

12 **EUROPEAN PATENT APPLICATION**

21 Application number: 89118512.6

51 Int. Cl.⁵: **B41F 31/26**

22 Date of filing: 05.10.89

30 Priority: 14.10.88 JP 259071/88
09.12.88 JP 311064/88

43 Date of publication of application:
18.04.90 Bulletin 90/16

64 Designated Contracting States:
AT CH DE FR GB IT LI

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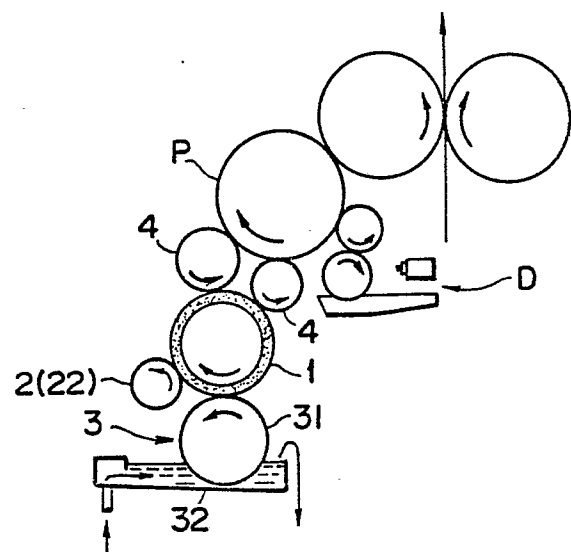
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54 **Ink furnishing device for printing machines.**

57 This invention is related to an ink furnishing device for printing machines, and some of the rollers which are provided in the intermediate route of the ink furnishing such as an inking roller, fountain roller, and transfer roller is constituted with a minute hollow body dispersing roller.

With this roller constitution, the ink transfer action of the roller becomes sure and it is possible to provide a roller that can be used for a long term, and the time period between successive roller exchanges becomes thereby longer and an ink furnishing device with a high machine availability factor can be provided for printing machines.

FIG. 5



INK FURNISHING DEVICE FOR PRINTING MACHINES

BACKGROUND OF THE INVENTION

(1) Field of the Invention

This invention relates to an ink furnishing device used for rotary printing machines, in which the ink furnishing route from an ink furnishing device such as a fountain roller to which ink is furnished all the time during printing operation to an ink form roller which is in contact with a plate and furnishes ink to it is constituted with rollers which are in contact successively.

The present invention is related in particular to a keyless ink furnishing device in which an ink removal member is in contact with the surface of an inking roller in order to remove excessive ink and the ink is furnished by the keyless ink furnishing.

The present invention is also related to an ink furnishing device in which the surfaces of a fountain roller and/or transfer roller are constituted with a rough surface.

(2) Description of the Prior Art

A keyless ink furnishing device has been used in the field of flexographic printing. It has an ink metering roller, namely anilox roller on the surface of which minute carved cells of an exquisite and substantially fixed shape are arranged regularly and ink removal member (for instance, a blade) to remove excessive ink which is received in the cells, both the ink metering roller and the blade working in cooperation, and the ink received in the cells are furnished to the plate during the printing operation.

The anilox roller used for a keyless ink furnishing device has its minute carved cells formed by form rolling or laser beam machining. Sometimes those cells are covered with an adequate material as needed when used for printing.

On the other hand, an ink furnishing device in which at least one of the surfaces of an ink fountain roller and transfer roller is constituted with a rough surface is well known, for instance, in Japanese Patent Laid-Open No. 63-22648 'Inking Device' (called hereinafter Prior Art 1) and Japanese Patent Laid-Open No. 63-22649 'Inking Device' (called hereinafter Prior Art 2), both being applied to offset printing machines.

The ink furnishing device in Prior Art 1 transfers ink continuously by making the fountain roller

and transfer roller contact each other under pressure with both rollers rotating respectively at different peripheral speeds, and at the same time at least one of the fountain roller and transfer roller has its surface made rough. And, by the rough surface of either one of them the ink is retained in the rough surface and the retained ink gives an uniform lubrication to the friction at the contact section under pressure of the fountain roller and transfer roller, preventing the vibration of both rollers caused by an unstable lubrication at the contact section under pressure and at the same time preventing the separation of the ink and water at the rough surface and making possible the dispersal of the water and ink and improving the performance in receiving ink.

The ink furnishing device in Prior Art 2 has a fountain roller made of rubber and it is made to contact directly an inking roller (intermediate roller, drive roller) to transfer ink between them, and the surface of the fountain roller is constituted with a rough surface. This ink furnishing device has a construction in which the fountain roller is a rubber roller and it is possible thereby to have a direct contact between the fountain roller and inking roller, and accordingly a transfer roller which is placed between the fountain roller and inking roller in conventional ink furnishing devices is omitted and the drive means for the transfer roller is eliminated at the same time to make the overall construction simple with the cost reduced. The control of the nip between the transfer roller and above mentioned two rollers which is a difficult work is thereby eliminated, relieving the worker of this work. Furthermore, the performance of ink transfer is improved by making the surface of the fountain roller rough.

The continuous contact of surfaces among the inking roller, fountain roller, transfer roller, etc. develops friction and their surfaces are worn. The volume of each cell in the surface of the anilox roller (inking roller) in a keyless ink furnishing device becomes smaller by this wear with the result of a smaller amount of the ink that can be supplied to the plate and the quality of the printing can not be maintained at a constant level.

The rough surface in the prior art of the fountain roller and transfer roller has convex and concave spots formed simply in a certain range (15 - 20 μ m in Prior Art 1 and Prior Art 2) in the roller surface, and the state of roughness in subject to a change or vanish in a short time by the friction during printing operation between the fountain roller and inking roller or between the fountain roller and transfer roller so that the benefits derived from

having roller surface rough, the lubrication at roller contacts under pressure, prevention of the separation of ink and water, dispersal of ink and water, improved performance in ink receiving, and improved performance in the transfer of ink are diminished or lost in a short term. The frequency of replacing roller with rough surface or reclamation of the rough surface, therefore, rises with the problem of lowered machine availability factor.

SUMMARY OF THE PRESENT INVENTION

An object of the invention is to make sure the transfer of the ink between rollers such as an inking roller and fountain roller which are in the intermediate route of an ink furnishing device by the roller constitution that the outer surface of a roller has minute hollow bodies dispersed on the surface and to make longer the period of roller replacement in the ink furnishing device in order to provide an ink furnishing device of high efficiency for printing machines.

In an ink furnishing device according to the invention for printing machines, some of the rollers in the ink furnishing route which comprises the route from a fountain roller to the plate and the route from the fountain roller that is furnished ink always during printing to the ink form roller that is in contact with the plate and furnishes ink to it are constituted with an ink receiving layer on which minute hollow bodies are dispersed and mixed in and which is provided on the outer circumferential surface of a roller and the hollow section of those minuted hollow bodies is opened to provide rollers on which minute hollow bodies are dispersed.

For example the inking roller of an ink furnishing device of a printing machine has the above mentioned minute hollow bodies dispersed on its surface.

The fountain roller and/or transfer roller are constituted with the above mentioned surface constitution.

BRIEF DESCRIPTION OF THE DRAWINGS

The drawings show embodiments of the present invention in which:

Fig. 1 is a perspective view of a roller on which minute hollow bodies are dispersed,

Fig.2 is the view of a partial surface of the roller of Fig.1,

Fig.3 is the view of a partial surface of the roller of Fig.2 on which hard material powder is uniformly dispersed,

Fig.4 is a schematic view of an ink furnishing device used for a printing machine in general,

Fig.5 through Fig.8 are the schematic views of the embodiments in which the inking roller is a roller with minute hollow dispersed on it,

Fig.29, Fig.30, Fig.37, Fig.38, Fig.39, and Fig.40 are the schematic views of the embodiments in which the fountain roller is a roller with minute hollow bodies dispersed on it,

Fig.33, Fig.34, Fig. 41, and Fig.42 are the schematic views of the embodiments in which the transfer roller is a roller with minute hollow bodies dispersed on it, and

Fig.36, Fig.37, Fig.43, and Fig.44 are the schematic views of embodiments in which both the fountain roller and transfer roller have minute hollow bodies on them.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Fig.4 is a representative schematic view of an ink furnishing device in general for printing machines to explain its functions. It is constituted with an ink furnishing device 3, inking roller 1, ink form roller, and plate cylinder P which are successively arranged in this order from the upstream side and all of which are in contact with the neighboring members. An ink removal device 2 which is for removing excessive ink on the circumferential surface of the inking roller in contact with the inking roller and a wetting water supply device D which supplies water to the plate cylinder P to wet it are provided. The ink furnishing device 3 in this drawing consists of a fountain roller 31 and ink reservoir 32.

In Fig.1, a roller 1 on which minute hollow bodies are dispersed consists of a main body member 16 made from, for instance, a steel stock and an ink receiving layer 11 which has a plurality of mixed materials on the surface of the main body member 16.

In Fig.2, this ink receiving layer 11 has minute hollow bodies 12 that are substantially uniformly dispersed and those minute hollow bodies 12 which are located on the outer circumferential surface of the roller 1 have the hollow section of the minute hollow body 12 opened.

In Fig.3, in addition to the minute hollow bodies 12 the layer 11 has the powder 13 of a hard material such as hard inorganic material also uniformly dispersed to be mixed among the minute hollow bodies 12 in order to raise the wear resistance of the layer 11.

