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[54] **INK WASHING DEVICE FOR A PRINTING MACHINE**

[75] Inventors: **Fumio Matsuda**, Toyohashi; **Isao Chonan**, Ichinomiya; **Hideo Kitagawa**, Gifu; **Katsunori Furuta**, Mino, all of Japan

[73] Assignee: **Sakurai Graphic Systems Corporation**, Tokyo, Japan

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Related U.S. Patent Documents

Reissue of:

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Appl. No.: **28,798**
Filed: **Mar. 9, 1993**

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[51] **Int. Cl.**[6] **B41F 35/00**; B41F 33/00

[52] **U.S. Cl.** **101/424**; 101/425; 101/484

[58] **Field of Search** ..... 101/423–425, 101/DIG. 45, DIG. 47, 484

[56] **References Cited**

U.S. PATENT DOCUMENTS

3,800,702	4/1974	Roberts	101/425
4,686,902	8/1987	Allain et al.	101/424
4,781,115	11/1988	Ueda et al.	101/425
4,967,664	11/1990	Iijima	101/423
5,105,740	4/1992	Loos et al.	101/424
5,119,132	6/1992	Butler	355/208

FOREIGN PATENT DOCUMENTS

2944322	5/1981	Germany	101/DIG. 45
00050144	3/1987	Japan	101/423
0162243	7/1988	Japan	101/DIG. 45
0941214	7/1982	U.S.S.R.	101/DIG. 45

Primary Examiner—Edgar S. Burr
Assistant Examiner—Anthony H. Nguyen
Attorney, Agent, or Firm—Hickman Beyer & Weaver

[57] **ABSTRACT**

An ink washing device is disclosed, for use in a printing machine having a deposit roller with a variable luminance outer surface. The washing device includes a blade disposed adjacent to the deposit roller, for removing excess deposit of ink on the outer surface of the deposit roller, thus causing its luminance to vary. A luminance sensor detects changes in the luminance of the outer surface. The washing operation is interrupted or continued based on the detected luminance changes.

