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(72) Inventors:
• **BARBUI, Daniele**
20025 Legnano, MILANO (IT)
• **BARBUI, Maurizio**
20025 Legnano, MILANO (IT)

(74) Representative: **Leihkauf, Steffen Falk et al**
Jacobacci & Partners S.p.A.
Via Senato, 8
20121 Milano (IT)

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(71) Applicant: **ACE DI BARBUI DAVIDE & FIGLI S.R.L.**
20025 Legnano, Milano (IT)

(54) **PRINTING UNIT FOR ROTOGRAVURE PRINTING**

(57) A printing unit (1) for the rotogravure printing of a sheet or roll material (74), comprising: a printing roller (20), defining a printing roller rotation axis (22) and an outer printing roller lateral surface (21); a pressure roller (10) comprising a pressure roller body (11) and a pressure roller sleeve (30) which is fitted, or fittable, onto said pressure roller body (11), said pressure roller body (11) defining a pressure roller rotation axis (12) and a pressure roller body lateral surface (13); said pressure roller sleeve (30) having a tubular shape defining an outer sleeve lateral surface (31) and an inner sleeve lateral surface (33), said pressure roller sleeve (30) comprising an outer layer (32) made of elastomeric material delimited by said outer sleeve lateral surface (31); pressing means (60) for pressing said pressure roller (10) against said printing roller (20), so that a rotation of said pressure roller (10) and of said printing roller (20) is capable of feeding the sheet or roll material (74) interposed between said outer printing roller lateral surface (21) and said outer sleeve lateral surface (31) according to a feeding direction (73) of the material (74); an electrostatic printing aid apparatus (50) associated with said pressure roller (10) and configured to transmit electrostatic charges having a first electrical polarity to said outer lateral surface (31) of said sleeve (30); an electrostatic bar (110) arranged at the outlet with respect to said pressure roller (10) according to said feeding direction (73) of the material (74), and adapted to face said material (74), wherein said electrostatic bar (110) is configured to transmit electrostatic charges having a second electrical polarity opposite to the first electrical polarity to said material (74), so as to

neutralize residual electric charges having the first electrical polarity, which remained associated with said material (74) downstream of said pressure roller (10).

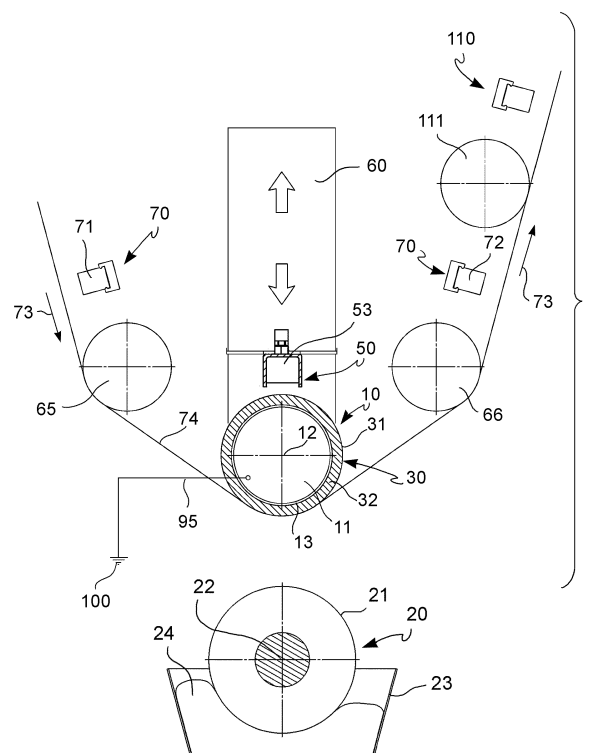


FIG. 2

Description

Field of the invention

[0001] The present invention relates to a printing unit for rotogravure printing comprising a pressure roller adapted to be pressed against a printing roller, with the interposition therebetween of a sheet material to be printed, for example wound in a roll. Both the pressure roller and the printing roller are configured to rotate about the axis thereof, feeding the sheet or roll material therebetween during printing. The pressure roller is coated with a coating layer, or sleeve, made of elastomeric material which is electrostatically charged by an electrostatic printing aid apparatus.

Background art

[0002] Rotogravure printing is a direct printing technique for printing a sheet or roll material, in particular, a strip material.