Each of the minute hollow bodies 12 that are uniformly dispersed on the substrate 14 of the ink receiving layer 11 should be open by removing part of its shell. The minute hollow body 12 is generally called a microballoon, microsphere, hol-

low balloon, glass balloon, silica balloon, sirus balloon, phenol balloon, vinylidene chloride balloon, alumina balloon, and zirconia balloon, and various hollow powder of various materials are known. One or two example(s) will be mentioned, which include proprietary products such as 'Carbo Sphere' (registered) of VERSAR Manufacturing Inc. of U.S.A. and 'Fillite' (trade name) of Fillite Inc. of U.K. The former product is a carbon balloon, its bulk density being 0.15 g/cm^3 and the thickness of the body is in $1 - 2 \text{ }\mu\text{m}$, and there are four distributions of particle diameters ranging in $50 - 150 \mu\text{m}$ (average diameter of $50 \text{ }\mu\text{m}$), $5 - 100 \mu\text{m}$ (average of $45 \text{ }\mu\text{m}$), $5 - 50 \mu\text{m}$ (average of $30 \text{ }\mu\text{m}$), and $50 - 150 \mu\text{m}$ (average of $60 \text{ }\mu\text{m}$). A minute hollow body the surface of which is coated with nickel, iron, copper, gold or other metal is known, and this coating is effective. The last mentioned of the proprietary products is a silica balloon, its bulk density being 0.4 g/cm^3 , and the distribution of the particle diameters ranges in $30 - 300 \mu\text{m}$.

In the present invention, minute hollow bodies in which particle diameters are in range of $5 - 300 \mu\text{m}$ are usable. It is easy to provide an inking roller which gives different amounts of ink supply to the plate by changing the ratio of mixture of minute hollow bodies 12 dispersed on the ink receiving layer 11 of the inking roller 1 or/and changing the size of the minute hollow body 12. The inking roller 1 which is capable of changing the amount of ink taken into the minute hollow bodies dispersed and mixed on the outer circumferential face of the inking roller 1 furnishes a proper amount of each color ink in multicolor printings where the supply of ink of different physical properties should be balanced in quantity. In the multicolor printing, it is thereby easy to provide an ink furnishing device which can furnish a proper amount of color ink for each color in multicolor printing. This ink furnishing device can be effectively applied to a multicolor rotary press of satellite type, B-B stacking type, B-B laterally arranged type, etc. With the conventional multicolor rotary printing machine, the physical properties of ink change with color. When all of the color ink is furnished by using an anilox roller which is provided with cells of an identical capacity, there is an excess or shortage of ink by color, causing an unbalance among colors on the print face, and the overall results of the color printing is not satisfactory in its beautifulness. Accordingly, with the above mentioned keyless ink furnishing device for a multicolor rotary printing machine, it is necessary to change a little the cell capacity in anilox roller by color, which entails more works in the machining of the cells and the control of wear of the cells. This created the problem of higher cost in running a color printing machine in comparison with the running of a monocolour rotary printing

machine. This problem can be, however, solved by the constitution above described of the present invention.

For a hard material powder 13 to be used with the minute hollow bodies, a powder of ceramic material, metal, alloy, etc. can be used. The size of the particle in the hard inorganic material powder 13 should be at least $1 - 100 \mu\text{m}$ in diameter when it is used in this invention.

Next, the method of manufacture of an inking roller 1 will be explained below. At first, in an inking roller 1 in Fig.2 minute hollow bodies 12 are uniformly dispersed on the substrate 14 of an ink receiving layer 11. In the inking roller 1 in Fig.3 minute hollow bodies 12 and hard material powder 13 are uniformly dispersed in the substrate 14 of the ink receiving layer 11. This work process is carried out by a method as mixing or mulling that is suitable for the characteristics of the substrate 14 of the ink receiving layer 11. The substrate 14 of the ink receiving layer 11 thus obtained in which the minute hollow bodies 12 or both the minute hollow bodies 12 and hard material powder 13 are dispersed uniformly covers the surface of the main body member 16 to form an ink receiving layer 11. In this work process casting, wrapping, painting, or other suitable methods are used. Next, the ink receiving layer 11 covering the surface of the main body member is ground at the surface of the layer 11. The grinding is given by either a grinding machine or the friction between the inking roller 1 and the blade or bar after the inking roller 1 has been installed on the rotary printing machine. Then with the grinding in the ink receiving layer on which minute hollow bodies 12 are dispersed, the minute hollow bodies 12 which are near the surface of the ink receiving layer 11 have part of the shell removed and expose the inner surface of the hollow body in the surface of the ink receiving layer 11 as shown in Fig.2. Fig.3 shows an ink receiving layer 11 on which minute hollow bodies 12 and hard material powder 13 are dispersed and part of the shell layer of a minute hollow body 12 located near the surface of the ink receiving layer 11 which is removed and the inside of the shell exposed and open in the surface of the ink receiving layer and at the same time the hard material powder 13 are exposed at the surface of the ink receiving layer 11.

Next, in Fig.5 through Fig.28, various embodiments of the present invention are described and explained in which the inking roller 1 of an offset rotary printing machine related to the present invention is constituted with a roller 10 on which minute hollow bodies are dispersed.

As ink removal device is 2, in Fig.4, comprises a blade 21 which is provided to make a contact with the outer circumferential surface of the inking

roller 1. The ink furnishing device 3 comprises a fountain roller 31 which is provided upstream of the inking roller 1 and rotates with its outer circumferential surface a little apart from that of the inking roller 1 and an ink reservoir 32 which stores the ink with part of the fountain roller 31 immersed in the ink. And, the ink in the ink reservoir 32 receives additional ink during printing operation to overflow the ink in order to maintain a constant stored ink level as shown by the arrow mark in the figure.

In Fig.5 and Fig.6, an ink removal devices 2 are shown which are different in form from that in Fig.4. This device 2 uses, in Fig.5, a roller 22 in place of the blade 21, which has outer circumferential surface in contact with the outer circumferential surface of the inking roller 1 and is either rotated at a speed lower than the peripheral speed of the inking roller 1 or rotated at a speed almost the same as the peripheral speed of the inking roller 1 with a strengthened pressure of contact with the inking roller 1. The ink removal device 2 in Fig.6 uses a bar 23 in place of the blade 21. The bar 23 is in contact with the outer circumferential surface of the inking roller 1 by its side. Although in Fig.7 through Fig.24 the ink removal devices 2 use a blade 21 but it should be understood that they also can use a roller 22 or a bar 23.

In Fig.7 through Fig.28, the constitution of the embodiments of the present invention which combines an ink furnishing device 3 to the inking roller 1 with an ink supply route to the inking roller 1 or the plate is shown. In Fig.7 through Fig.12, ink reservoir 32 in the shape of an ink pan or ink fountain to maintain the height of the ink storage always constant are shown. The ink reservoir 32 is a required constituent of the ink furnishing device 3. Fig.13 through Fig.18 show ink discharge bodies 33 in the shape of nozzle, for instance, to discharge a specified volume of ink all the time. The ink discharge body 33 is also a required constituent of the ink furnishing device. In Fig.19 through Fig.28, ink storage bodies 34 or 35 in the shape of an ink pot or ink chamber, for instance, are provided to divide at least part of the open section of the ink storage body by part of the circumference of the inking roller 1 or fountain roller 31. Those ink storage bodies 34 or 35 are required constituents of the ink furnishing device 3. In Fig.19 through Fig.24, an ink storage body 34 which opens part of the open section is used, and in Fig.25 through Fig.28, an ink storage body 35 which closes the open section and at the same time has an ink removal device added to itself is used. In Fig.25 and Fig.26, the ink removal device 2 which is installed with the ink storage body 35 consists of a blade 21 and in Fig.27 and Fig.28, the ink removal device 2 which is installed with the ink storage body 35 consists of a bar 23. In Figures 7, 9, 11,

13, 15, 17, 19, 21, 23, 25, and 27, the inking roller 1 directly furnishes ink to the surface of the plate. In Figures 8, 10, 12, 14, 16, 18, 20, 24, 26, and 28, the ink form rollers 4 stand between the inking roller 1 and the plate, and the ink from roller 4 furnishes ink to the plate. In Figures 7, 8, 13, 14, 19, 20, 25, and 26, the ink from the ink reservoir 32, ink discharge body 33 or ink storage body 34 or 35 is directly furnished to the outer circumferential surface of the inking roller 1. Likewise in Fig.21, 22, 23, and 24, the ink furnishing device 3 is provided with the fountain roller 31 and the ink is furnished to the outer circumferential surface of the inking roller 1 through the fountain roller 31 from the ink reservoir 32, ink discharge body 33, or ink storage body 34 or 35. In Figures 9, 10, 15, 16, 21, 22, 27, and 28, the fountain roller furnishes ink directly to the outer circumferential surface of the inking roller 1. In Figures 11, 12, 17, 18, 23, and 24, a transfer roller 36 is provided between the fountain roller 31 and inking roller 1 and this transfer roller 36 furnishes ink to the outer circumferential surface of the inking roller 1. The fountain roller 31 in this embodiment can be away from or in contact with the outer circumferential surface of the inking roller 1. Further, in this embodiment an ink film thickness regulating blade 37 is provided near the outer circumferential surface of the fountain roller 31 and this blade limits the ink film thickness on the outer circumferential surface of the fountain roller 31 and the ink is furnished to the outer circumferential surface of the inking roller 1 through the transfer roller 36. The transfer roller 36 is, therefore, in contact with both the circumferential surface of the fountain roller 31 and the circumferential surface of the inking roller 1 and the outer circumferential surface of the inking roller 31 is not furnished excessive ink. But on the outer circumferential surface of the inking roller 1 after it has run on the outer circumferential surface of the ink form roller 4, there is ink which was not used because it did not contact images or lines on the plate, that is residual ink is left or transferred. The blade 21 which is a member of the ink removal device 2 is provided to remove the residual ink.

In the embodiments that have been described and explained in the foregoing, the ink is furnished by an ink furnishing device 3 which attaches the ink to the outer circumferential surface of the inking roller 1.

