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(54) Photosensitive material processing device.

(57) A photosensitive material processing device of the invention processes an exposed photosensitive material with a processing liquid such as a developer. The device has a processing liquid bath containing a processing liquid, a plurality of long arcuated guide path (G) forming elements, arranged in the processing liquid bath along the longitudinal direction, for guiding a belt-like photosensitive material (F), and a photosensitive material (F) conveying (41, 42) unit arranged in a region formed between one end of a given guide path forming element and the other end of the following guide path forming element at an upper portion of the processing liquid bath. Each guide path forming element has, in its two sides, guide grooves (22) for slidably guiding the photosensitive material. One and the other ends of each guide path forming element are deviated along the longitudinal direction of the processing liquid bath. One end of one of two adjacent guide path forming elements and the other end of the remaining one oppose each other to be perpendicular to the longitudinal direction of the processing liquid bath. The guide path forming elements constitute a helical photosensitive material guide path.

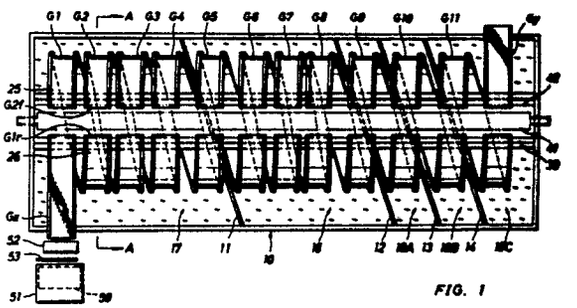


FIG. 1

EP 0 274 625 A1

Photosensitive Material Processing Device

BACKGROUND OF THE INVENTION

FIELD OF THE INVENTION

The present invention relates to a processing device for processing an exposed photosensitive material with a processing liquid such as a developer, fixer, and for washing with water.

DESCRIPTION OF THE PRIOR ART

In conventional picture processing, an exposed photosensitive material must be processed. In the case of a photosensitive material for a black-and-white picture, the material is normally subjected to processings such as development, fixing, washing with water, and so on. In the case of a color photosensitive material, the material is normally subjected to processings such as color developing, bleaching, fixing, washing with water, and so on; or processing such as color developing, simultaneous bleaching and fixing, water-washing, and so on. A picture can be obtained in this manner.

In order to process a photosensitive material in the manner as described above, the material must be passed through a processing liquid tank such that it contacts the processing liquid of each processing liquid tank for a predetermined period of time.

In a conventional, widely-known practical photosensitive material processing device, appropriate guide rollers are arranged at upper and lower levels of a processing bath. A belt-like photosensitive material is guided along a path that extends in a repeated zig-zag manner through a U-turn portion constituted by the guide rollers. The lower portion of the zig-zag path is immersed in the processing. Required photosensitive material processing device is achieved with the above arrangement.

In the above photosensitive material processing device, however, a deep or large processing bath is required in order to obtain a high processing efficiency. In order to obtain a high processing efficiency with a small processing bath, the radius of curvature of the U-turn portion constituted by the guide rollers must be considerably small. In this case, the conveying resistance of the photosensitive material becomes large, and accordingly the photosensitive material is undesirably deformed largely. In addition, the number of guide rollers to be used is increased, resulting in an expensive device.

Japanese Patent Publication No. 54-31895 discloses a photosensitive material processing device for performing processing without using a zig-zag path. In this photosensitive material processing device, a closed helical guide tube constitutes a photosensitive material path. Although this device may be useful for a specific application, it is considerably expensive and it requires a long leader extending through the entire length of the closed guide tube in order to guide a photosensitive material to be processed in the processing path. The leader in this case is not an auxiliary leader for reliably guiding and conveying the photosensitive material, but a leader for guiding a photosensitive material into a predetermined curved path. This leader thus must have a length to extend along the entire length of the processing path. Even if it poses no problem in processing a considerably long photosensitive material, it is very disadvantageous when a relatively small photosensitive material, such as a film used for general photographying, is to be processed.

SUMMARY OF THE INVENTION

It is a first object of the present invention to provide a photosensitive material processing device which can achieve a required processing with a high efficiency while using a very small processing liquid bath.