[0003] Such technique involves a pressure roller and a printing roller, both rotating about the rotation axes thereof, and pressed against each other, so that they may rotate together, and so as to feed and print during the rotation, a material interposed therebetween.

[0004] The printing roller has an outer surface, generally cylindrical, having a plurality of grooves or cells, corresponding to a figure to be printed on the sheet or roll material, and adapted to receive within them respective quantities of ink to be transferred to the surface of the sheet or roll material.

[0005] The ink is generally liquid and contained in an ink tank in which a portion of the lateral surface of the printing roller is immersed, so that the outer printing roller surface may be progressively wetted into the ink during the rotation thereof.

[0006] The excess of ink on the outer printing roller surface is generally removed by using a blade, or doctor blade, arranged so as to scrub such outer printing roller surface of the printing roller and remove the ink which remains outside the grooves or cells.

[0007] Thereby, only the grooves, or cells, contain the ink, while the rest of the surface of the printing roller is cleaned by the doctor blade.

[0008] Generally, the printing roller is coated with a copper layer which defines the engraved outer surface thereof.

[0009] The pressure roller is coated with a coating layer, or sleeve, made of elastomeric material.

[0010] The elasticity of the coating material of the pressure roller which is pressed against the printing roller, with the sheet or roll material to be printed interposed, allows pressing the sheet or roll material to be printed on the grooves, or cells, of the printing roller, so as to transfer the ink contained in such cells to the sheet or roll material to be printed.

[0011] To facilitate the transfer of the ink, the technique

of providing the printing unit with an electrostatic printing aid apparatus, associated with the pressure roller and having the function of distributing an electrostatic charge on the pressure roller outer sleeve lateral surface, is known.

[0012] The presence of such surface charge has the purpose of generating an electric field between the pressure roller and the printing roller, through the sheet or roll material to be printed, interposed therebetween.

[0013] Such electric field helps to polarize the ink contained in the grooves, or cells, of the printing roller, to attract it against the sheet or roll material to be printed, considerably improving the ink coverage of the printed areas and, therefore, the resulting print quality, which is consequently more detailed and precise.

[0014] A known technique involves the use of a pair of anti-static bars, of which one upstream and the other one downstream of the pressure roller, of which the upstream one is adapted to neutralize the sheet or roll material to be printed, before it reaches the pressure roller, and the other one has the purpose of neutralizing the sheet or roll material, at the outlet with respect to the pressure roller.

[0015] Such inlet and outlet anti-static bars have a plurality of electrodes operatively facing the sheet or roll material, and are supplied, by means of a special electrostatic generator, with polarity alternating over time, in an attempt to remove both the positive and the negative charges.

[0016] However, this known technique has proved unsatisfactory since, although the anti-static outlet bar neutralizes a large part of the electrostatic charges which remained associated with the sheet or roll material, it is not capable of neutralizing the polarization of the ink.

[0017] In fact, the electrostatic printing aid apparatus, by means of the electric field which it generates, strongly polarizes the ink to attract it against the surface of the sheet or roll material to be printed, and this ink remains substantially polarized even after the passage in front of the anti-static outlet bar.

[0018] The ink remains polarized with electrostatic charges with a polarity equal to the charges distributed by the electrostatic printing aid apparatus associated with the pressure roller.

[0019] A rotogravure printing line generally includes a drying oven arranged downstream with respect to the printing unit, which has the purpose of drying the ink just deposited on the sheet or roll material by means of the printing unit.

[0020] It has been found that the drying of the ink blocks the ink itself in the polarized form, therefore, the printed product remains permanently polarized.

[0021] Various disadvantages follow, such as, for example, the electrostatic attraction between the various layers of the sheet or roll material, adhesions, folds, dust attraction, reduced product quality.

[0022] Therefore, the need is felt to provide a printing unit for rotogravure printing capable of supplying a print-

ed sheet or roll material, in particular strip material, with high final quality, which is effectively free of electrostatic charge.

Summary of the invention

[0023] It is the object of the present invention to devise and provide a printing unit for rotogravure printing, which allows satisfying the aforesaid needs and to at least partially obviate the drawbacks mentioned above with reference to the background art.

[0024] In particular, it is an object of the present invention to provide a rotogravure printing unit capable of supplying a printed sheet or roll material, in particular strip material, with high final quality, which is effectively free of electrostatic charge.