If the ink furnishing device 3 has an ink reservoir 32, at least part of the inking roller 1 or fountain roller 31 is immersed in the ink in the ink reservoir 32. And, the ink is directly furnished to the circumferential surface of the inking roller 1 or the ink pumped up by the outer circumferential surface of the fountain roller 31 is furnished to the outer circumferential surface of the fountain roller

31 or through a transfer roller 36 from the outer circumferential surface of the fountain roller 31. When the ink furnishing device 3 is provided with an ink discharging body 33, the ink is discharged from it to the outer circumferential surface of the inking roller 1. Alternatively the ink is discharged to the section where the fountain roller 31 and inking roller 1 come close together or the contact section between them. Or the ink is discharged to the outer circumferential surface of the fountain roller 31 and then the ink is furnished directly to the outer circumferential surface of the inking roller 1 from the fountain roller 31 or through the outer circumferential surface of the transfer roller 36 from the fountain roller 31. When the ink furnishing device 3 has an open port and has an ink storage body 34 or 35 in which at least part of the open port is divided by a section of the inking roller or fountain roller 31, the ink is furnished directly to the outer circumferential surface of the inking roller 1 which divides the open port of the ink storage body 34 or 35 or the ink is furnished to the inking roller 1 from the outer circumferential surface of the fountain roller 31 or through the outer circumferential surface of a transfer roller 36 from the fountain roller 31.

Part of the ink furnished to the inking roller 1 is received in the minute hollow bodies 12 which are open and dispersed and mixed on the outer circumferential surface of the inking roller 1.

Next, the ink removal device 2 which is in contact with the outer circumferential surface of the inking roller 1 removes the excessive ink that is furnished to the outer circumferential surface of the inking roller 1 from it. On the outer circumferential surface of the inking roller 1, ink in a proper amount for printing is stored and stays in the hollow sections of the minute hollow bodies 12 which act as if they were ink reservoir cells.

On the other hand in Figures 11, 12, 17, 18, 23, and 24, the inking roller 1 has ink furnished on its outer circumferential surface in the amount which is regulated to be proper for printing at the ink furnishing device 3. Since the furnished ink is received in the open minute hollow bodies on the outer circumferential surface of the inking roller 1, no excessive ink exists on the outer circumferential surface of the inking roller 2, and accordingly the removal of excessive ink is not needed.

As the inking roller 1 rotates on further, an amount of the ink on the outer circumferential surface of the inking roller 1 which is received in the open minute hollow bodies 12 and suitable for printing is furnished directly or through the outer circumferential surface of the ink form roller 4 to the plate.

On the outer circumferential surface of the inking roller 1 which has finished furnishing ink directly or through the outer circumferential surface

of the ink form roller 4 to the plate from the inking roller 1, the ink which was not used and left without contact with images and lines on the plate, namely residual ink stays. In Figures 5, 6, 7, 8, 9, 10, 13, 14, 15, 16, 19, 20, 21, and 22, the ink is furnished on the residual ink and then the excessive ink is removed by the ink removal device 2 to make the amount of the ink on the outer circumferential surface of the inking roller 1 adequate, but in Figures 11, 12, 17, 18, 23, and 24, if the ink is furnished additionally, the sections where the ink is excessive develop on the outer circumferential surface of the inking roller 1 so that the excessive ink is removed from the outer circumferential surface of the inking roller 1 by providing the blade which is a member of the ink removal device 2 in contact with the outer circumferential surface of the inking roller 1 that has just finished furnishing ink to the plate.

With the rotation of the inking roller 1 continued, the actions described in the foregoing continue.

On the other hand, the outer circumferential surface of the inking roller 1 wears gradually by the ink removal action of the ink removal device 2 for the excessive ink or residual ink staying on the outer circumferential surface of the inking roller 1, but the minute hollow bodies 12 are dispersed substantially uniformly in the ink receiving layer 11 provided on the surface of the inking roller and those hollow bodies are exposed to be opened on the outer circumferential surface successively as the wear of the receiving layer 11 proceeds so that the outer circumferential surface of the inking roller 1 develops no significant change until the ink receiving layer 11 wears out. An adequate amount of ink for printing can be, therefore, maintained on the inking roller 1 for long.

Furthermore, when an inking roller 1 which has on its ink receiving layer 11, the powder of, for instance, a hard inorganic material that is uniformly dispersed, the friction that develops by the ink removal device 2 is taken up exclusively by the inorganic powder, reducing the wear of the outer circumferential surface of the inking roller 1. In this case also the state of the outer circumferential surface of the inking roller 1 develops no significant change until the ink receiving layer 11 wears out. Accordingly, an adequate amount of ink for printing can be furnished for a long period.

Next, in Fig.29 through Fig.44, various aspects of the constitution of a second embodiment of the present invention and in which the fountain roller 31 and/or transfer roller 36 have minute hollow bodies 10 on their outer circumferential surface will be explained.

Fig.29 through Fig.36 give representative schematic views of the second embodiment. In Figures 29, 31, 33, 35, 37, the ink furnishing device which

furnishes ink to the fountain roller 31 is an ink reservoir which stores ink with part of the fountain roller 31 immersed in the ink.

In Figures 30, 32, 34, 36, and 38, the ink furnishing device to furnish ink to the fountain roller 31 is an ink discharge body 33 which discharges ink towards the outer circumferential surface of the fountain roller 31.

In Fig.29 and Fig.30, a rotating fountain roller 31, ink furnishing device which is provided upstream of the fountain roller 31 and furnishes ink to the outer circumferential surface of the fountain roller 31, ink form roller 4 which is in contact with the plate on a plate cylinder and rotates to furnish ink to the plate, and inking roller 1 which is placed between the fountain roller 31 and ink form roller 4 and rotates in parallel to them in contact with the outer circumferential surfaces of the fountain roller 31 and ink form roller 4 are shown, and the fountain roller 31 is the minute hollow body dispersing roller 10.

In Fig.31 through Fig.36, the rotating fountain roller 31, ink furnishing device positioned upstream of the fountain roller 31 to furnish ink to its outer circumferential surface, ink form roller 4 which is in contact with the plate on a plate cylinder and which rotates and furnishes ink to the plate, transfer roller 36 which is positioned between the fountain roller 31 and ink form roller 4 and rotates in parallel to them and has its outer circumferential surface in contact with the fountain roller 31 and ink form roller 4 in succession, and inking roller 1 are shown, and the ink fountain roller 31 is the minute hollow body dispersing roller 10.

In Fig.31 through Fig.36, the rotating fountain roller 31, ink furnishing device positioned upstream of the fountain roller 31 to furnish ink to its outer circumferential surface, ink form roller 4 which is in contact with the plate on a plate cylinder and which rotates and furnishes ink to the plate, transfer roller 36 which is positioned between the fountain roller 31 and ink form roller 4 and rotates in parallel to them and has its outer circumferential surface in contact with the fountain roller 31 and ink form roller 4 in succession, and inking roller 1 are shown, and the ink fountain roller 31 is the minute hollow body dispersing roller 10.

In Fig.33 and Fig.34, the transfer roller 36 is the minute hollow body dispersing roller 10, and in Fig.35 and Fig.36, both fountain roller 31 and transfer roller 36 are the minute hollow body dispersing rollers 10.

The embodiments in Fig.37 through Fig.44 are those in Fig.29 through Fig.36, and with those embodiments an ink film thickness regulating blade 7 near or in contact with the side face downstream of the ink furnishing device in the direction of rotation of the fountain roller 31 is provided and,

furthermore, a blade 21 to erase printing marks which is near or in contact with the side face downstream of the contact position of the ink form roller 4 in the direction of rotation of the inking roller 1 is provided. Figures 37, 38, 39, 40, 41, 42, 43, and 44 correspond to Figures 29, 30, 31, 32, 33, 34, 35, and 36.

In Fig.29 through Fig.44, the peripheral speed of the fountain roller 31 is set lower than the peripheral speed of the inking roller 1 with which the fountain roller 1 contacts and which is positioned downstream of the fountain roller 31 or transfer roller 36, and the drive means (not shown) of the fountain roller 31 is either the drive gear system for the ink furnishing device or specializing single drive means. In Figures 35, 36, 43, and 44, the ink receiving layers 11 for both fountain roller 31 and transfer roller 36 need not be the same, namely the ratios of mixing of the dispersed minute hollow bodies need not be the same nor the sizes of the minute hollow bodies 12 on them need to be the same. Regarding the ratios of mixing of the hard material powder 13 in the ink receiving layer 11, it is not required that they are the same.

In the foregoing description, only the examples of the case in which the ink furnishing device is an ink reservoir 32 or it is an ink discharge body 33 were given, but it can be other convenient devices.

The above mentioned embodiments of the present invention were related to the offset rotary printing machine, but they can be used with rotating letterpress machines which include flexographic printing machines.

In the embodiments described above, at first the ink is furnished to the fountain roller 31 so as to attach the ink to the outer circumferential surface of the roller 31 by means of an ink furnishing device.

When the ink furnishing device 6 is an ink reservoir 32, part of the fountain roller 31 is immersed in the ink in the ink reservoir to furnish ink to the outer circumferential surface of the fountain roller 31. When the ink furnishing device is an ink discharge body 33, the ink is discharged towards the outer circumferential surface of the fountain roller 31 from the ink discharge body 33 to furnish ink to the outer circumferential surface of the fountain roller 31.

When the fountain roller 31 is a roller 1 which has minute hollow bodies dispersed on its outer circumferential surface, part of the ink furnished to the fountain roller 31 is taken in the minute hollow bodies 12 which are dispersed and mixed on the outer circumferential surface of the inking roller 31 with the hollow sections of the minute hollow bodies 12 opened.