13 Claims, 6 Drawing Sheets

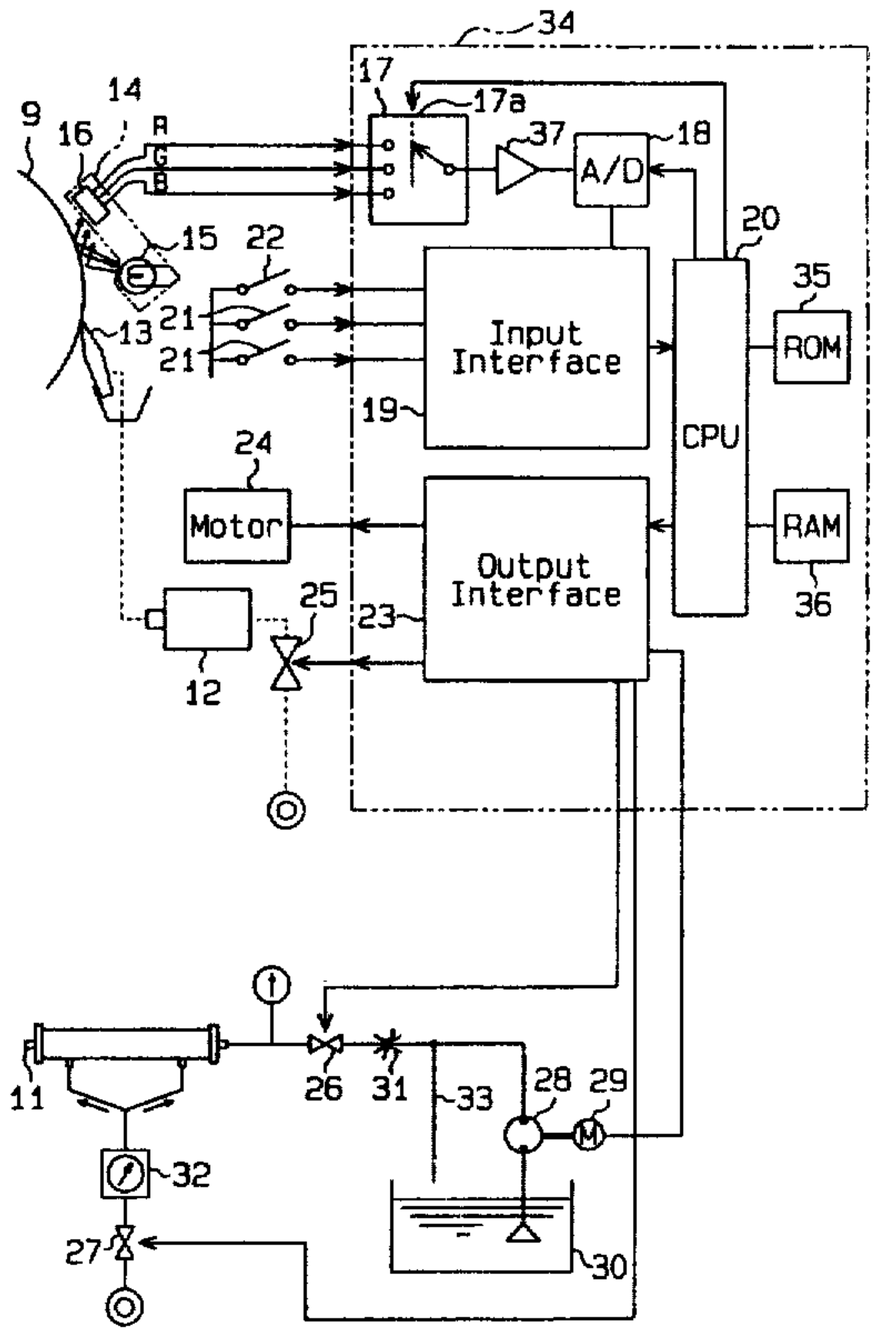


Fig. 1

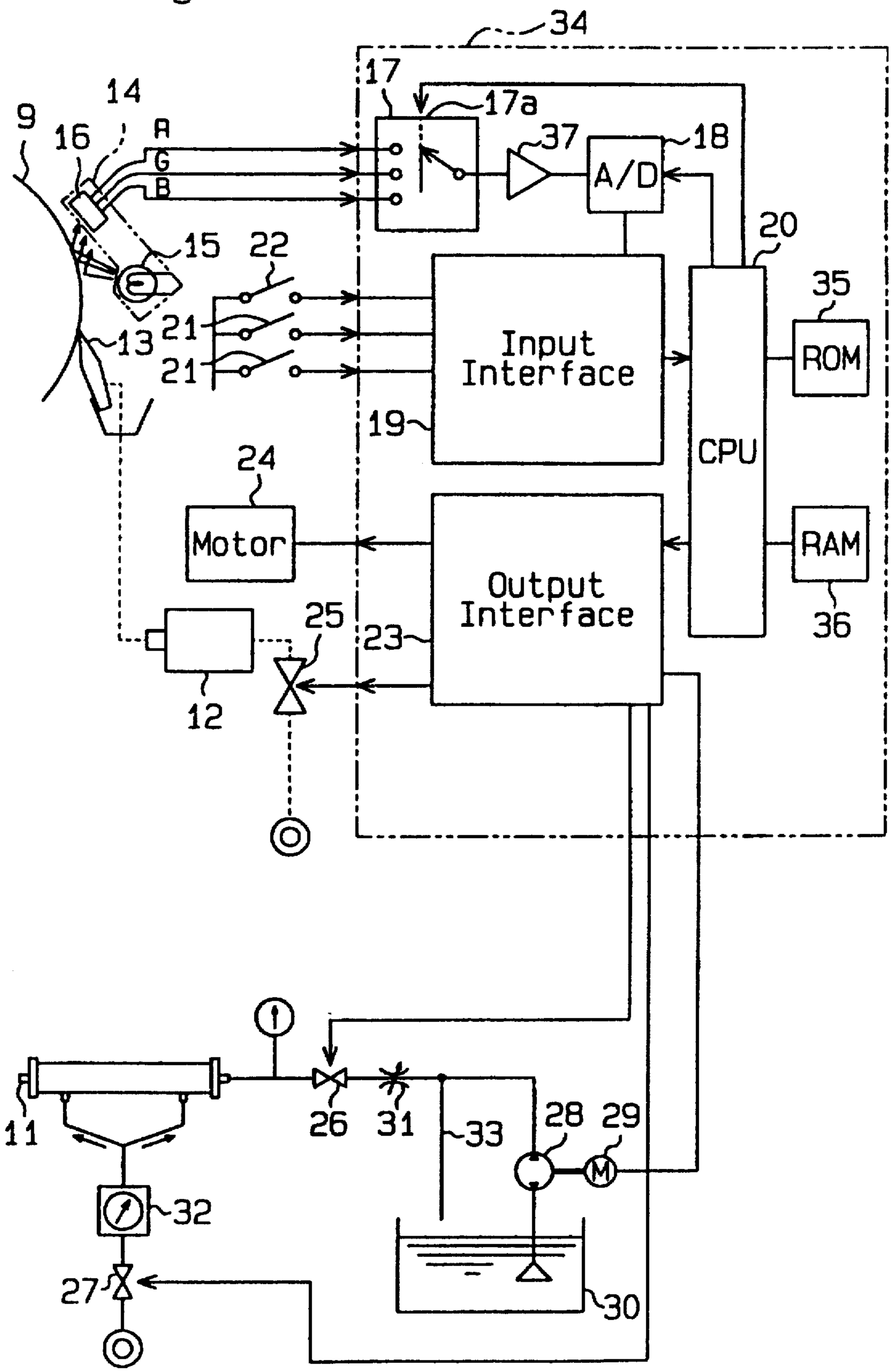

34
17
17a
14
9
16
A
G
B
37
18
A/D
20
15
22
21
21
13
Input Interface
19
35
ROM
CPU
24
Motor
Output Interface
23
25
12
RAM
36
11
26
31
33
28
29
M
32
27
30