It is a second object of the present invention to provide a photosensitive material processing device which has a helical photosensitive material guide path partially immersed in a processing liquid bath.

It is a third object of the present invention to provide a photosensitive material processing device wherein a plurality of guide path forming elements are arranged in a processing liquid bath, and one end of one of two adjacent guide path forming elements opposes one end of the other of the element in a direction perpendicular to the longitudinal direction of the processing liquid bath.

It is a fourth object of the present invention to provide a photosensitive material processing device which can process two or more photosensitive materials having different widths at high processing efficiencies.

BRIEF DESCRIPTION OF ACCOMPANYING DRAWINGS

Fig. 1 is a plan view of a main part of a photosensitive material processing device according to an embodiment of the present invention;

Figs. 2A and 2B are a partial perspective view and an end face view of a guide path forming element;

Fig. 3 is a perspective view of an example of a guide path forming element;

Fig. 4 is a sectional view taken along the line A - A of Fig. 1;

Fig. 5 is a partially sectional view showing an arrangement of a circumferential gap and convey rollers of the photosensitive material processing device of the present invention;

Fig. 6 is a front view of convey rollers of the photosensitive material processing device of the present invention; and

Figs. 7A and 7B show end faces of modifications of a guide path forming element preferably used in the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

An embodiment of the present invention will now be described.

Fig. 1 is a plan view for explaining a main part of a photosensitive material processing device according to an embodiment of the present invention. Referring to Fig. 1, reference numeral 10 denotes a processing bath divided into five blocks by oblique partition walls 11, 12, 13, and 14. A color developer bath 17, a bleaching/fixing liquid bath 18, a first stabilizing bath 19A, a second stabilizing bath 19B, and a third stabilizing bath 19C are formed in the processing bath 10 from the left to right. The first, second and third baths may be a washing bath.

A guide mechanism constituted by a plurality of guide path forming elements G is provided in the processing bath 10.

Each guide path forming element G is made by a belt-like guide path forming member B. Projecting ridges 21 project from two sides of one surface of an elongated substrate 20 of the guide path forming member B, as shown in Figs. 2A and 2B. Guide grooves 22 are formed in opposing inner surfaces of the projecting ridges 21 to extend in the longitudinal direction of the member B. In the guide path forming member B, the guide grooves 22 slidably receive two sides of a photosensitive material F to be processed and guide the same. Therefore, a distance a between the projecting ridges 21 and a distance b between the bottom surfaces of the guide grooves 22 are set to coincide with a width f of the photosensitive material to be processed. A space S is preferably formed between the inner surface of the guided photosensitive material F and the substrate 20.

The guide path forming element G is obtained by bending the belt-like guide path forming member B having the above structure in a loop-like manner. More specifically, as shown in Fig. 3, assume a column P having a horizontal axis X. The guide path forming member B is bent by winding it around the outer surface of the column P substantially helically such that its projecting ridges 21 face outward. One and the other ends 23 and 24 of the guide path forming member B are located obliquely with respect to each other through a circumferential gap that coincides with a belt-like region R corresponding to the top portion of the column P. Namely, the two ends 23 and 24 close to each other are deviated along the axis X of the column P. A pitch c of the coil along which the guide path forming element G extends must be larger than a width d of the guide path forming member B. Therefore, a gap g is present between the one and the other ends 23 and 24 of the guide path forming member B.

The guide path forming element G basically has the above-described structure. In practice, as shown in Fig. 1, one and the other ends 25 and 26 of the guide path forming member B extend perpendicularly with respect to the axis X. The axial deviation (the lead angle of the coil) of the upper two end portions of the loop-like guide path forming element G having a gap in its upper end is set to be zero. A plurality of guide path forming elements G are sequentially arranged such that the trailing end of each guide path forming element G opposes the leading end of the following guide path forming element G in the circumferential direction.