Then, as the fountain roller 31 rotates, the ink furnished to the outer circumferential surface of the fountain roller 31 goes to the contact section be-

tween the ink fountain roller 31 and inking roller 1 or to the contact section between the ink fountain roller 31 and transfer roller 36, and when the ink passes through either one of those contact sections, the ink is transferred to either the inking roller 1 or transfer roller 36.

The peripheral speed of rotation of the fountain roller 31 is set slower than that of the inking roller and that of the transfer roller 36 so that the ink conveyed from the inking roller 1 or transfer roller 36 can be controlled. The ink which is at the contact section of the fountain roller 31 and inking roller 1 or at the contact section of the fountain roller 31 and transfer roller 36 and which is excessive is squeezed out from those contact sections and the excessive ink stays on the upstream side of those contact sections with respect to the direction of rotation.

When the fountain roller 31 is a roller 1 which has minute hollow bodies 12 dispersed on its outer circumferential surface, the ink which is received in the open minute hollow bodies in the ink receiving layer 11 is not squeezed out by the contact section of the rollers but is capable of passing through it. By increasing or reducing the amount of the ink that is received in the minute hollow bodies 12 which are open, that is by changing the size of the minute hollow body 12 or changing the ratio of mixing of the hollow bodies to change the amount of ink that is received in the minute hollow bodies 12 that are open on the outer circumferential surface of the roller, it is possible to change the amount of the ink passing through the contact section, that is to change the amount of the ink transferred from the fountain roller 31 to the inking roller 1 or to the transfer roller 36.

If the transfer roller 36 is a roller 1 which has the minute hollow bodies 12 on the outer circumferential surface of the roller, it is possible to increase or reduce and adjust the amount of the ink transferred from the above mentioned fountain roller 31 to the transfer roller 36. In other words, the amount of the ink received from the fountain roller 31 can be increased or reduced by changing the size of the minute hollow body in the ink receiving layer 11 that is provided on the surface of the transfer roller 36 or changing the ratio of mixing of the minute hollow bodies 12 to increase or reduce the amount of ink received in the minute hollow bodies 12.

The ink that is transferred to the transfer roller 36 reaches the contact section of the transfer roller 36 and inking roller 1 as the transfer roller rotates, and when the ink passes through the contact section, the ink is transferred to the inking roller 1.

The ink that is transferred from the fountain roller 31 or transfer roller 36 to the inking roller 1 reaches the contact section between the inking

roller 1 and the ink form roller 4 as the inking roller 1 rotates, and when the ink passes through the contact section, the ink is transferred to the ink form roller 4 and the ink on this roller is in turn furnished to the plate on the plate cylinder P.

On the other hand, an ink film thickness regulating blade 7 and previous print mark erasing blade 21 as shown in Fig.37 through Fig.44 act respectively as follows.

The ink film thickness regulating blade 7 is installed to the fountain roller 31 and regulates beforehand the amount of the ink that reaches the contact section between the fountain roller 31 and intermediate roller or the contact section between the fountain roller 31 and transfer roller 36 as the fountain roller 31 rotates. The blade 7 contributes to avoiding before it happens an unexpected mishap that the total amount of the ink given to the fountain roller 31 is squeezed at the above mentioned contact section as the fountain roller 31 rotates and stays in a large amount at the contact section on the side of the upstream and part of this ink passes through the above mentioned contact section by widening it forcibly as the inking roller 1 or transfer roller 36 rotates. When the fountain roller 31 is a roller 1 which has minute hollow bodies dispersed on its outer circumferential surface, it is possible by bringing the ink film thickness regulating blade 7 in contact with the fountain roller 31 to regulate the amount of ink that reaches the above mentioned contact section as the fountain roller 31 rotates to an amount which is almost equal to the amount of ink that is received in the minute hollow bodies 12 that are open on the outer circumferential surface of the roller and this is very effective to regulate very easily the amount of ink passing through the above mentioned contact section always to a certain amount.

The previous print mark erasing blade 21 is for making uniform or remove the ink on the outer circumferential surface of the inking roller 1 which is transferred to it from the ink form roller 4 and is uneven. The uneven distribution of the ink that is left on the ink form roller 4 after furnishing ink to a plate because of the sections of the ink form roller 4 which made contact with images and lines on the plate and other sections which made no contact with them and have the ink not transferred to the plate left on it is eliminated by the blade 21 on the inking roller to which the uneven ink distribution is transferred, eliminating at the same time the uneven furnishing of ink to the images and lines on a plate by continuing the above mentioned state of the uneven ink distribution on the roller and preventing thereby thick and thin tones on the print, so called 'ghost'. Further, according to the present invention, the peripheral speeds of rotation of the fountain roller 31 and inking roller 1 or those of the

fountain roller 31 and transfer roller 36 are different so that there is a friction at the contact section of those rollers, causing a wear on one of whose rollers. But when the roller 1 which has minute hollow bodies dispersed on its circumferential surface is used for at least one of the fountain roller 31 and inking roller 1 or the fountain roller 31 and transfer roller 36, there will be no significant unfavorable change on the outer circumferential surface of the roller until the ink receiving layer 11 on it is worn out finally, because there are minute hollow bodies 12 in the ink receiving layer 11 and the minute hollow bodies 12 that are dispersed and mixed in the ink receiving layer 11 are successively exposed on the outer circumferential surface as the ink receiving layer 11 is worn to open the shells of the minute hollow bodies. And, by providing a hard material powder 13 dispersed and mixed with the minute hollow bodies on the ink receiving layer 11, the above mentioned wear is exclusively carried by the hard material powder 13 so that the wear in the ink receiving layer 11 is suppressed and the life of the roller is extended.

Since a roller which is constituted with the roller 1 on which minute hollow bodies are dispersed is subject to no significant change on its outer circumferential surface and it can be used for a long term even if its outer circumferential surface is worn, the frequency of replacing rollers becomes very small with the machine availability factor improved a good deal.

The present invention is not limited by the embodiments in the above description and it should be understood that a modification is included as far as it does not go beyond the spirit of the invention as claimed in the claim.

Claims

1. An ink furnishing device for printing machines which comprises rollers mutually in contact in succession in the ink furnishing route ranging from ink replenishing means to an ink form roller which is in contact with the surface of a plate and furnishes ink to it, wherein some of said rollers is constituted with a minute hollow body dispersing roller which is provided with an ink receiving layer on which minute hollow bodies are dispersed and the hollow sections of said minute hollow bodies located at the outer circumferential surface of said roller are open.

2. An ink furnishing device for printing machines which comprises rollers mutually in contact in succession in the ink furnishing route ranging from ink replenishing means to an ink form roller which is in contact with the surface of a plate and furnishes ink to it, wherein an inking roller is con-

stituted with a minute hollow body dispersing roller which is provided with an ink receiving layer on which minute hollow bodies are dispersed and the hollow sections of said minute hollow bodies located at the outer circumferential surface of said roller are open.

3. An ink furnishing device for printing machines which comprises rollers mutually in contact in succession in the ink furnishing route ranging from ink replenishing means to an ink form roller which is in contact with the surface of a plate and furnishes ink to it, wherein a fountain roller is constituted with a minute hollow body dispersing roller which is provided with an ink receiving layer on which minute hollow bodies are dispersed and the hollow sections of said minute hollow bodies located at the outer circumferential surface of said roller are open.

4. An ink furnishing device for printing machines which comprises rollers mutually in contact in succession in the ink furnishing route ranging from ink replenishing means to an ink form roller which is in contact with the surface of a plate and furnishes ink to it, wherein at least one of a fountain roller and transfer roller is constituted with a minute hollow body dispersing roller which is provided with an ink receiving layer on which minute hollow bodies are dispersed and the hollow sections of said minute hollow bodies located at the outer circumferential surface of said roller is open.

5. An ink furnishing device as claimed in any of the preceding claims from Claim 1 to Claim 4 wherein the ink receiving layer is provided with the powder of a hard material mixed and dispersed in said ink receiving layer.

