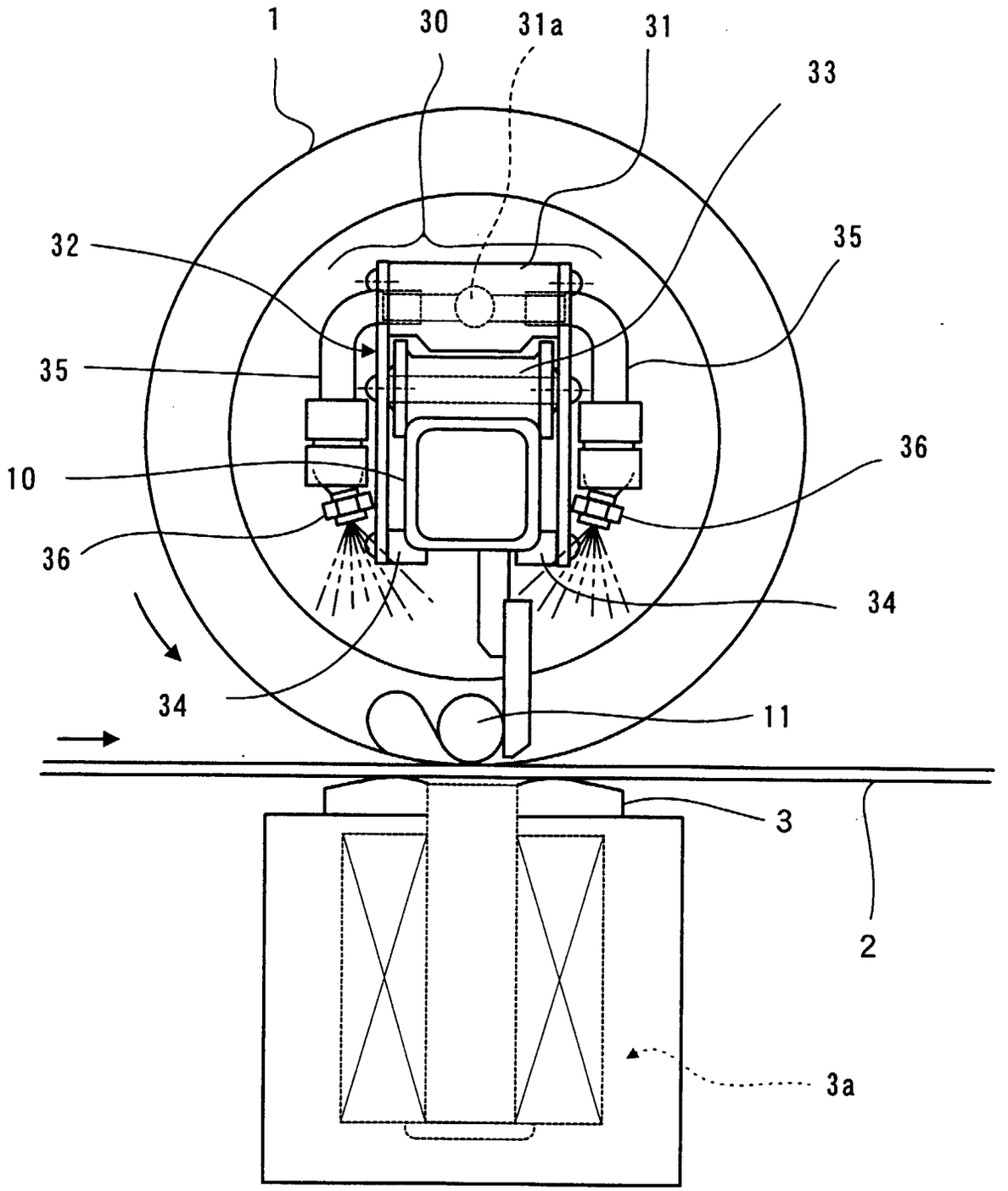


FIG. 3

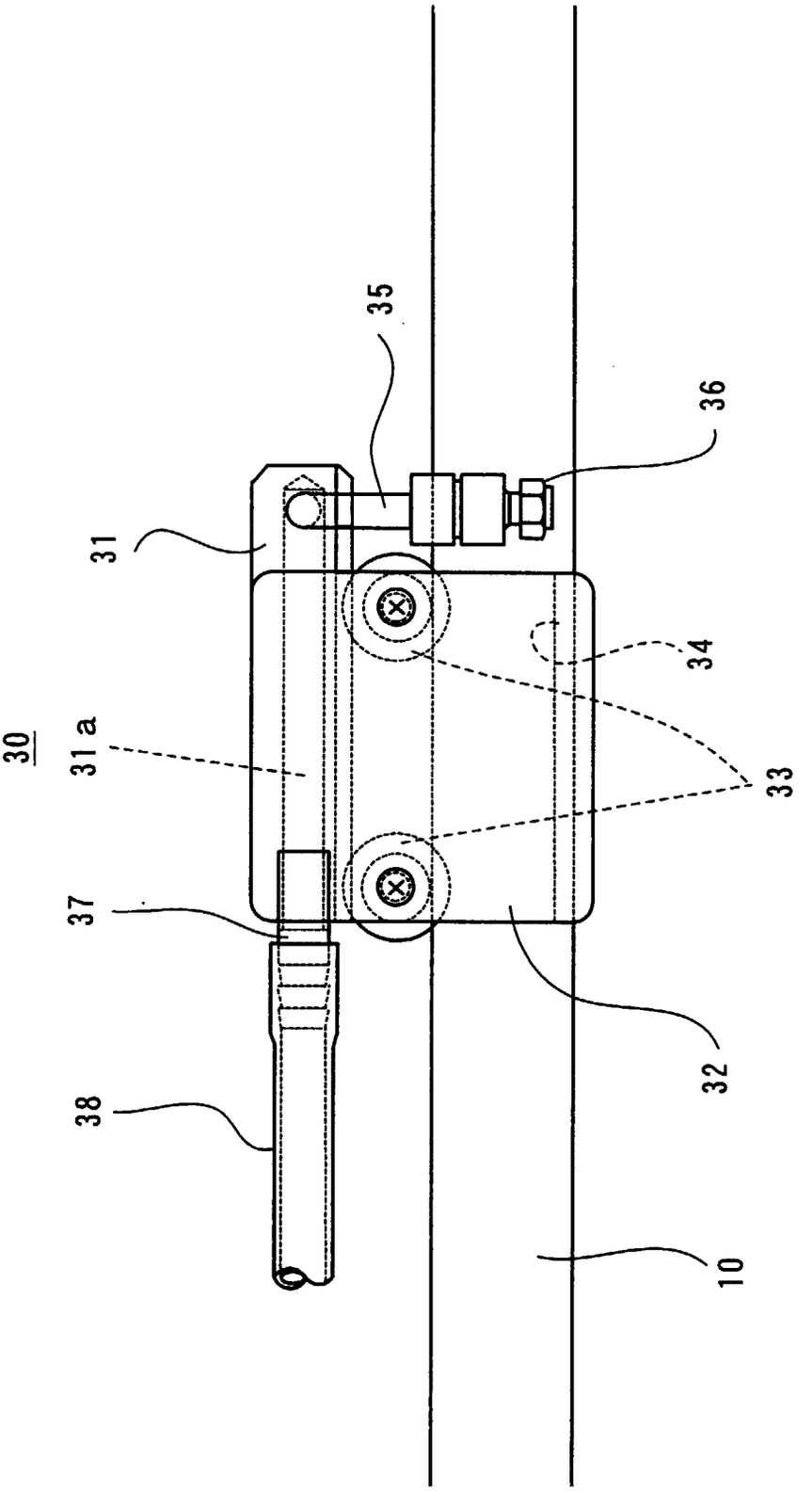