The device shown in Fig. 1 will be described in detail. A first guide path forming element G1 is arranged in the left region of the color developer bath 17 such that its one and the other end portions 25 and 16 are located at an upper portion of the bath 17, as is shown also in Fig. 4. A second guide path forming element G2 is arranged coaxially and adjacent to the first guide path forming element G1 such that its leading end G2f opposes a trailing end G1r of the first guide path forming element G1 in the circumferential direction of the column P. In a similar manner, a plurality of guide path forming elements, i.e., a total of eleven elements G1 to G11 in Fig. 1, are sequentially arranged, thereby constituting a guide mechanism of a photosensitive material guide path which is helical in shape as a whole and is continuous through a circumferential gap at every turn.

The guide path forming elements G are fixed

commonly by a trough coupling 30 extending in the direction of the X axis and having a U-shaped section. The coupling 30 is arranged in the processing bath 10 by being fixed on the walls of the processing bath 10 so that a portion of each guide path forming element G including at least its lower half portion is located under a liquid level L, as shown in Fig. 4. Among a total of eleven guide path forming elements G1 to G11, the first four forming elements G1 to G4 are located in the color developer bath 17, the following four forming elements G5 to G8 are located in the bleaching/fixing liquid bath 18, and the following three forming elements G9, G10, and G11 are located in the three stabilizing baths 19A, 19B, and 19C. The partition wall 11 is arranged between the forming elements G4 and G5, and the partition walls 12, 13, and 14 are arranged between the forming elements G8 and G9, G9 and G10, and G10 and G11, respectively.

As shown in detail in Fig. 5, upper and lower rollers 41 and 42 extending along substantially the entire length of the processing bath 10 are arranged at a portion of the column P corresponding to the belt-like region R such that they are vertically urged against each other. The lower roller 42 is constituted by a central shaft 43 which is fixed in position and housed in the coupling 30. The upper roller 41 is constituted by a central shaft 44 vertically movable and biased downward by a spring (not shown). In the circumferential gap of continuous, adjacent guide path forming elements, a nip portion between the upper and lower rollers 41 and 42 is located on a circumference on the outer surface of the column P passing the guide grooves of these guide path forming elements. The upper and lower rollers 41 and 42 pass all the circumferential gaps of the axially adjacent guide path forming elements G. Therefore, the upper and lower rollers 41 and 42 constitute common convey rollers provided in the region where the conveying force acts by the circumferential gap. Rubber O-rings 45 are fitted on portions of the upper roller 41 that contact the two sides of the photosensitive material F passing through the respective circumferential gaps, as shown in Fig. 6.

Referring to Fig. 1, reference symbol Gx denotes a feed guide mechanism, and Gy, a discharge guide mechanism. A patrone holding section 51, a feed roller 52, and a cutter 53 are arranged at an inlet port of the supply guide mechanism Gx. The patrone holding section 51 holds a patrone 50 housing a film as a photosensitive material to be processed. The feed roller 52 feeds the film extracted from the patrone 50. The cutter 53 is operated when the film is entirely extracted from the patrone 50. A drying mechanism for drying a discharged, processed photosensitive material with, e.g., hot air, is arranged on the outlet port of the discharge guide mechanism Gy.

In the above arrangement, the loop of each guide path forming element G need not strictly extend along the outer surface of the column P, but can be arcuated such that it does not interfere with the travel of the photosensitive material. Therefore, the term "column" must be understood widely to include various columnar members having arcuated outer surfaces.

The term "coil" does not indicate only those having predetermined pitch and diameter, but can also indicate those whose lead angle or diameter in a given guide path forming element changes, like the above-described coil including a portion with a lead angle of 0. All the guide path forming elements used in the present invention need not have the same shape, and forming elements having different shapes can be preferably used. For example, in the case of Fig. 1, the guide path forming element G4 has a larger lead angle than those of the forming elements G1 to G3.

With the device described above, a photosensitive material convey path which is arcuated substantially helically is formed in the processing bath 10 by the guide groove forming elements G arranged adjacent to each other through circumferential gaps, and convey rollers arranged in the region where the convey force acts by the circumferential gap. Each guide path forming element G does not exceed a single turn of the coil, and the convey force is applied on the photosensitive material by the convey rollers at every turn. Therefore, the guided photosensitive material is reliably moved along the arcuated convey path constituted by the guide path forming elements.