FIG. 1

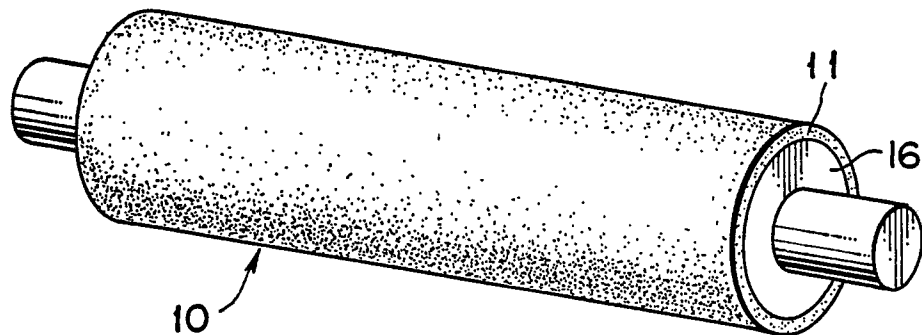


FIG. 2

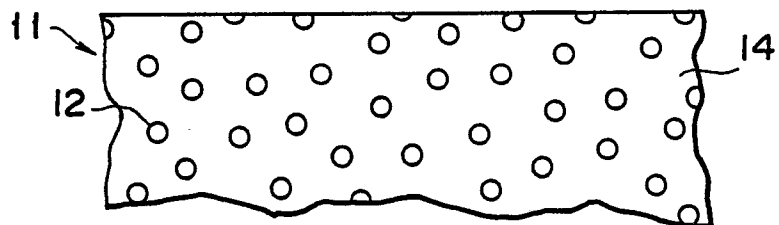


FIG. 3

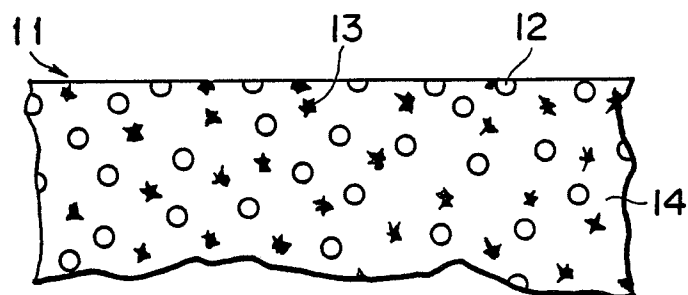


FIG. 4

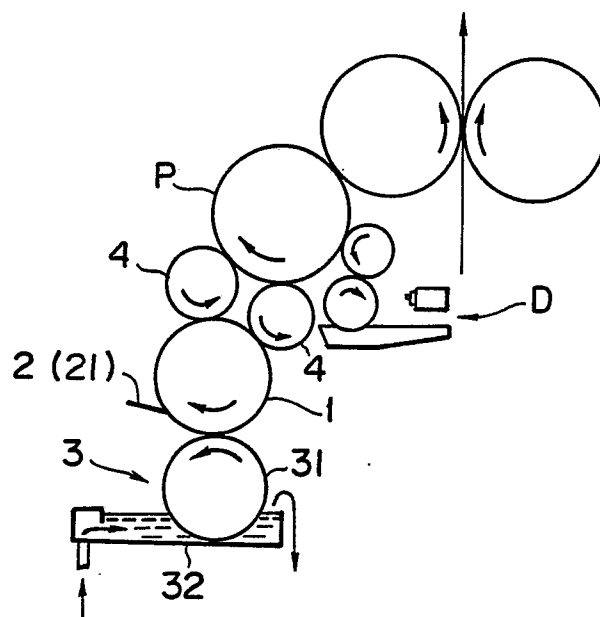


FIG. 5

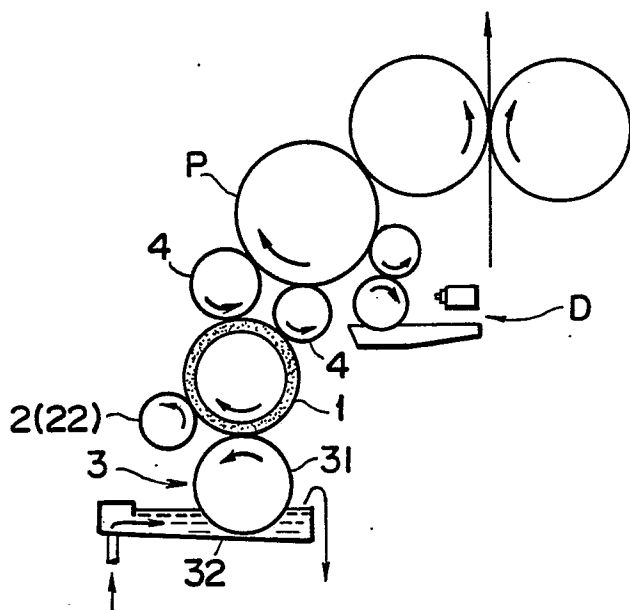
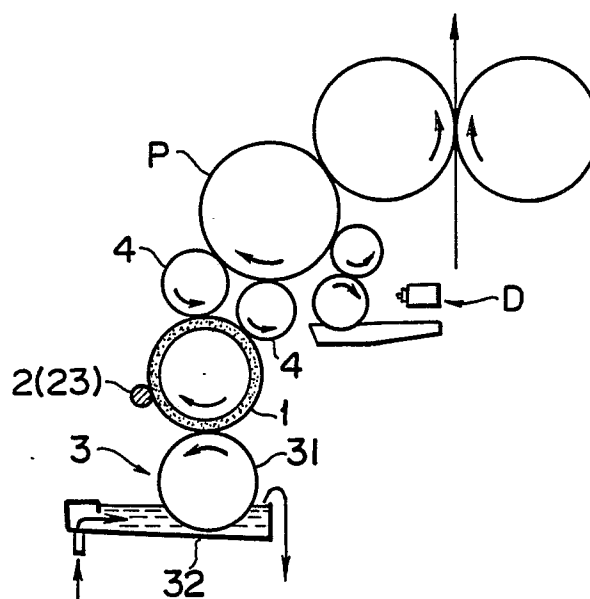


FIG. 6



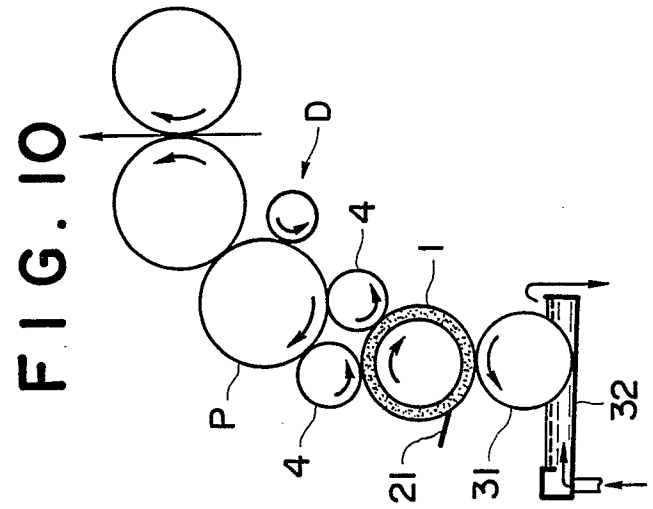
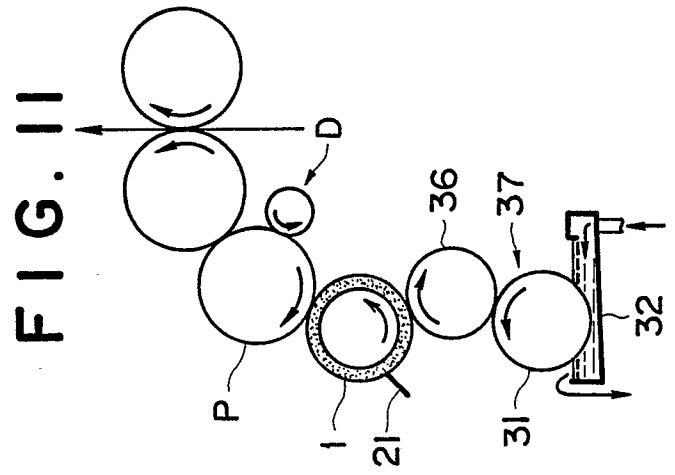
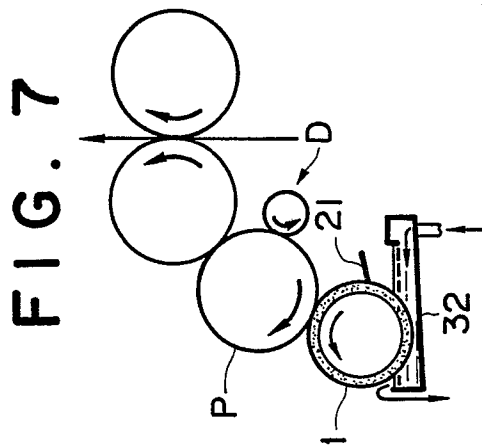
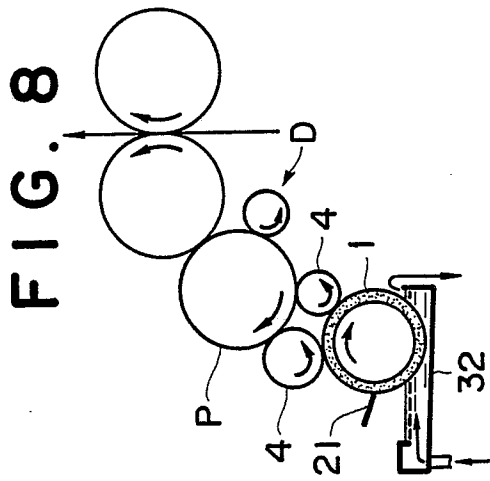
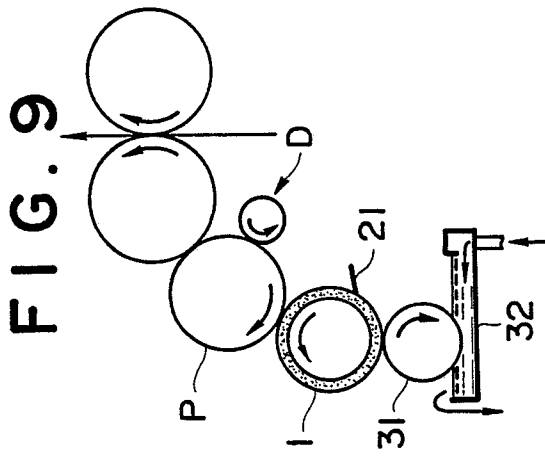