Fig.2

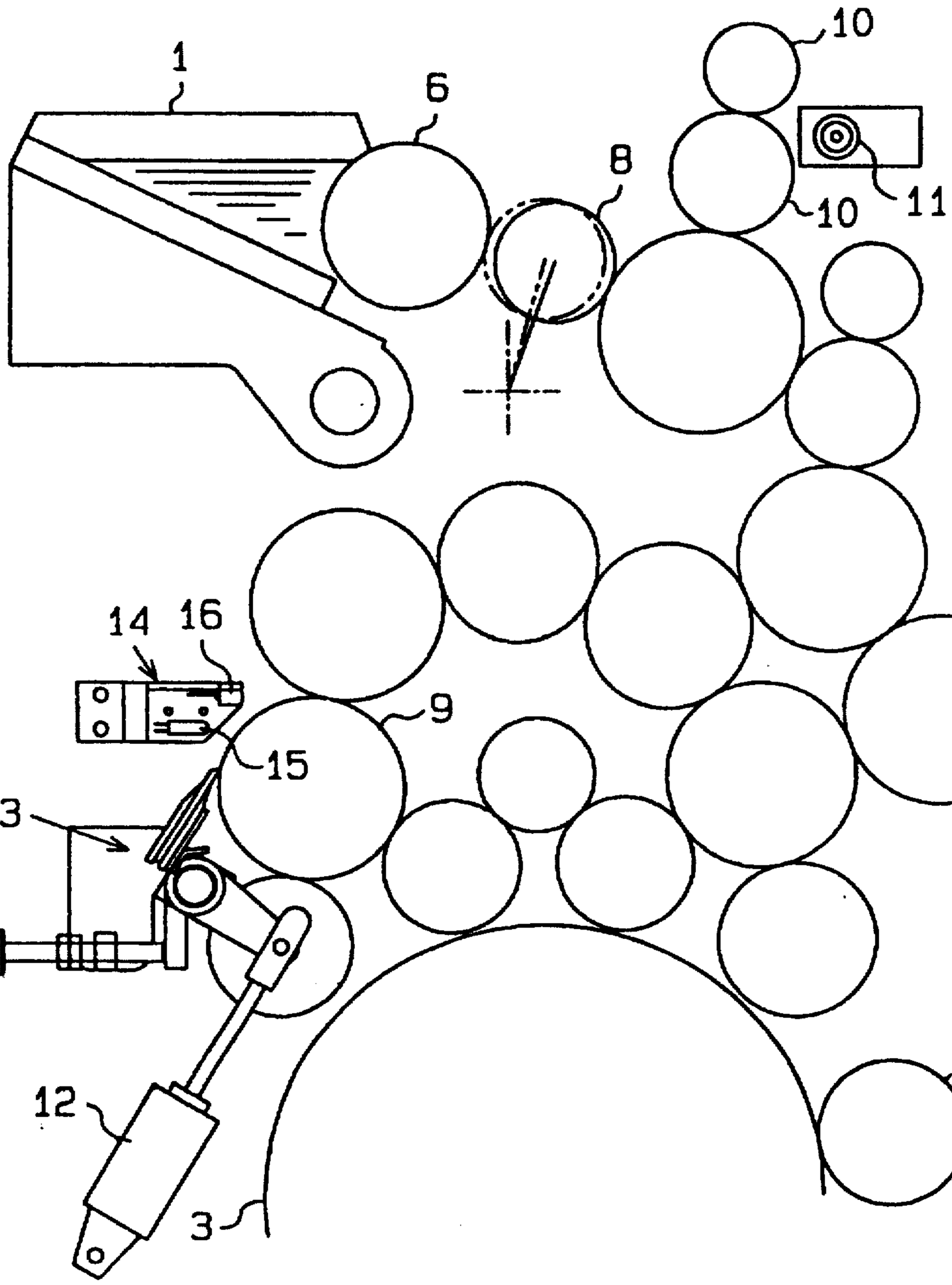


Fig.3