[0025] Even more in particular, it is an object of the present invention to provide a rotogravure printing unit capable of neutralizing the polarization of the ink downstream of the pressure roller, before the drying thereof.

[0026] It is another object of the present invention to provide a rotogravure printing unit capable of supplying a printed sheet or roll material which is, at the same time, free of electrostatic charges distributed on the surface thereof and free of residual ink polarization.

[0027] It is another object of the present invention to provide a rotogravure printing unit capable of supplying a printed sheet or roll material, free of any residual capability to electrostatically attract dust particles.

[0028] It is a further object of the present invention to provide a rotogravure printing unit capable of supplying a printed sheet or roll material having the faces of such material free of electrostatically adhered powders.

Brief description of the drawings

[0029] The invention will be illustrated below with the description of some of the embodiments thereof, given by way of explanation and not by way of limitation, with reference to the accompanying drawings in which:

- Figure 1 shows a printing unit in accordance with the invention comprising an electrostatic printing aid apparatus configured to transmit electrostatic charges having a first electrical polarity, for example of the direct charging type, to the pressure roller sleeve, and an electrostatic bar arranged at the outlet with respect to said pressure roller, configured to transmit to said sheet or roll material electrostatic charges having a second electrical polarity opposite to the first electrical polarity;
- Figure 2 shows a diagrammatic view of a printing unit according to the invention, in which the electrostatic printing aid apparatus is of the top-loading type, and in which there is a pair of anti-static bars, arranged at the inlet and outlet with respect to the pressure roller, respectively, of which the anti-static outlet bar is interposed between the electrostatic

printing aid apparatus and the electrostatic bar;

- Figure 3 shows a perspective view of the printing unit of Figure 2;
- Figure 4 shows a longitudinal sectional view of an example of pressure roller adapted to be used in association with an electrostatic printing aid apparatus of the top-loading type;
- Figure 5 shows a diagrammatic view of a printing unit in accordance with the invention, in which the electrostatic printing aid apparatus is of the direct charging type and is arranged axially with respect to the pressure cylinder beyond the support, therefore not visible in the Figure;
- Figure 6 shows a perspective view of the printing unit of Figure 5.

Description of the preferred embodiments

[0030] With reference to the Figures, a printing unit for the rotogravure printing of a sheet or roll material, according to the invention, is overall indicated with reference numeral 1.

[0031] The printing unit 1 comprises a printing roller 20, a pressure roller 10, pressing means 60 for pressing said pressure roller 10 against said printing roller 20, an electrostatic printing aid apparatus 50 associated with said pressure roller 10, an electrostatic neutralization bar 110 arranged at the outlet with respect to said pressure roller 10 according to a feeding direction 73 of the material 74.

[0032] The printing roller defines a printing roller rotation axis 22 and an outer printing roller lateral surface 21.

[0033] The pressure roller 10 comprises a pressure roller body 11 and a pressure roller sleeve 30 which is fitted, or fittable, onto the pressure roller body 11.

[0034] The pressure roller body 11 defines a rotation axis of the pressure roller 12 and a pressure roller body lateral surface 13.

[0035] The pressure roller sleeve 30 has a tubular shape defining an outer sleeve lateral surface 31 and an inner sleeve lateral surface 33.

[0036] The pressure roller sleeve 30 comprises an outer layer 32 made of elastomeric material delimited by the outer sleeve lateral surface 31.

[0037] In accordance with an embodiment, the elastomeric material has a hardness of between 50 and 95 ShoreA (ShA), preferably of between 70 and 95 ShoreA (ShA), even more preferably of about 75 ShoreA.

[0038] In accordance with an embodiment, the elastomeric material is selected from synthetic rubber and natural rubber.

[0039] The pressing means 60 for pressing the pressure roller 10 against the printing roller 20 are configured so that a rotation of the pressure roller 10 and of the printing roller 20 is capable of feeding the sheet or roll material 74 interposed between said outer printing roller lateral surface 21 and said outer sleeve lateral surface 31 according to a feeding direction 73 of the material 74.

[0040] The electrostatic printing aid apparatus 50 associated with said pressure roller 10 is configured to transmit electrostatic charges having a first electrical polarity to said outer lateral surface 31 of said sleeve 30.