FIG. 12

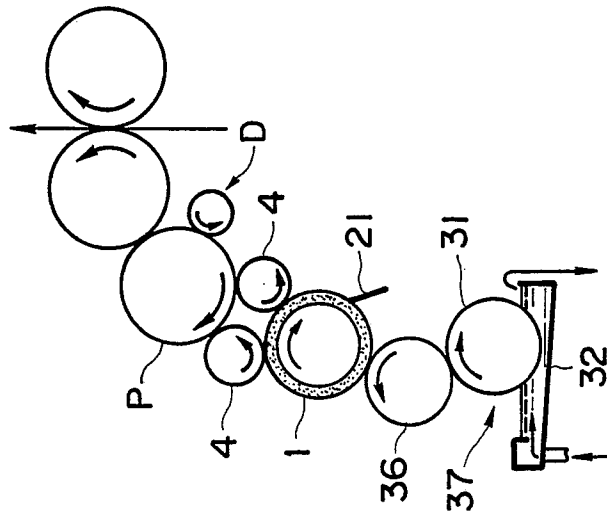


FIG. 13

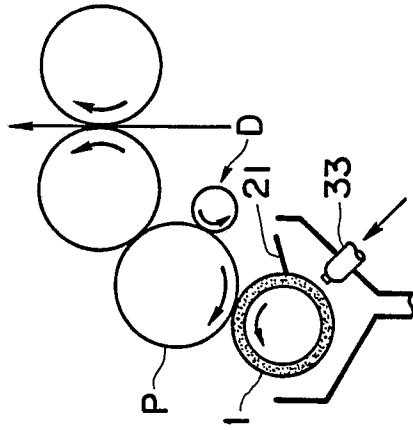


FIG. 14

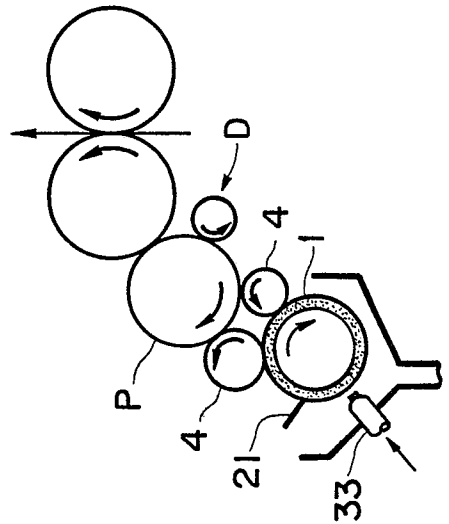


FIG. 15

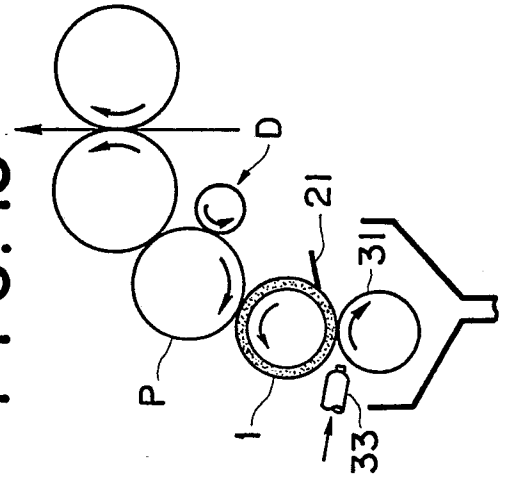
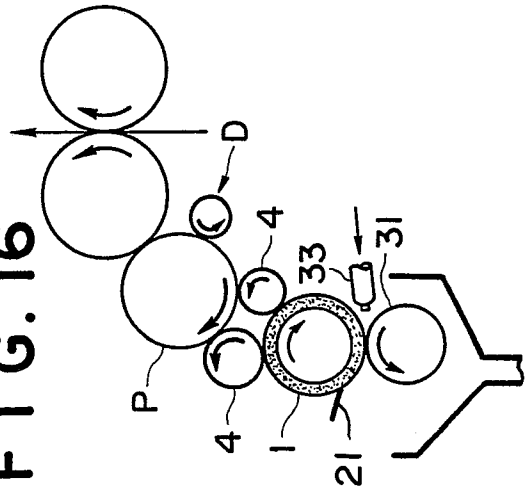


FIG. 16



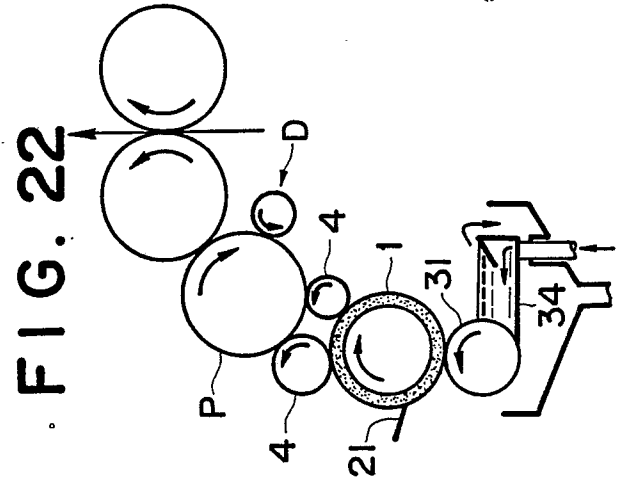
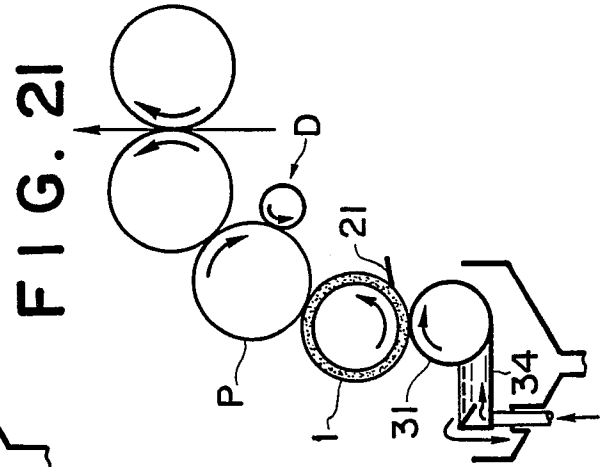
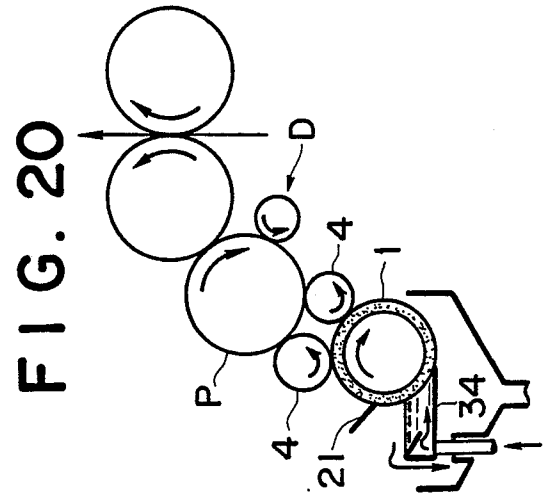
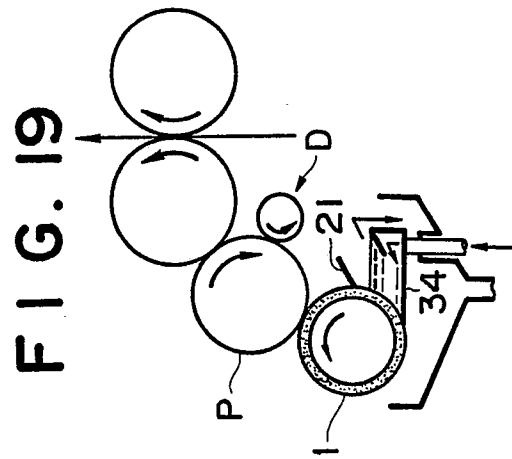
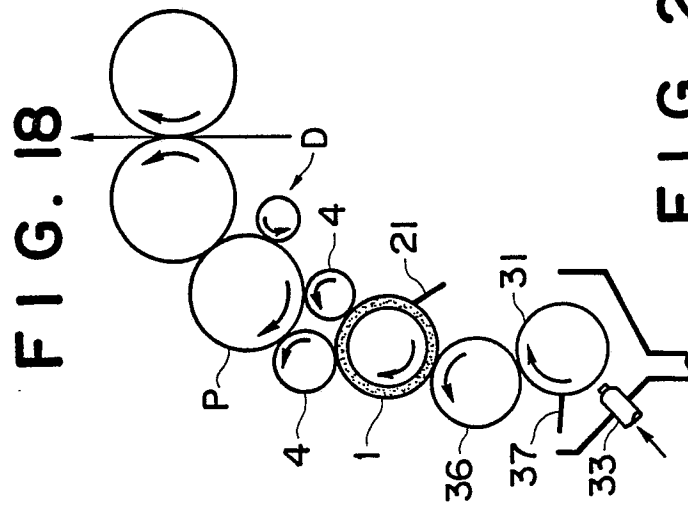
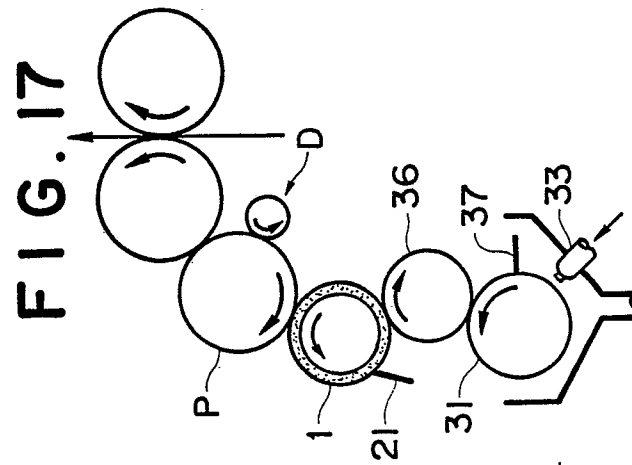