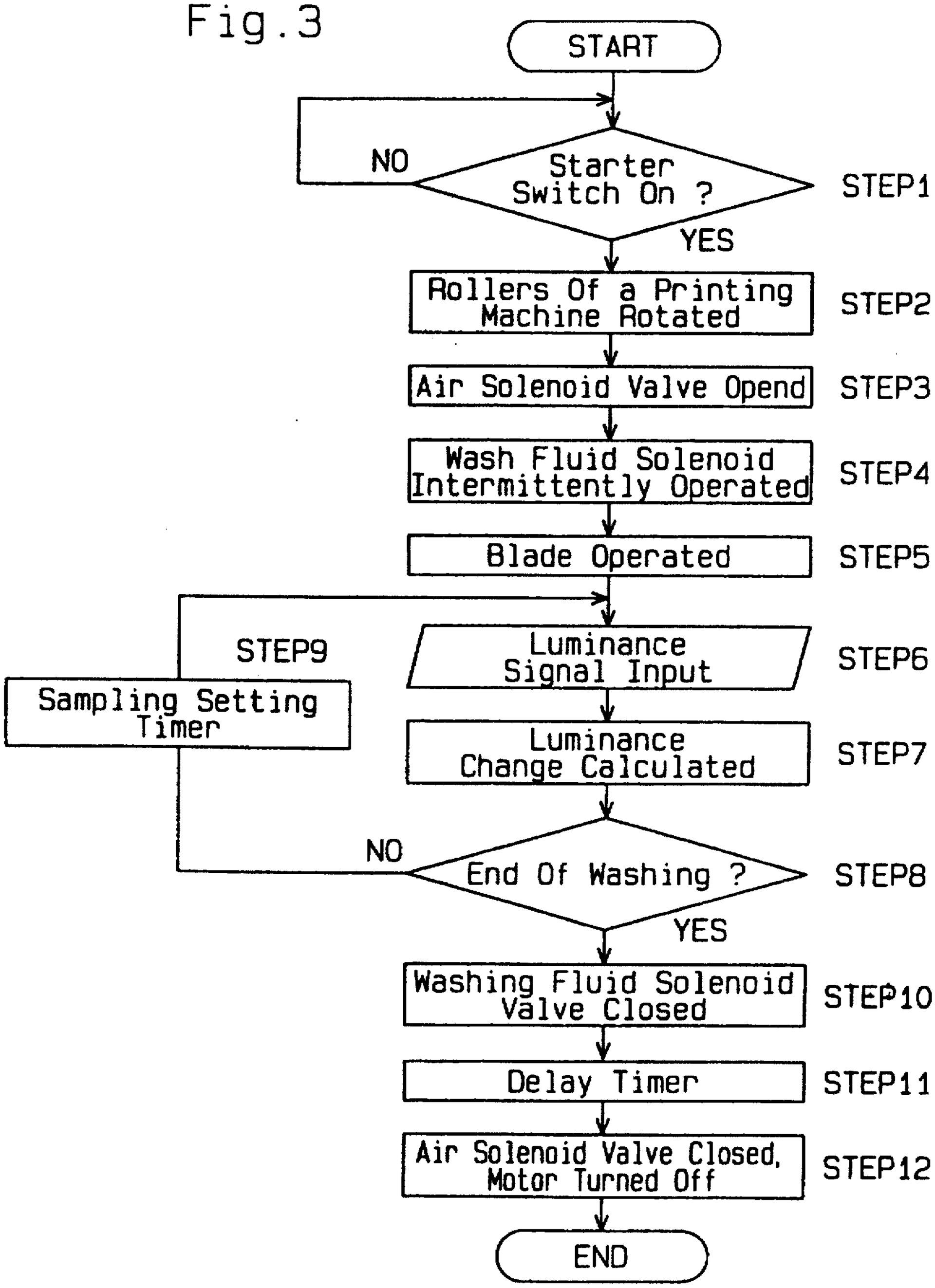
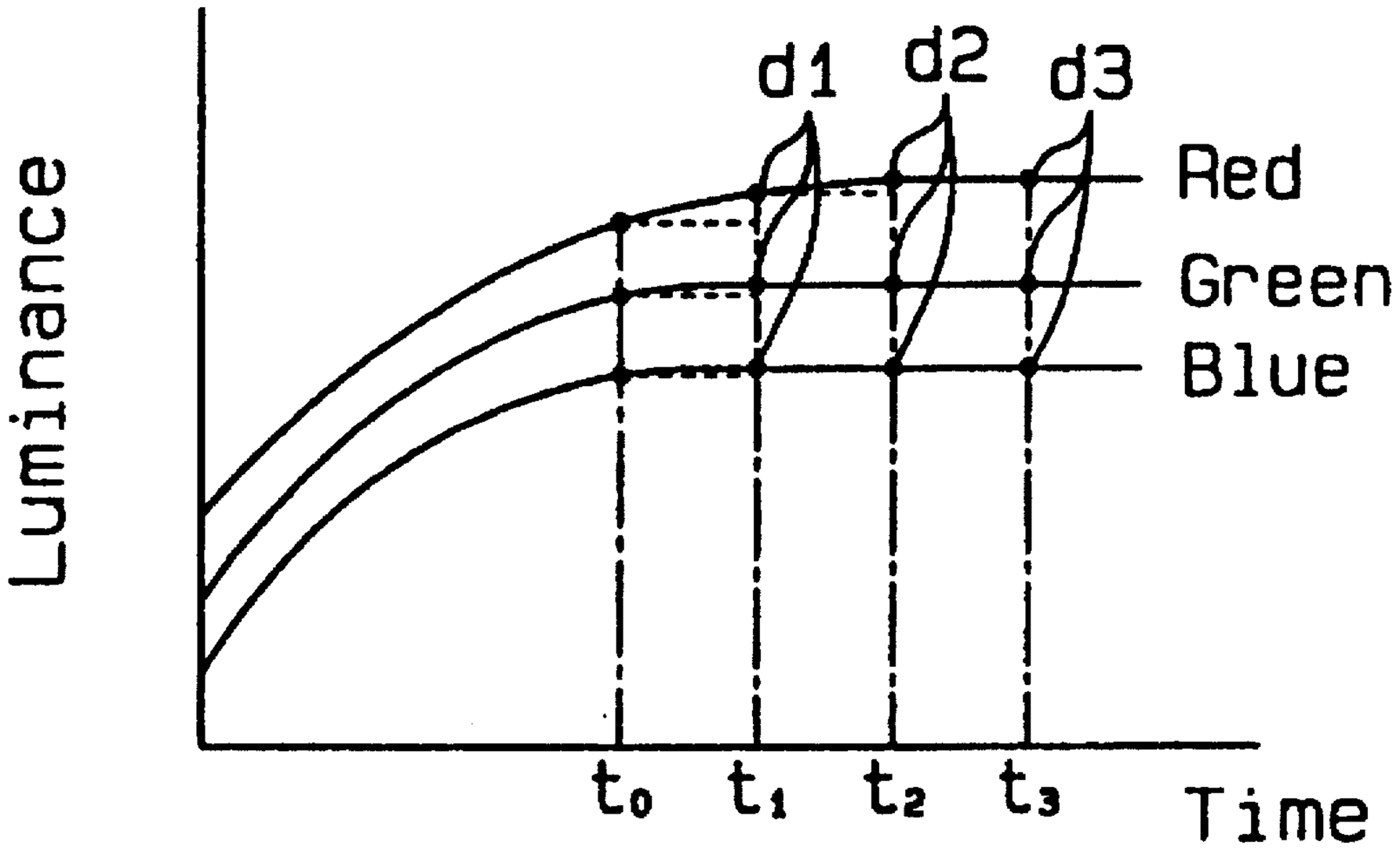