[0041] The electrostatic neutralization bar 110 is arranged at the outlet with respect to said pressure roller 10 according to said feeding direction 73 of material 74, and is adapted to face said material 74.

[0042] The electrostatic bar 110 is configured to transmit electrostatic charges having a second electrical polarity opposite to the first electrical polarity to said material 74, so as to neutralize residual electric charges having the first electrical polarity, which remained associated with said material 74 downstream of said pressure roller 10.

[0043] In accordance with an embodiment, the electrostatic bar 110 comprises at least one row of electrodes and an electrostatic generator connected to said electrodes.

[0044] In accordance with an embodiment, the electrodes are adapted to supply a preset electrical voltage and to be crossed by a preset current, during use.

[0045] In accordance with an embodiment, the preset electrical voltage supplied by the electrodes of the electrostatic neutralization bar 110 is preferably lower than 8 kVolts, even more preferably between 6 kVolts and 8 kVolts.

[0046] In particular, the preset electrical voltage supplied by the electrodes of the electrostatic neutralization bar 110 is preferably lower than the preset electrical voltage presented to the electrodes of the non-contact electrostatic charge bar 53, which will be described below.

[0047] Such voltage of the electrostatic neutralization bar 110 may be measured by means of a high voltage probe, placed in electrical contact with said electrodes and capable of measuring the voltage difference between said electrodes and the ground.

[0048] The current may be measured by means of a tester in contact with said electrodes.

[0049] In accordance with an embodiment, the preset voltage and/or the preset current are adjustable, for example on the basis of the residual charge intensity left distributed on the printed sheet or roll material, or on the basis of the charge intensity distributed on the pressure roller.

[0050] In accordance with an embodiment, the electrostatic generator is supplied at low voltage, preferably at about 24 Volts.

[0051] Thereby, the electrical cables which carry the power supply to the electrostatic bar 110 are supplied at low voltage, thus avoiding the risks deriving from a high voltage.

[0052] In accordance with one embodiment, the charge generator is incorporated within said electrostatic bar 110.

[0053] Such charges, distributed on the outer sleeve lateral surface 31, have the function of electrostatically attracting the ink collected in the grooves, or small cells,

of the outer lateral surface of the printing roller, which is arranged on the opposite side of the pressure roller with respect to the sheet material.

[0054] Thereby, the ink is attracted towards the surface of the sheet material to be printed, facing the printing roller.

[0055] Due to the electric field generated by the electrostatic charges deposited on the outer lateral surface of the sleeve of the pressure roller, the ink collected in the small cells of the printing roller is polarized.

[0056] In accordance with an embodiment, the electrostatic printing aid apparatus 50 comprises a non-contact, or top-loading, electrostatic charge bar 53, configured to transmit the electrostatic charges having the first electrical polarity from the exterior of the pressure roller to the outer lateral surface 31 of the sleeve 30, avoiding an electrical contact with said outer lateral surface 31 of said sleeve 30.

[0057] In accordance with an embodiment, in the case of an electrostatic printing aid apparatus 50 of the top-loading type, the outer sleeve layer 32 made of elastomeric material is semiconductive.

[0058] Semiconductive elastomeric material means an elastomeric material which has an electrical resistance, and therefore a conductivity, of a preset value.

[0059] The resistance may be considered as the surface resistance between two points of the outer sleeve lateral surface, or as the insulation resistance between the outer sleeve lateral surface and the inner sleeve lateral surface.

[0060] Both the surface resistance value and the insulation resistance value are chosen according to the printing needs.

[0061] The elastomeric material is made semiconductive in a production step thereof, for example by mixing conductive particles, for example carbon, in the elastomeric material.

[0062] In the case of an electrostatic printing aid apparatus of the non-contact, or top-loading, type 51 said inner sleeve lateral surface 33 may comprise, in accordance with an embodiment, an electrically conductive surface portion 96 electrically connected to said outer sleeve layer 32, for example, by means of an electric resistance element 97, so that when the sleeve 30 is fitted on the pressure roller body 10, said electrically conductive surface portion 96 is in electrical contact with a corresponding conductive portion of said pressure roller body lateral surface 13.

[0063] In accordance with an embodiment, the conductive portion of said pressure roller body lateral surface 13 is connected with an electrical ground connection 95 to earth 100.