FIG. 23

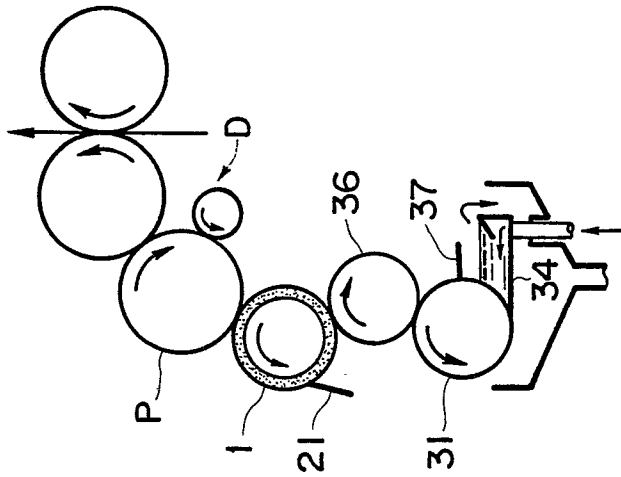


FIG. 24

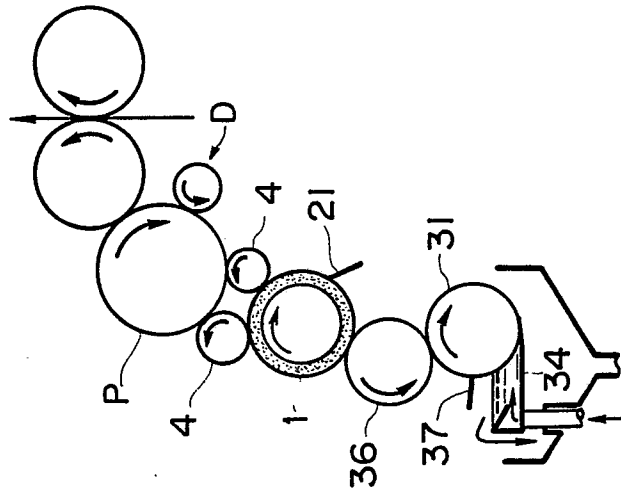


FIG. 25

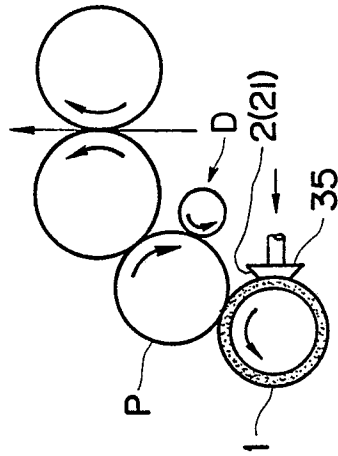


FIG. 26

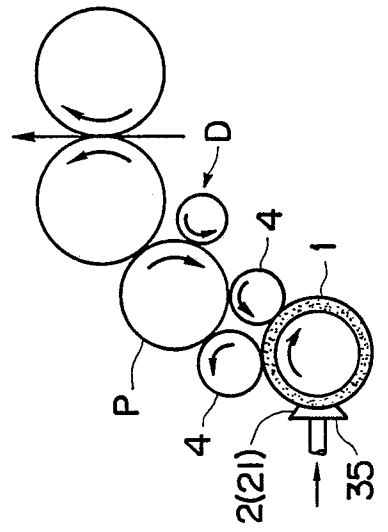


FIG. 27

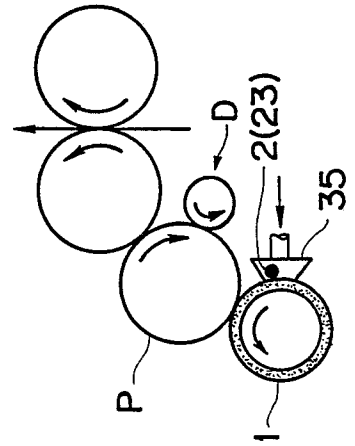


FIG. 28

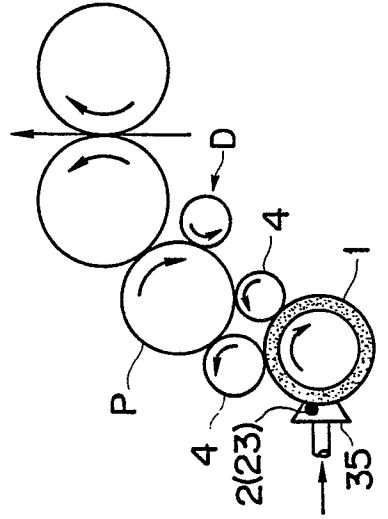


FIG. 29

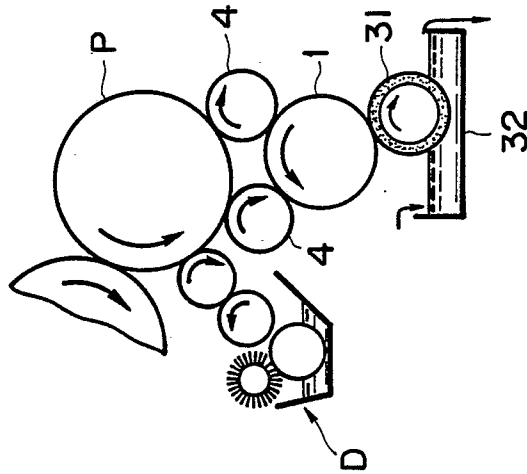


FIG. 30

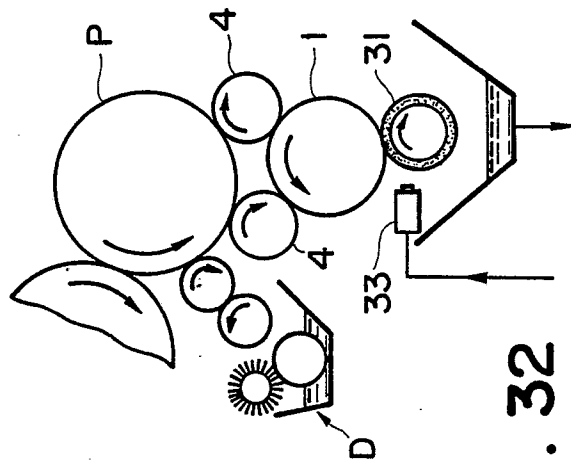


FIG. 31

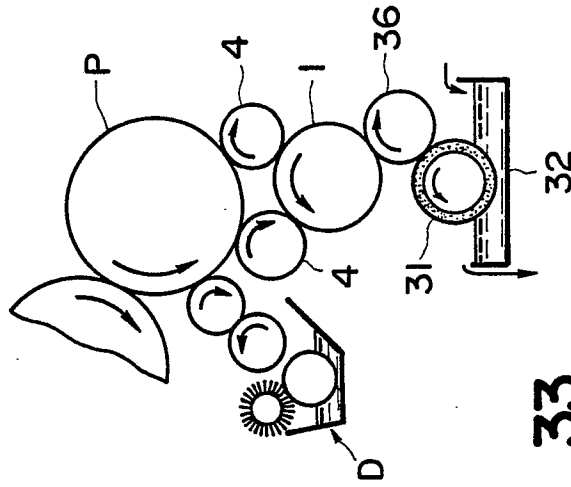


FIG. 32

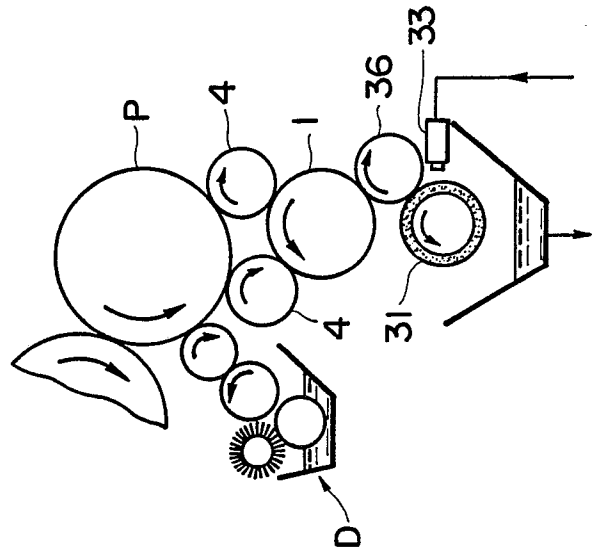


FIG. 33

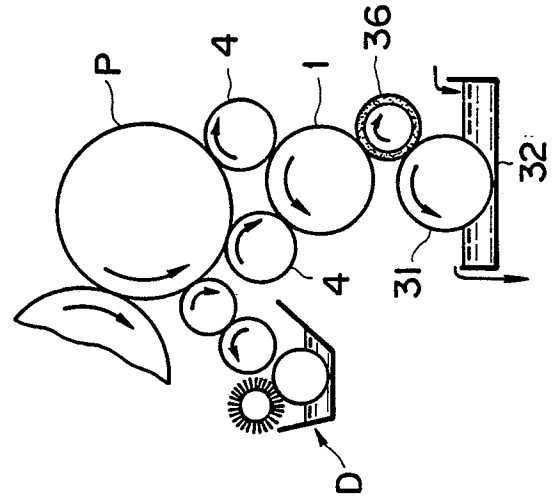


FIG. 34

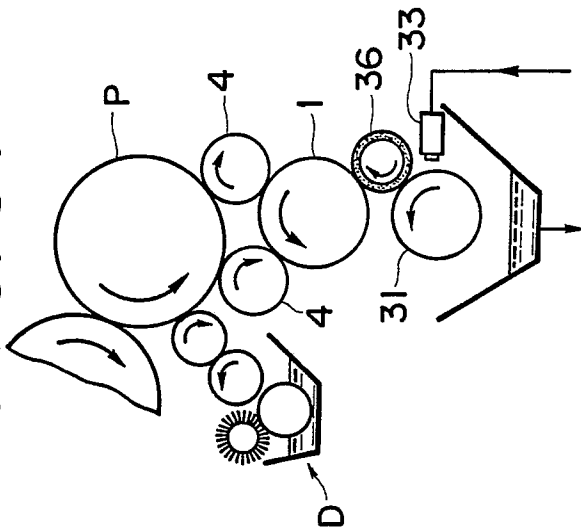


FIG. 35

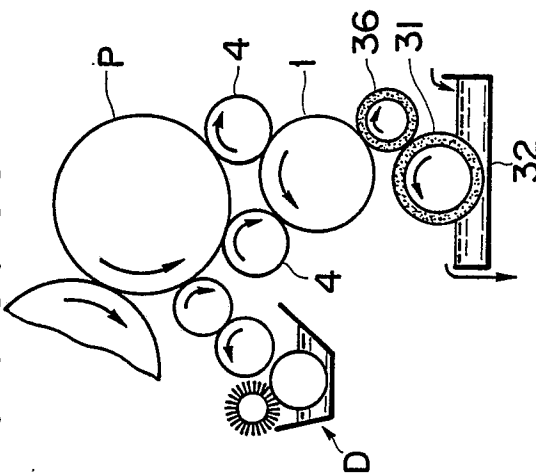


FIG. 36

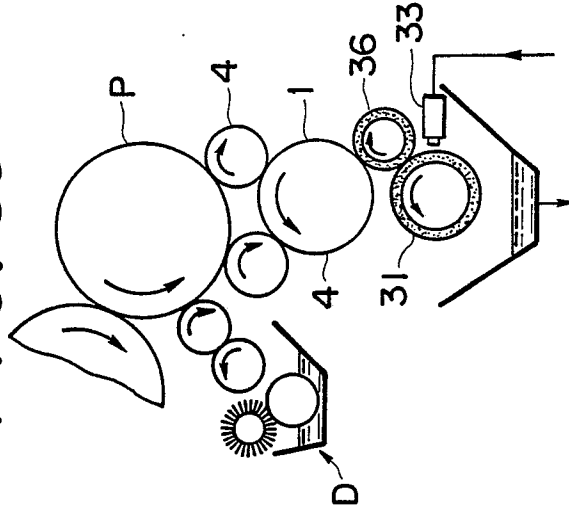


FIG. 37

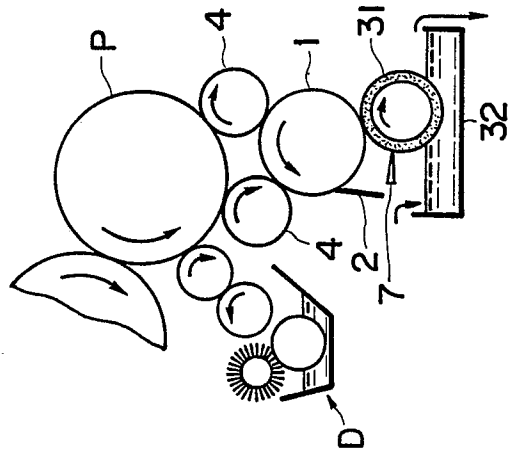


FIG. 38

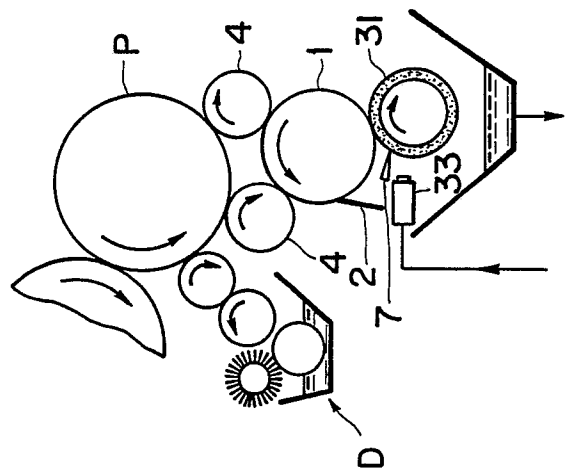