START
NO
Starter Switch On ?
STEP1
YES
Rollers Of a Printing Machine Rotated
STEP2
Air Solenoid Valve Opend
STEP3
Wash Fluid Solenoid Intermittently Operated
STEP4
Blade Operated
STEP5
STEP9
Sampling Setting Timer
Luminance Signal Input
STEP6
Luminance Change Calculated
STEP7
NO
End Of Washing ?
STEP8
YES
Washing Fluid Solenoid Valve Closed
STEP10
Delay Timer
STEP11
Air Solenoid Valve Closed, Motor Turned Off
STEP12
END

Fig.4



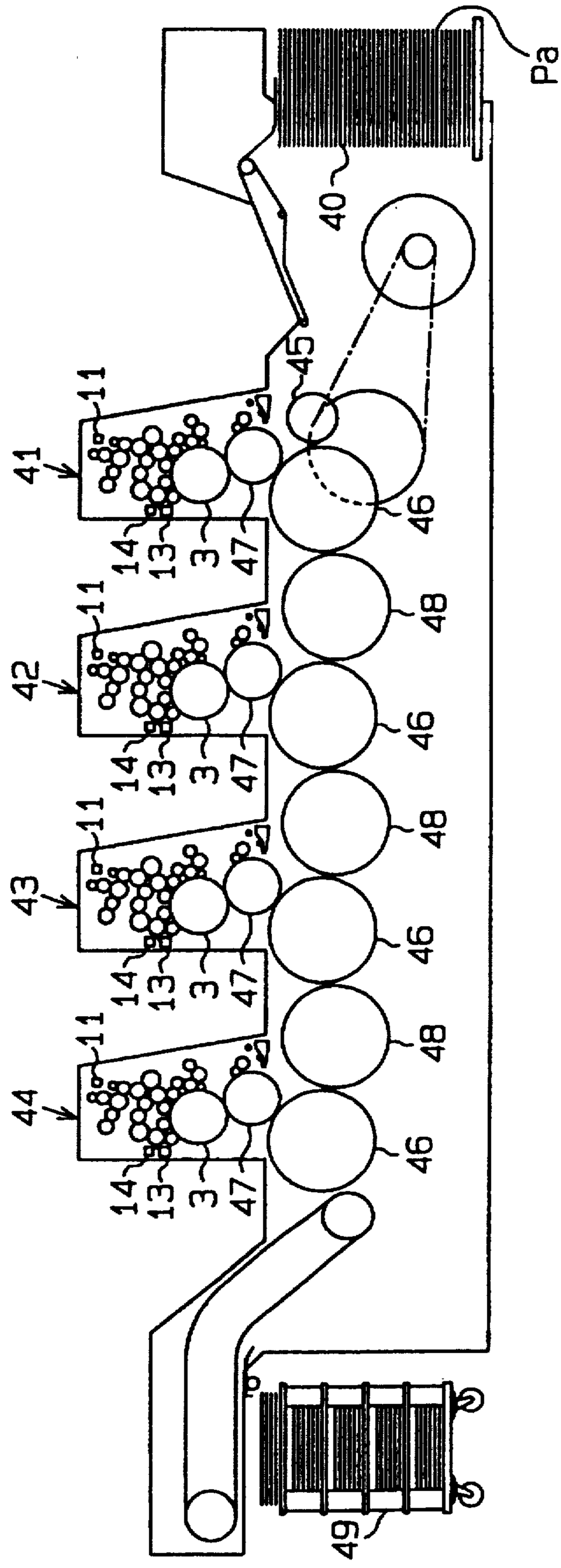
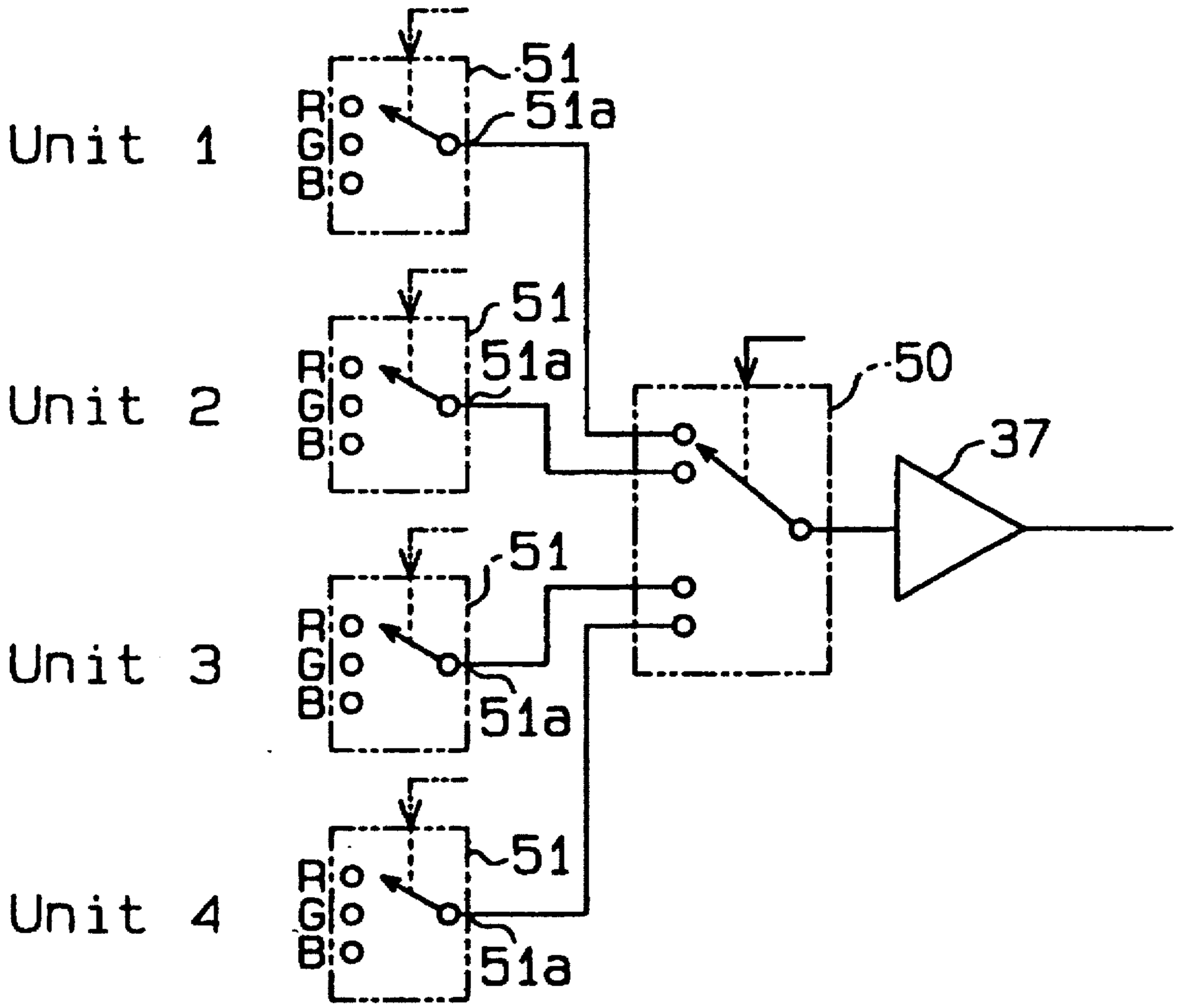


Fig.5

Fig.6



INK WASHING DEVICE FOR A PRINTING MACHINE

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.

BACKGROUND OF THE INVENTION

This application claims the priority of Japanese Patent Application No. 4-349465 filed Dec. 28, 1992, which is incorporate herein by reference.

1. Field of the Invention

The present invention relates to a device for washing the ink rollers of a printing machine. More particularly, the invention pertains to a device capable of automatically washing the ink rollers.

2. Description of the Related Art

In general, printed materials such as pamphlets, catalogs and the like, are normally printed by an offset printing machine. The offset printing machine enables multiple color printing, and is suitable for producing a large quantity of paintings. The printing machine is equipped with a plurality of ink rollers which convey ink from an ink tank to a plate cylinder. The ink rollers are disposed between the ink tank and the plate cylinder, for feeding the ink from the ink tank to the plate cylinder. The ink used for printing, forms layers on the outer surface of the ink rollers. The ink on the rollers needs to be washed away before using ink of another color or after the completion of the printing operation.

Usually, an operator puts washing fluid on the ink rollers, and washes them. A blade is pressed against the surface of a lower roller, adjacent to the plate cylinder, to scrape off the ink from the surface of that lower roller, as it rotates. However, this cleaning work is cumbersome.

Some attempts have been made to improve the washing operation. One such attempt is described in the Japanese Unexamined Patent Publication No. 62-50145, which describes an ink washing device which automatically sprays washing fluid from a nozzle, by operating a switch. The ink washing device includes a tank containing washing fluid, which is connected to a nozzle for spraying the washing fluid is sprayed on the ink rollers. Subsequently, a blade is pressed against the outer surface of the ink roller adjacent to the plate cylinder in order to remove the layer of ink that deposited thereon.