Each guide path forming element G guides the photosensitive material by receiving two sides of the material with the guide grooves in its projecting ridges. The photosensitive material is guided while its surface is exposed. A portion of each guide path forming element G including at least a lower half portion thereof is located under the liquid level of the processing bath 10. Therefore, the photosensitive material which is guided through this lower half portion of the forming element G travels while it is immersed in the processing, thereby allowing required process. In the case shown in the drawings, the photosensitive material is color-developed, bleached/fixed, and stabilized when it passes through the lower half portions of the guide path forming elements G1 to G4, G5 to G8, and G9 to G11, respectively, thereby achieving process.

According to the present invention, since a helical photosensitive material path is formed as a whole, the density of the photosensitive material path in the processing bath becomes high, thus setting a long path in the processing bath. Therefore, required process can be performed at a high

efficiency with a small processing bath. Furthermore, since the photosensitive material path need not have a portion of a small radius of curvature, it does not undesirably deform a photosensitive material, thereby conveying the photosensitive material quite smoothly.

A trailing end of a given guide path forming element and a leading end of the following guide path forming element, that oppose each other through a circumferential gap of the continuous, adjacent guide path forming elements G, are aligned on a straight line, and convey rollers, whose convey force acts on the circumferential gap, are provided commonly for the trailing and leading ends of the given and following guide path forming elements G. Therefore, the convey force can be caused to act on the photosensitive material at every turn of the helical path with a quite simple arrangement. As a result, the photosensitive material to be processed can be reliably conveyed, as described above, and the overall device can be made inexpensive. In this arrangement, the lead angle of the coil at the circumferential gap is zero and is different from those at other path portions. Therefore, the lead angles are different when the photosensitive material is conveyed through the circumferential gap and through the other path portion, and accordingly the photosensitive material is slightly deformed. However, this change in lead angle is snall, and a deformation in the photosensitive material for absorbing the change in lead angle is found only when a considerably long photosensitive material is assumed. Therefore, the photosensitive material may not be damaged and the smooth convey does not suffer in practice.

When the device of the present invention is used, it is sometimes preferable to connect a leader on a leading end of a photosensitive material to be processed. In this case, since the convey force of the convey rollers acts at every turn of the helical path, the leader may have a length slightly larger than a length corresponding to the single turn.

Figs. 7A and 7B show modification of a guide path forming member B preferably used in the present invention. In the guide path forming member B shown in Fig. 7A, projecting ridges 61, a gap therebetween is smaller than that of the ridges 21 on one surface of the substrate 20, are formed in the other surface of the substrate 20 and extend in the longitudinal direction of the substrate 20. Guide grooves 62 similar to those described above are formed in the opposing inner surfaces of the projecting ridges 61. In the guide path forming member B shown in Fig. 7B, a guide path forming member is formed on one side of the substrate integrally with another guide path forming member having a different guide width. More specifically, a substrate 63 is formed in the substrate 20 along its widthwise direction, and one of projecting ridges 64 formed with guide grooves 65 therein is integral with one projecting ridge 21. With such a guide groove forming member having a plurality of guide paths of different guide widths, even when a plurality of types of photosensitive materials having different widths are used, a photosensitive material processing device can perform predetermined process by selecting a suitable path.

Claims

1. A photosensitive material processing device comprising

a processing liquid bath containing a processing liquid,

a plurality of long arcuated guide path forming elements, arranged in said processing liquid bath along a longitudinal direction thereof, for guiding a belt-like photosensitive material, each of said guide path forming elements having, in two sides thereof, guide grooves for slidably guiding the photosensitive material, and one and the other ends deviated along the longitudinal direction of said processing liquid bath, and one end of one of two adjacent guide path forming elements and the other end of the remaining one thereof oppose each other to be perpendicular to the longitudinal direction of said processing liquid bath, and

photosensitive material conveying means arranged in a region formed between one end of a given guide path forming element and the other end of the following guide path forming element at an upper portion of said processing liquid bath, wherein

said plurality of guide path forming elements constitute a helical photosensitive material guide path.

2. A device according to claim 1, wherein said guide path forming elements are helically bent so as to be wound on an outer surface of an imaginary column.