FIG. 39

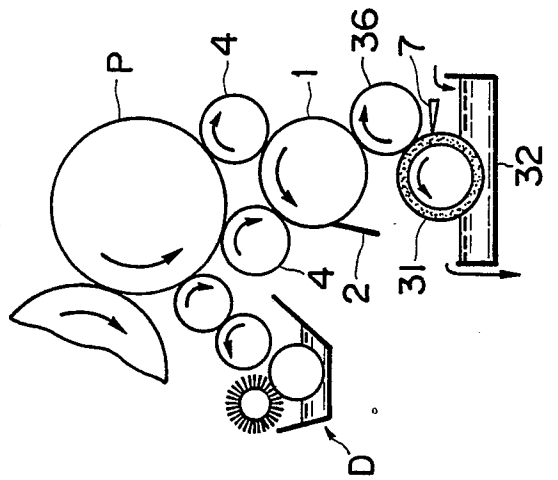


FIG. 40

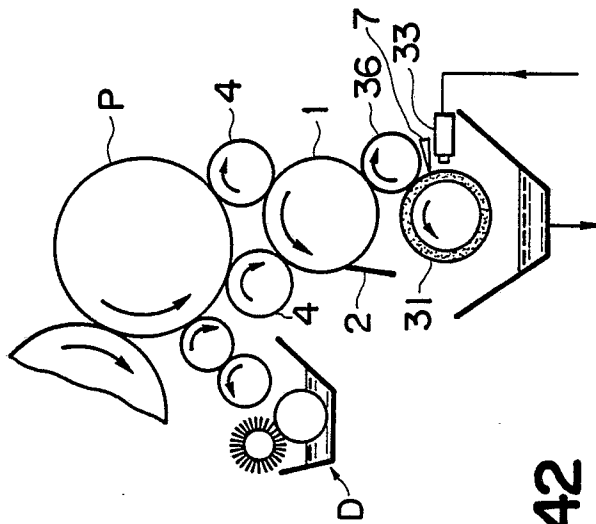


FIG. 41

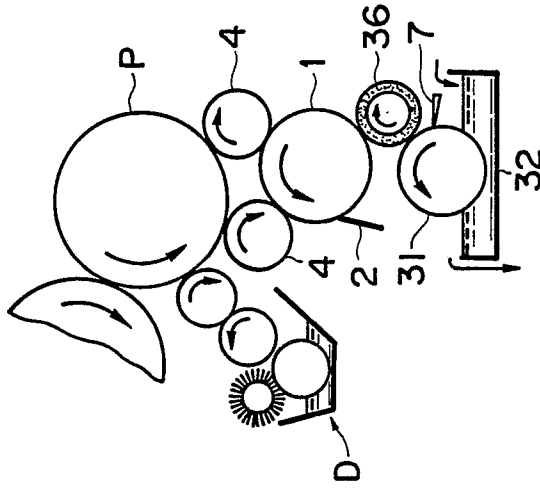


FIG. 42

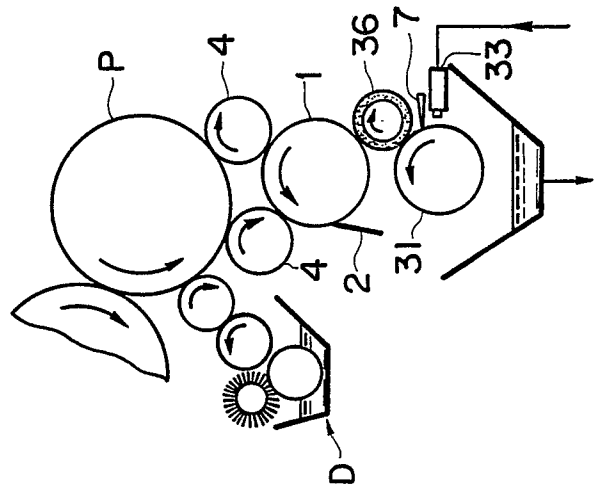


FIG. 43

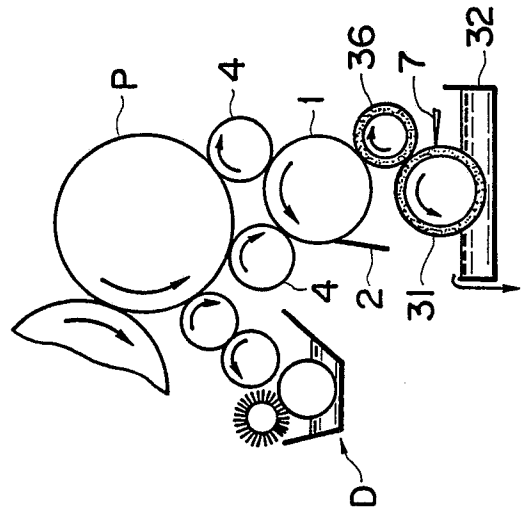
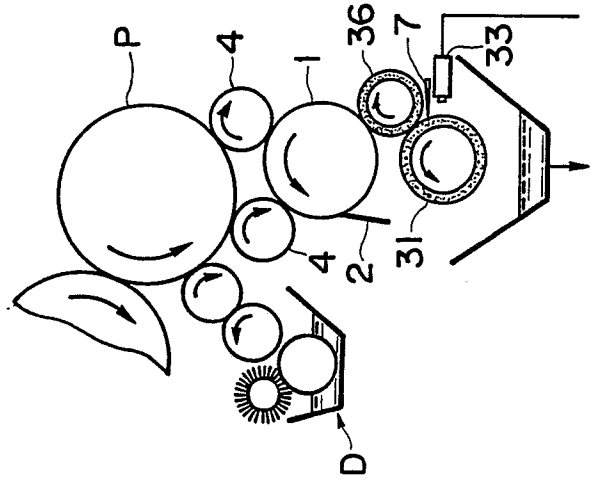


FIG. 44





EP 89 11 8512

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
P,X	WO-A-8902833 (KINYOSHA CO. LTD) * abstract; figure 5 * ---	1-4	B41F31/26
P,A	EP-A-303866 (ROCKWELL INTERNATIONAL CORPORATION) * the whole document * ---	1-5	
A	GB-A-2089473 (VEB KOMBINAT POLYGRAPH) * abstract; figure 1 * -----	1-5	
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			B41F B41N
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 01 FEBRUARY 1990	Examiner THIBAUT E.E.G.C.
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			