The completion of the washing operation in the above washing device is determined by calculating the number of times N the ink roller is sprayed, or the period of time for spraying. In the Japanese Unexamined Patent Publication No. 62-50145, the number of times N or the period time of washing fluid spraying is preset, depending upon the ink condition of ink roller surface. However, the condition of the ink on the ink rollers might vary, and the washing efficiency might not be equally efficient for different types of ink or washing fluid.

As a result, the washing operation could end regardless of the condition of the rollers, since the washing period or the amount of washing fluid is predetermined. When the number N is below an adequate level, the amount of the washing fluid sprayed on the rollers is insufficient, and the rollers are not cleaned completely. If the printing is resumed after such incomplete washing, the printing quality could become inadequate.

To avoid this problem, the amount of post-washing residual ink on the ink rollers must be checked by the operator. When the washing period is not long enough to clean the rollers, the ink rollers must be washed again. However, this operation is cumbersome, since the washing device needs to reset the washing period several times until the roller is properly washed. Also, the printing problem can be avoided in another way, such as by presetting the number N to a relatively high value. However, when this number N is too high, the washing fluid could be continuously sprayed even after the rollers become clean. Therefore, the washing fluid and time are wasted, and the work efficiency problems remain.

SUMMARY OF THE INVENTION

Accordingly, it is an object of the present invention to provide a washing device for a printing machine which operates economically, efficiently and easily, without interfering with the printing operation.

To achieve the forgoing and other objects, and in accordance with the purpose of the invention, there is disclosed an ink washing device for a printing machine. The ink washing device is for use in a printing machine having a deposited roller with a variable luminance outer surface. The washing device includes a blade disposed adjacent to the deposit roller, for removing excess deposit of ink on the outer surface of the deposit roller, thus causing its luminance to vary. A luminance detector detects changes in the luminance of the outer surface of the deposit roller. The washing operation is interrupted or continued based on the detected luminance changes. Consequently, since the completion of the washing operation is determined by a luminance detector, and since the ink washing operation stops automatically the present device performs an efficient washing of the rollers. Furthermore, the amount of washing fluid required for the washing operation is minimized, since the washing operation stops just after the completion of the washing operation.

BRIEF DESCRIPTION OF THE DRAWINGS

The features of the present invention that are believed to be novel are set forth with particularity in the appended claims. The invention, together with the objects and advantages thereof, may best be understood by reference to the following description of the preferred embodiments, together with the accompanying drawings, in which:

FIG. **1** is a block diagram of the printing machine showing an electric circuit and piping layout of an air pipe, and a washing fluid pipe provided on a printing machine, in accordance with the preferred embodiment of the present invention;

FIG. **2** is a front view of the printing unit of the printing machine which includes a washing device;

FIG. **3** is a flow chart showing the washing operation of the washing device of FIG. **2**;

FIG. **4** includes three graphs showing the relationship between the luminance changes and time.

FIG. **5** is a schematic front view diagram of the printing machine according to another embodiment; and

FIG. **6** is a circuit diagram of the printing machine showing a part of an electric circuit provided in the printing machine of FIG. **5**.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

A preferred embodiment of a washing device for a printing machine according to the present invention will now be described in detail referring to FIGS. **1** to **4**.

In the offset printing machine illustrated in FIG. **2**, ink is transferred from an ink tank **1** to the plate cylinder **3**, via a set of ink rollers **2**, and is mixed with water on the plate cylinder **3**. The ink is fed to the ink rollers **2** through a base roller **6** and a transfer roller **8**. Excess ink is fed toward the plate cylinder **3** side through the rotating ink rollers **2** and is deposited on a deposit roller **9**.

A spray nozzle **11**, for spraying washing fluid, is disposed adjacent to a pair of ink rollers **10**, which are located at the upper side of the ink rollers **2**. The washing fluid is sprayed from the spray nozzle **11** onto the ink rollers **10**, at predetermined time intervals. The washing fluid is transferred to the deposit roller **9**, via the ink rollers **2**. The ink layers formed on the deposit roller **9** is softened by the washing fluid. Usually light oil is used for the washing fluid. At the same time, a blade **13** is driven by an air cylinder **12**, which is disposed in the vicinity of the deposit roller **9**. As the blade **13** is pressed against the surface of the deposit roller **9**, it scrapes off and removes the ink layers that have deposited on the outer surface of the deposit roller **9**.

An opto-electrical luminance sensor **14** is placed near the surface of the deposit roller **9**, to monitor the amount of the ink remaining on the surface of the deposit roller **9**.

An electrical layout and a pipe arrangement of the printing machine are described below with reference to FIG. **1**.

The luminance sensor **14** comprises a lighting device **15** and a photo detector **16**. White light from the lighting device **15** is projected onto the surface of the roller **9**. The reflected light from the surface of the roller **9** is then detected by the photo detector **16**. Luminance signals corresponding to three colors, red, green and blue are generated as analog data.

The output terminals of the luminance sensor **14** are connected to a control unit **34**. The control unit **34** comprises CPU (Central Processing Unit) **20** and peripheral devices to control the printing machine. In the control unit **34**, the output terminals of the luminance sensor **14** are connected to a multiplexer **17**, which selects one of the signals at the predetermined interval from the sensor **14** and transmits it to output.

A control terminal **17**a, of the multiplexer **17**, is connected to the CPU **20**, and receives a signal from the CPU **20** to select one luminance signal from the red, green and blue signals. This multiplexing operation is proceeded three times to transmit three colors. This multiplexer reduce the number of wiring and amplifiers of the control unit **34**. The output terminal of the multiplexer **17** is connected, via an amplifier **37**, to an analog-to-digital converter **18**, which converts the analog signals into digital signals. The digital signals from the analog-to-digital converter **18** are transmitted to the CPU **20**, via an input interface **19**.

ROM (Real only Memory) **35** and RAM (Random Access Memory) **36** are connected to the CPU **20**. A program for controlling the printing machine, is stored in the ROM **35**, and data are temporarily stored in the RAM **36** A change in the luminance, during the predetermined sampling periods, is calculated by the CPU **20**, from the signals generated by the luminance sensor **14**. The washing operation of the ink rollers **2** is determined to be completed, when the luminance signals are kept constant for a predetermined period of time. Accordingly, the washing operation is interrupted.