3. A device according to claim 1, wherein a deviation in the longitudinal direction between one and the other ends of said guide path forming element varies.

4. A device according to claim 1, wherein at least lower half portions of said guide path forming elements are immersed in said processing liquid bath.

5. A device according to claim 1, wherein a gap between said adjacent two guide path forming elements varies.

6. A device according to claim 1, wherein each of said guide path forming elements has guide grooves, that guide the photosensitive material, having different widths on one and the other surfaces thereof.

7. A device according to claim 1, wherein each of said guide path forming elements has at least two grooves, that guide the photosensitive material, having different widths on one surface thereof.

8. A device according to claim 1, wherein said processing liquid bath is divided into a plurality of processing liquid baths.

9. A device according to claim 1, wherein said conveying means comprises a pair of rollers arranged to sandwich the photosensitive material.

10. A device according to claim 1, wherein either of said pair of rollers has rubber O-rings spaced apart from each other in the axial direction.

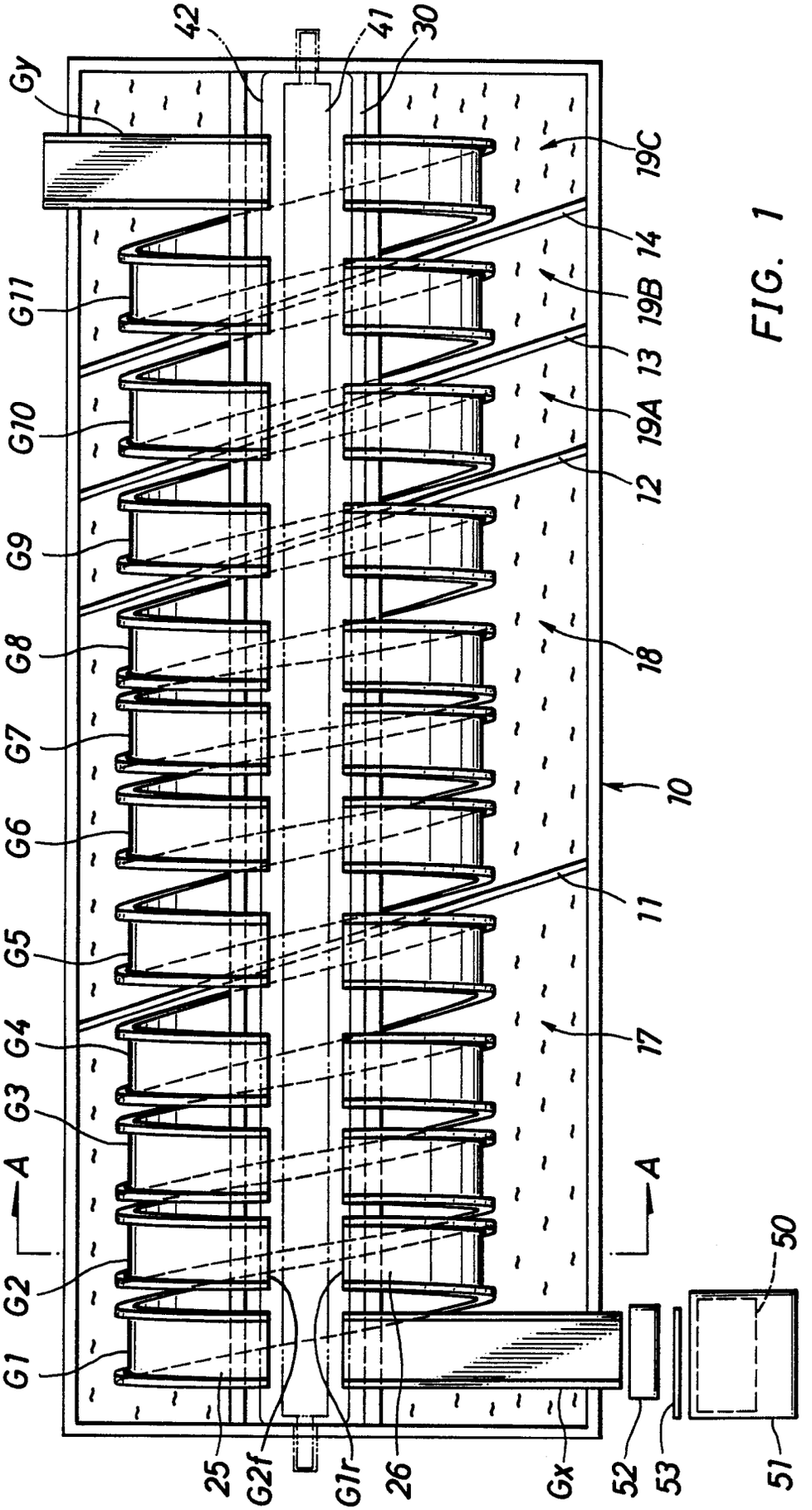

42
41
30
Gy
19C
14
19B
13
19A
12
18
10
11
17
A
A
G11
G10
G9
G8
G7
G6
G5
G4
G3
G2
G1
25
G2f
G1r
26
Gx
52
53
50
51

FIG. 1

FIG. 2A

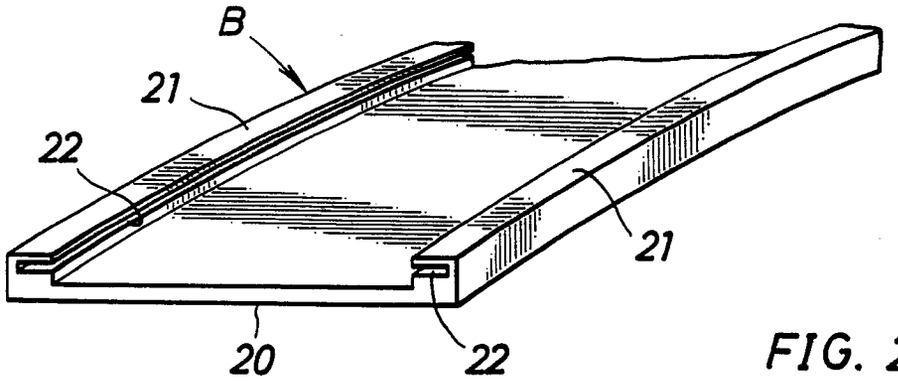


FIG. 2B

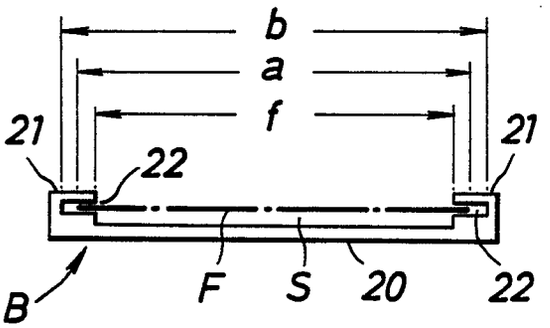


FIG. 3

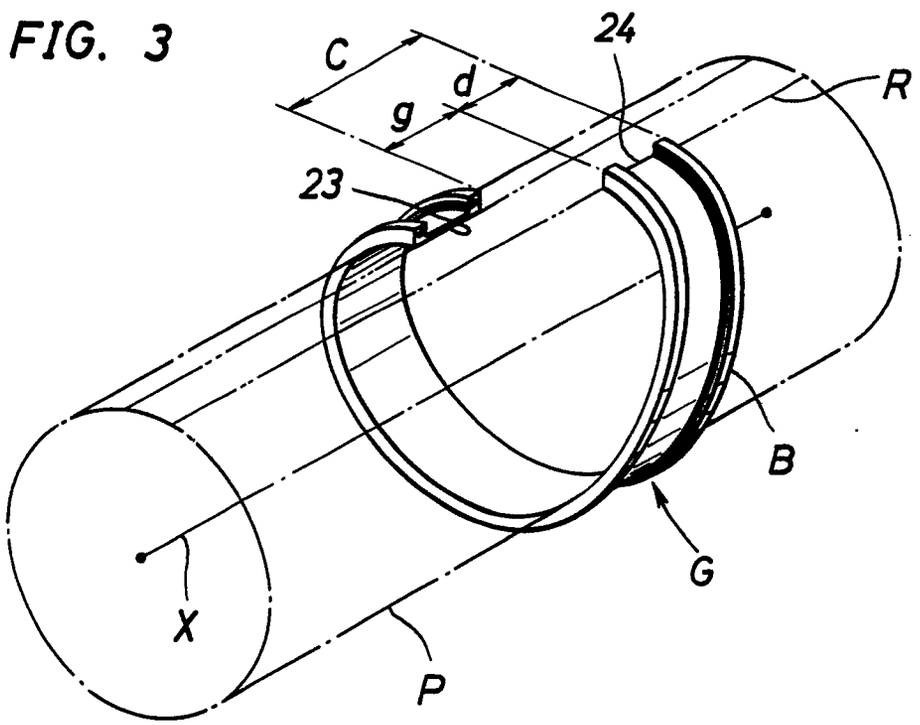


FIG. 4

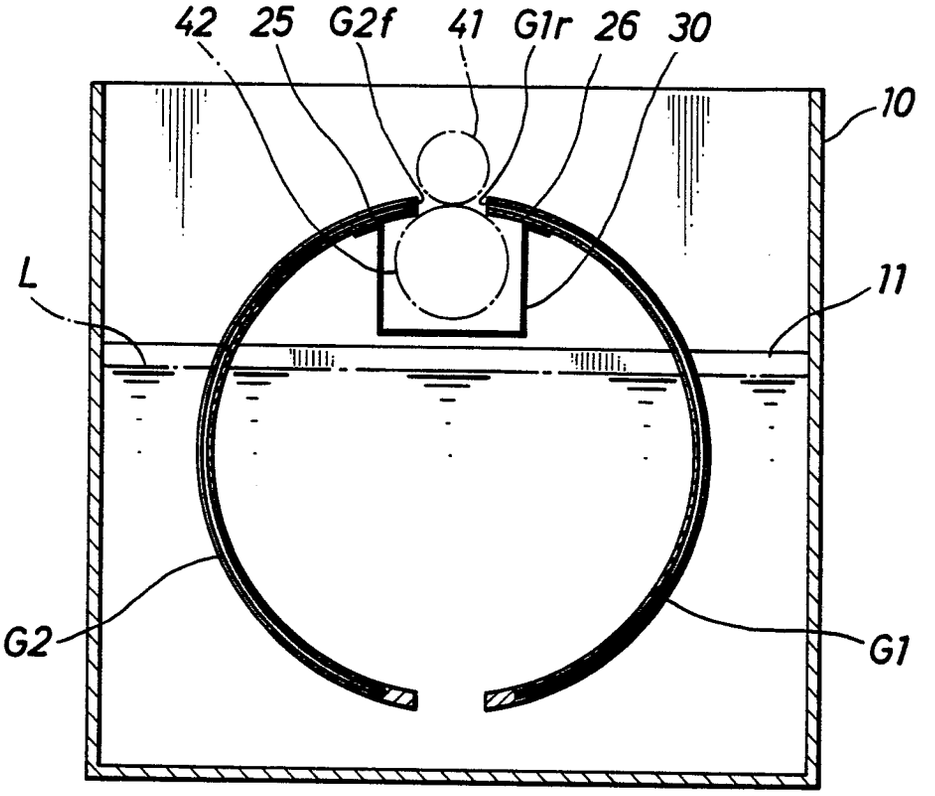

42
25
G2f
41
G1r
26
30
10
L
11
G2
G1

FIG. 5

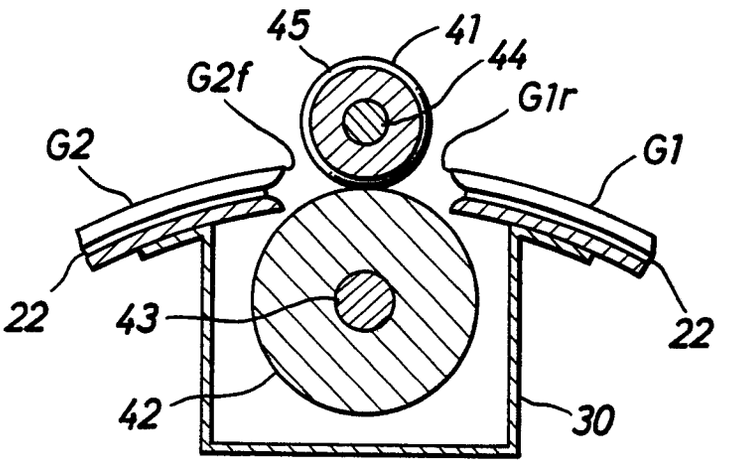

45
41
44
G2f
G1r
G2
G1
22
43
22
42
30

FIG. 6

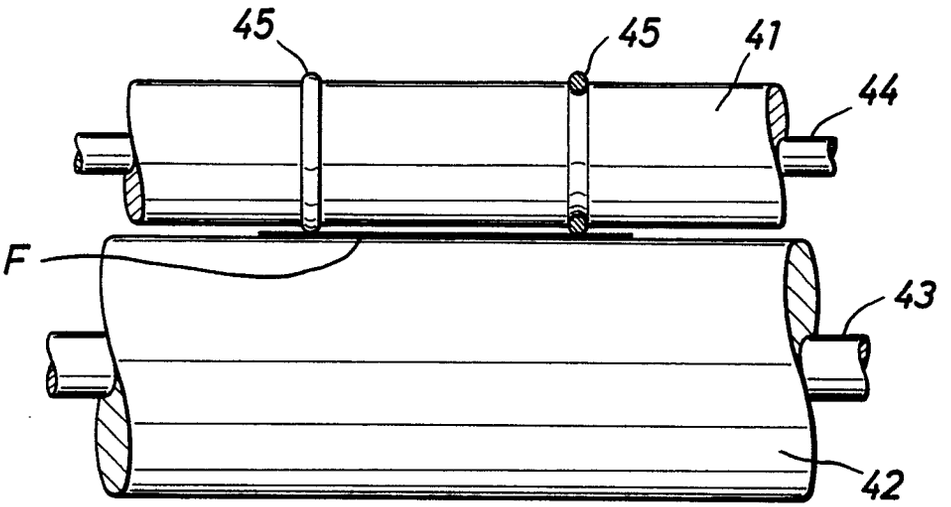


FIG. 7A

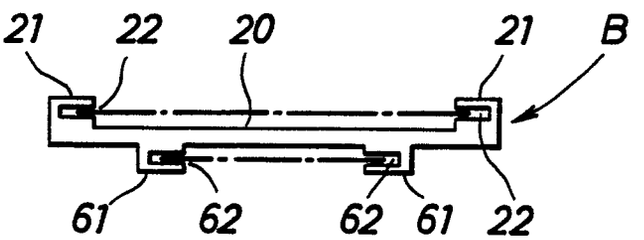