[0064] This electrical ground connection 95 allows any possible electrostatic charge in excess, distributed on the outer sleeve lateral surface 31, to be discharged or dispersed to earth.

[0065] In other words, the semiconductivity of the sleeve allows the charges to cross the thickness of the

sleeve 30 from the outer sleeve lateral surface 31 towards the roller body lateral surface 13, and then to earth 100 by means of the electrical ground connection 95.

[0066] In accordance with an embodiment, said electrically conductive surface portion 96 is the radially internal surface of a conductive annular element 96' coaxial with the tubular sleeve 30, preferably incorporated in said inner sleeve layer 98.

[0067] In accordance with an embodiment, the electrically conductive surface portion 96 is flush with said inner sleeve lateral surface 33.

[0068] In accordance with an embodiment, the conductive annular element is made of carbon.

[0069] In the case of an electrostatic printing aid apparatus of the non-contact, or top-loading, type 51, in accordance with an embodiment, the non-contact, or top-loading, electrostatic charge bar 53 comprises charge electrodes which face the outer sleeve lateral surface and at a minimum distance therefrom.

[0070] Thereby, said electrostatic charge bar 53 is adapted to transmit a quantity of electrostatic charge to the outer lateral surface 31 of said sleeve 30, avoiding direct contact with such outer lateral surface 31 of said sleeve 30.

[0071] Such electrodes of the non-contact electrostatic charge bar 53 of the electrostatic printing aid apparatus are adapted to present a preset electrical voltage and to be crossed by a preset current during use.

[0072] In accordance with an embodiment, such preset electrical voltage presented to the electrodes of the non-contact electrostatic charge bar 53 is between 9 kVolts and 11 kVolts, preferably it is about 10 kVolts.

[0073] Such voltage may be measured by means of a high voltage probe, placed in electrical contact with said discharge electrodes and capable of measuring the voltage difference between said electrodes and the ground.

[0074] The current may be measured by means of a tester in contact with said electrodes.

[0075] In accordance with an embodiment, the non-contact electrostatic charge bar 53 of the electrostatic printing aid apparatus comprises an electrostatic charge generator connected to said electrodes and arranged inside said electrostatic charge bar, said generator being preferably supplied at low voltage, for example at 24 Volts.

[0076] Thereby, the electrical supply cables connected to the electrostatic charge bar 53 are supplied at low voltage, thus avoiding the risks on the operational safety of the machine which, instead, would be caused by high voltage.

[0077] In accordance with an embodiment, the electrostatic printing aid apparatus 50 comprises an electrostatic charge transmitter of the direct charging type 51, configured to transmit, to the outer lateral surface 31 of the sleeve 30, the electrostatic charges having the first electrical polarity from the interior of the pressure roller 10 towards the exterior of the pressure roller 10, through said sleeve 30, by means of a direct electrical connection

between the electrostatic charge transmitter and the pressure roller body lateral surface 13.

[0078] In accordance with an embodiment, in the case of an electrostatic printing aid apparatus 50 comprising an electrostatic charge transmitter 51 of the direct charging type, the outer sleeve layer 32 made of elastomeric material is preferably conductive.

[0079] According to such embodiment, the electrostatic charge generator is preferably integrated inside the pressure roller 10, or arranged axially in contact with said pressure roller 10, or arranged at an axial end of the pressure roller 10.

[0080] In accordance with an embodiment, the electrostatic charge generator of the electrostatic charge transmitter of the direct charging type 53 is adapted to be supplied at low voltage, preferably at about 24 Volts.

[0081] Thereby, the electrical supply cables connected to the electrostatic charge generator integrated inside the pressure roller are supplied at low voltage, thus avoiding the risks on the operational safety of the machine which, instead, may be caused by high voltage.

[0082] In accordance with an embodiment, the printing unit 1 comprises at least one anti-static outlet bar 72 interposed between the pressure roller 10 and the electrostatic bar 110.

[0083] In accordance with an embodiment, the anti-static outlet bar 72 comprises at least one row of electrodes and an electrostatic discharge generator, said electrodes being adapted to face said sheet or roll material 74 at the outlet with respect to said pressure roller 10, and adapted to be excited, by means of said generator, with electrostatic charges of alternating sign over time, so as to remove both the positive and the negative charges from the material 74 at the outlet with respect to the pressure roller 10.