FIG. 4

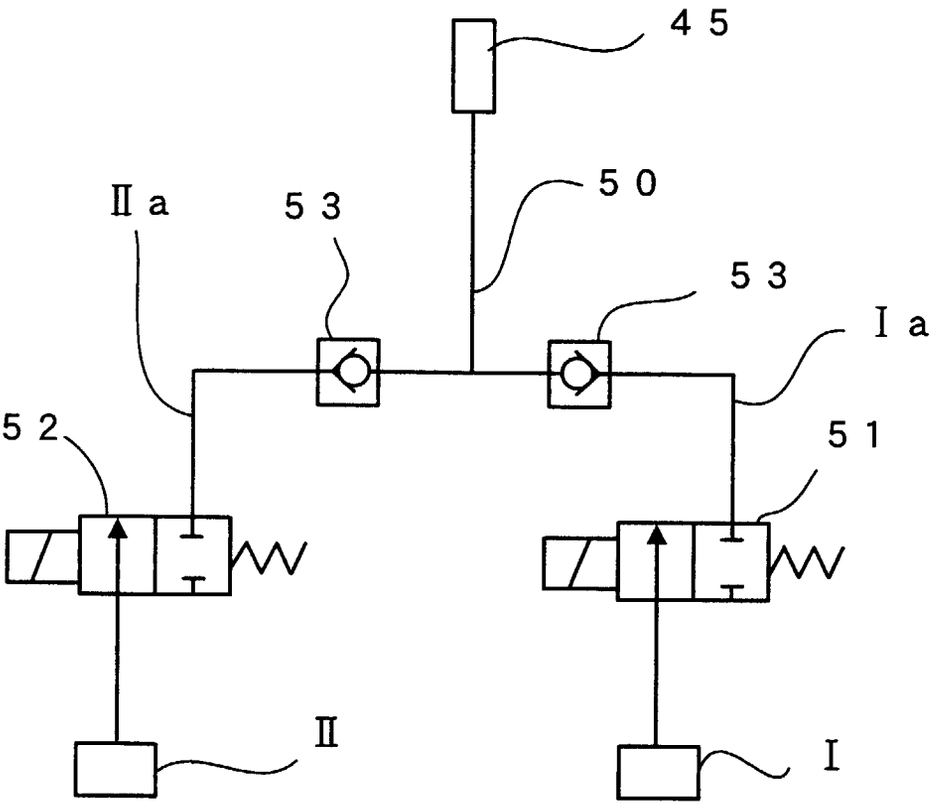


FIG. 5