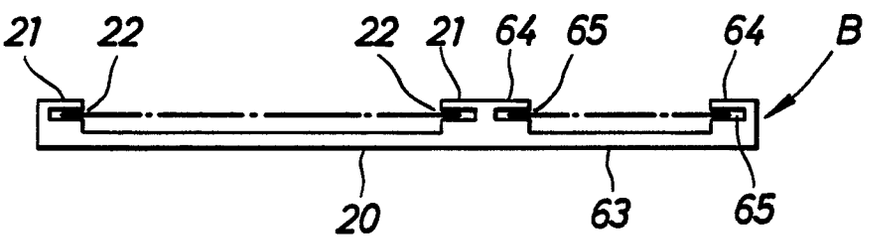


FIG. 7B



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EUROPEAN SEARCH REPORT

Application Number

EP 87 11 7341

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.4)
X	US-A-3 662 665 (L.A. MEEUSSEN) * Columns 2-4; figures 1-7 * ---	1,2,4,8	G 03 D 3/13
X	FR-A-1 057 550 (A.V.L.C. DEBRIE) * Pages 1,2; figures * -----	1,2,4,8,9	

TECHNICAL FIELDS SEARCHED (Int. Cl.4)

G 03 D 3/13

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	14-03-1988	BOEYKENS J.W.

CATEGORY OF CITED DOCUMENTS

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