A selector switch **21** and a starter switch **22** are connected to the CPU **20** via the input interface **19**. One of the printing units is selected to be washed by the selector switch **21**, and the washing operation is started by the starter switch **22**.

A motor **24** drives the ink rollers of the printing machine, and is connected to an output interface **23**, which, in turn, is connected to the CPU **20**. A solenoid valve **25** regulates an air cylinder **12**, and is connected to the output interface **23**. The air cylinder **12** actuates the blade **13**, and is connected to the solenoid valve **25**, by way of an air pipe. A solenoid valve **26**, regulates the washing fluid flow, and a solenoid valve **27**, regulates the air flow, both of which are connected to the output interface **23**. A motor **29** drives a washing fluid pump **28**, and is connected to the output interface **23**.

The washing fluid pump **28** is located between the washing fluid tank **30** and the spray nozzle **11**. The solenoid valve **26** is located between the pump **28** and the spray nozzle **11**. A variable pressure control orifice **31** regulates the pressure of the washing fluid at desirable value and maintains it at a constant value. It is located between the solenoid valve **26** and the pump **28**. The washing fluid in the tank **30** is pumped by the pump **28** and supplied to the spray nozzle **11** at a constant flow rate, which is controlled by the orifice **31**, while the solenoid valve **26** is opened. When the solenoid valve **26** is closed, the orifice **31** does not function and the washing fluid is returned to the tank **30**, through the return pipe **33**.

A compressed air generator comprises a compressor, not shown, and is connected to the spray nozzle **11**, via the solenoid valve **27**. A regulator **32** regulates the air pressure, and is disposed between the spray nozzle **11** and the solenoid valve **27**. The solenoid valve **27** is operated synchronously with the solenoid valve **26**, by a signal transmitted from CPU **20**, and is opened to supply the air to the spray nozzle **11**. The washing fluid from the washing fluid pipe and the compressed air from the air pipe are mixed together at the nozzle **11**. The nozzle **11** sprays a mist of washing fluid onto the ink rollers **10**.

The operation of the ink washing device of the above offset printing press will be described below with reference to the flow chart of FIG. **3**. The routine, as illustrated by the flow chart is executed under the control of the CPU **20**, in accordance with the program stored in the ROM **35**.

The motor **24** is started by operating the starter switch **22** (step **1**) to rotate each roller of the printing machine (step **2**). After a certain period of time, the solenoid valve **27** is opened (step **3**) to supply compressed air to the nozzle **11**. At the same time, the solenoid valve **26** is opened to supply the washing fluid, from the nozzle **11** to be sprayed onto the ink rollers **10**.

The amount of the washing fluid needed for the washing operation is determined at an appropriate level for each printing machine. Excess washing fluid causes the ink rollers to slip. Furthermore, excess washing fluid drops onto the plate cylinder and produces poor printing. In order to supply the appropriate amount of washing fluid, the solenoid valve **26** is intermittently opened to control the amount of the washing fluid while the ink rollers **2** are rotated (step **4**).

When the washing fluid then reaches the deposit roller **9**, the hardened ink deposited on the ink rollers **2** is softened by the washing fluid, and is gradually sent to the deposit roller **9** in accordance with the rotation of the rollers **2**. The blade **13** is pressed against the roller **9** (step **5**), and the softened ink is scraped off the surface of the roller **9**.

The photo detector **16** detects the luminance of the outer surface of the roller **9**, and generates three corresponding

luminance signals for the red, green and blue colors. The photo detector **16** then transmits these luminance signals to the output, as analog signals. These analog luminance signals are, in turn, transmitted to the analog-to-digital converter **18**, via the multiplexer **17** and the amplifier **37**. The analog signals are converted into digital data, and are then sent to the RAM **36** via the input interface **19** (step **6**), where they are stored.

Then, the data is compared with the previously stored data to calculate the value of luminance change, by subtracting the previous luminance data from the newly detected luminance data (step **7**). When all luminance changes of the three colors are determined to be less than a preset value, for a predetermined period of time, the washing operation is considered to be adequate (step **8**).

On the other hand, if any one of the three luminance changes is greater than the preset value, the washing operation is considered to be incomplete and is continued. In this case, the routine returns to step **6**, and proceeds with another washing operation, after the next sampling period has elapsed (step **9**), and new signals are detected by the luminance sensor **14** (step **6**).

The method for determining the completion of the washing operation will be described below with reference to the luminance signal changes illustrated in FIG. **4**.

At time t_1, a luminance change d_1 is calculated by subtracting the previous luminance signal at time t_0, from the luminance signal at time t_1. If all the luminance changes d_1 of the three colors, red, green and blue, are greater than the predetermined value (i.e. zero), the washing operation is determined to be incomplete. At time t_2, the calculated result indicates that the luminance change of the red signal is greater than the predetermined value (i.e. zero). Therefore, the washing operation is still determined to be incomplete. At time t_3, all three luminance changes d_3 are zero, and the washing operation is determined to be complete.

This method for determining the completion of the washing operation, by calculating the luminance change, is more practical than the method of monitoring only the luminance level. This method provides a more accurate determination, since the method of the present invention is not effected by the ink color and the color of the deposit roller **9**.

When the washing operation is determined to be complete, the solenoid valve **26** is closed first, and the washing fluid supply is stopped (step **10**). A delay timer allows the solenoid valve **27** to be kept open for a predetermined period of time, after the washing fluid valve **26** was closed (step **11**), in order to blow away the remaining washing fluid in the nozzle **11**.

After a present period of time has elapsed, the solenoid valve **27** is closed, and the motor **29** is stopped. The blade **13** is moved away from the roller **9**. The motor **24** is stopped, and the ink rollers **2** are also stopped (step **12**). The overall washing operation is completed by executing the foregoing steps.

Accordingly, the ink washing device of the present invention determines the completion of the ink washing operation with the luminance sensor **14**, and automatically stops the washing operation. This new washing method prevents printing problems caused by incomplete ink washing. Additionally, the amount of washing fluid and time is minimized, since the washing operation automatically stops after the completion of the washing operation.

Another embodiment applied to a multi-color offset printing press, is described below with reference to FIGS. **5** and **6**. The elements which have been described above will not be duplicated, and the same reference numerals as used above will be used in connection with, the same elements in this alternative embodiment.