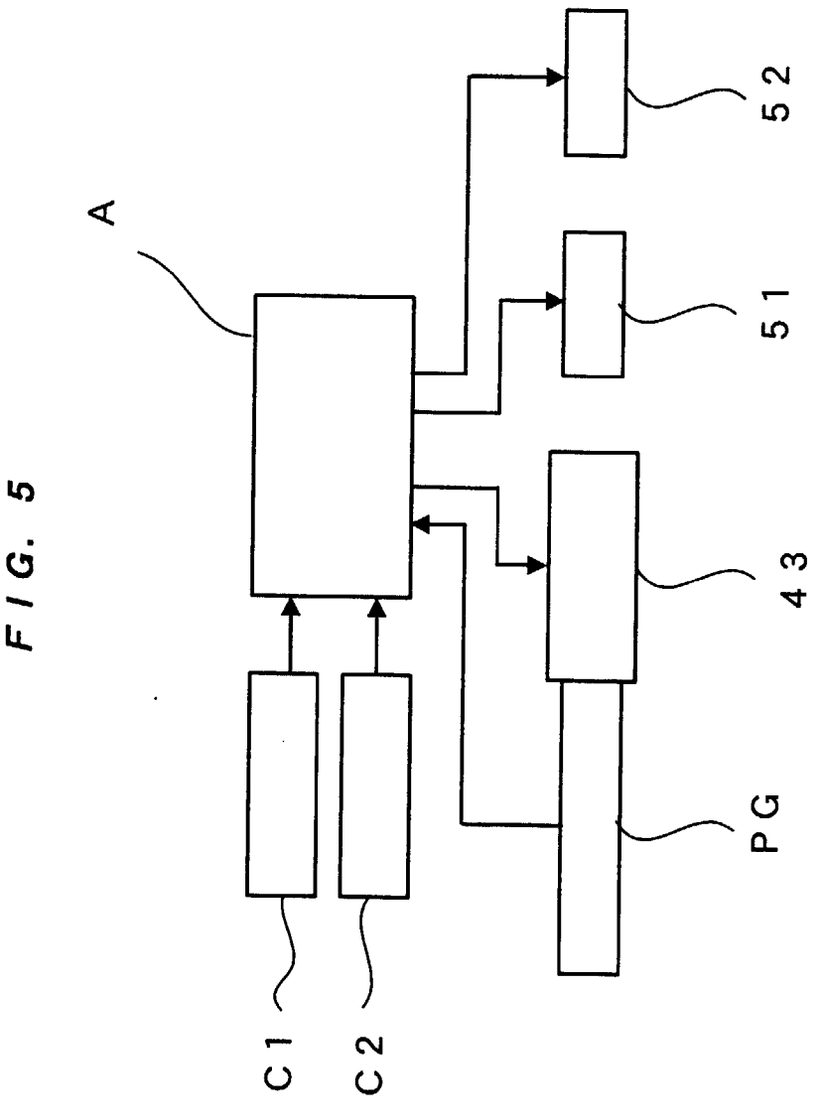


FIG. 6

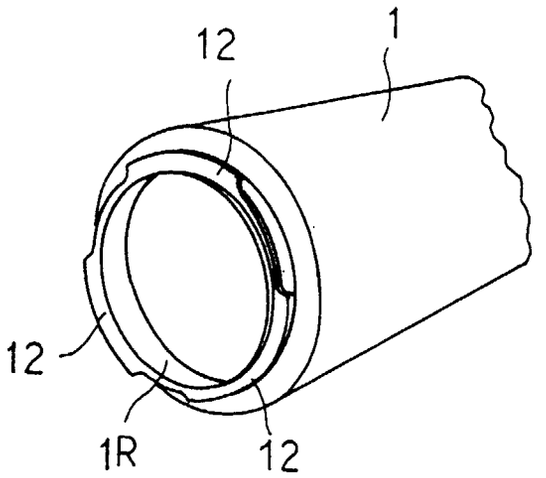


FIG. 7