In the four color offset printing press shown in FIG. **5**, a printing paper Pa is fed from a feeder **40** to a first printing unit **41**, via a transfer cylinder **45**. The paper Pa is kept on the surface of a rotatable impression cylinder **46**, and contacts the surface of a blanket cylinder **47** at which a first color is printed. As the impression cylinder **46** rotates, the blanket cylinder **47** also rotates, and printing is performed on the paper Pa. The paper Pa is then transferred to an impression cylinder **46** of a second printing unit **42**, via an intermediate transfer cylinder **48**. The paper Pa is fed rotatable impression cylinder **46**, and contacts the surface of a blanket cylinder **47** where a second color is to be printed. The paper Pa is then transferred to third and fourth printing units **43** and **44**, respectively, where third and fourth colors are to be printed, respectively. Once printing on the paper Pa is completed, it is transferred to a delivery cart **49**.

Referring now to FIG. **6**, the control unit **34** of the four color offset printing press comprises four multiplexers **51** and one multiplexer **50**, which selectively transmit a luminance signal from a photo detector **16** to the CPU **20**. The output terminals **51**a of each multiplexer are connected to input terminals of the multiplexer **50**. The multiplexer **50** sequentially selects one of the printing units **41** to **44** at a time. The multiplexer **51** selects one luminance signal from the red, green or blue colors, and transmits it to the multiplexer **50**. The washing fluid is sprayed from a spray nozzle **11** provided in each printing unit **41** to **44**, when the ink washing operation starts. The washing operation of the printing units **41** to **44**, is monitored by one control unit **34** and the luminance sensors **14** due to the multiplexer **50**. The washing operation is interrupted when the washing operation is determined to be completed. The washing operation of each unit is interrupted independently. The ink washing of four or more printing units can be controlled by only one control unit **34** provided with the multiplexers **50**, **51**.

Although only two embodiments of the present invention have been described herein, it should be apparent to those skilled in the art that the present invention may be embodied in many other specific forms, without departing from the spirit or scope of the invention.

For example, in the foregoing embodiments, the spray nozzle **11** is arranged to spray two ink rollers **10**. However, the spray nozzle **11** can alternatively be arranged to spray one or more other ink rollers. Moreover, a stepping motor can be used instead of the air cylinder **12** for actuating the blade **13**. Therefore, the present examples and embodiments are to be considered as illustrative and not restrictive, and the invention is not to be limited to the details given above, but may be modified within the scope of the appended claims.

What is claimed is:

1. An ink washing device, for performing a washing operation in a printing machine, the printing machine including a plurality of ink rollers for supplying ink to a cylinder plate, a deposit roller having an outer surface where excess ink from the ink rollers is deposited, said outer surface having a luminance that varies with the amount of the deposited ink, and a spraying device for spraying washing fluid on at least one ink roller to initiate a washing operation, the ink washing device comprising:

scraping means, disposed adjacent to said deposit roller, for removing the deposited ink on said outer surface; and

operating detection means for determining the completion of the washing operation, said operating detection means including a luminance detector means responsive to said luminance of said outer surface during removal of the deposited ink, said operating detection means indicating completion of the washing operation when a luminance signal from the luminance detector means exhibits substantially no change.

2. The ink washing device according to claim **1**, wherein said luminance signal includes red, green and blue luminance signals.

3. The ink washing device according to claim **2**, wherein said operation detection means includes selector means for selecting one of said red, green or blue luminance signals.

4. The ink washing device according to claim **1**, including means supplying pressurized air and washing fluid to the spraying device; and

further including:

a first solenoid valve for selectively interrupting the air supply to the spraying device;

a second solenoid valve for selectively interrupting the washing fluid supply to the spraying device; and

delay timer means for causing said first solenoid valve to remain open for a predetermined period of time after said second solenoid valve is closed.

5. The ink washing device according to claim **4**, including means operating said second solenoid valve intermittently, in order to control the amount of washing fluid sprayed from the spraying device.

6. The ink washing device according to claim **1**, wherein the printing machine includes a plurality of printing units, the operation detection means includes a selector means for selecting one of said printing units, and each of said printing units includes luminance detection means for generating corresponding luminance signals.

7. An ink washing device, for performing a washing operation in a printing machine, the printing machine including a plurality of ink rollers for supplying ink to a cylinder plate, a deposit roller having an outer surface where excess ink from the ink rollers is deposited, said outer surface having a luminance that varies with the amount of the deposited ink, and a spraying device including an air supply and a washing fluid supply for spraying washing fluid on at least one ink roller to initiate a washing operation, the ink washing device comprising:

scraping means, disposed adjacent to said deposit roller, for removing the deposited ink on said outer surface;

operating detection means for determining the completion of the washing operation, said operating detection means including a luminance detection means responsive to said luminance of said outer surface during removal of the deposited ink, said operating detection means indicating completion of the washing operation when a luminance signal from the luminance detector remains substantially constant for a predetermined period of time;

a first solenoid valve means for selectively interrupting the air supply to the spraying device; and

a second solenoid valve means for selectively interrupting the washing fluid supply to the spraying device.

8. The ink washing device according to claim **7**, wherein said luminance detection means includes a color detector for generating a plurality of different luminance signals.

9. The ink washing device according to claim **8**, wherein said operation detection means includes selector means for selecting at least one of said plurality of luminance signals.

10. The ink washing device according to claim **7**, further including:

delay timer means that causes said first solenoid to remain open for a predetermined period of time after said second solenoid valve is closed.

11. The ink washing device according to claim **7**, wherein said second valve means is operated intermittently in order to control the amount of washing fluid sprayed from the spraying device.

12. The ink washing device according to claim **7**, wherein the printing machine includes a plurality of printing units, the operation detection means includes a selector means for selecting one of said printing units, and each of said printing units includes luminance detection means for generating corresponding luminance signals.

13. A method for performing a washing operation in a printing machine, the method comprising the steps of:

spraying washing fluid on at least one roller of the printing machine to initiate a washing operation;

scraping excess ink deposited on an outer surface of a deposit roller, which causes the luminance of said outer surface to change;

detecting changes in the luminance of said outer surface during said scraping, and generating a signal indicative of said changes; and

determining the completion of the washing operation responsive to said signal remaining substantially constant.

* * * * *