[0084] In accordance with an embodiment, the electrostatic neutralization bar 110 is arranged downstream of the pressure roller and before a drying oven.

[0085] The electrostatic neutralization bar 110 is adapted to neutralize the ink before the drying thereof by means of the drying oven, and the drying oven is adapted to dry the ink after having been neutralized by means of the electrostatic bar 110.

[0086] In other words, the electrostatic neutralization bar 110 is interposed between the pressure roller 10 and the drying oven.

[0087] Preferably, the electrostatic bar 110 is interposed between the anti-static outlet bar 70 and the drying oven.

[0088] In accordance with an embodiment, the printing unit 1 comprises said drying oven.

[0089] In accordance with an embodiment, each printing unit 1 on a printing line having a plurality of printing units 1 in sequence, comprises a respective electrostatic neutralization bar 110 arranged downstream of the pressure roller 10 and before a drying oven.

[0090] In accordance with an embodiment, each printing unit 1 on a printing line having a plurality of printing

units 1 in sequence, comprises a respective electrostatic neutralization bar 110 interposed between the anti-static outlet bar 70 and the drying oven.

[0091] In accordance with an embodiment, the printing unit 1 comprises at least one anti-static inlet bar 71 arranged at the inlet with respect to the pressure roller 10 according to the feeding direction 73 of the sheet or roll material 74.

[0092] In accordance with an embodiment, said anti-static inlet bar 71 comprises at least one row of electrodes and an electrostatic discharge generator, said electrodes being adapted to face said sheet or roll material 74 at the inlet with respect to the pressure roller 10, and adapted to be excited, by means of said generator, with electrostatic charges of alternating sign over time, so as to remove both the positive and the negative charges from the material 74 at the inlet with respect to the pressure roller 10.

[0093] According to an embodiment, the sheet or roll material 74 comprises a film, or a layer, made of polymeric material.

[0094] According to an embodiment, the sheet or roll material 74 comprises a paper layer and/or a fabric layer.

[0095] In accordance with an embodiment, the printing unit comprises a pair of anti-static bars 70, of which one anti-static inlet bar 71 is arranged at the inlet with respect to the pressure roller 10, and one anti-static outlet bar 72 is arranged at the outlet with respect to the pressure roller 10, proceeding according to said feeding direction 73, said anti-static inlet bar 71 and said anti-static outlet bar 72 being configured to remove the electrostatic charges from the sheet or roll material at the inlet and at the outlet of the pressure roller 10.

[0096] Preferably, the anti-static inlet bar 71 and/or the anti-static outlet bar 72 each comprise a respective electrostatic charge generator inside them.

[0097] In accordance with an embodiment, the anti-static inlet bar 71 and/or the anti-static outlet bar 72 are supplied at low voltage, preferably at about 24 Volts.

[0098] In accordance with an embodiment, the printing unit 1 comprises a guide roller 111 arranged upstream of the electrostatic bar 110, adapted to guide the sheet or roll material 74 at the inlet of the electrostatic bar 110.

[0099] In accordance with an embodiment, the guide roller 111 is interposed between the anti-static outlet bar 72 and the electrostatic bar 110.

[0100] In accordance with an embodiment, the printing unit 1 comprises at least one tensioning roller 65, 66, arranged on at least one side with respect to the pressure roller 10, adapted to press on the substrate, or sheet or roll material to be printed, so as to keep it tense.

[0101] The printing unit 1 preferably comprises two tensioning rollers 65, 66, arranged on opposite sides with respect to the pressure roller 10, adapted to press on the substrate, or sheet or roll material to be printed, so as to keep it tense.

[0102] In accordance with an embodiment, a first roller 65 of said two guide rollers is interposed between the

anti-static inlet bar 71 and the pressure roller 10, and a second roller 66 of said two guide rollers is interposed between the roller presser 10 and the anti-static outlet bar 72.

[0103] In accordance with an embodiment, each of said at least one tensioning roller 65, 66, or each of said two tensioning rollers 65, 66, has a rotation axis which is parallel to the rotation axis of the pressure roller 10.

[0104] According to another aspect of the present invention, the aforesaid purposes and advantages are fulfilled by a method for neutralizing the residual ink charges on a sheet or roll material 74, in particular, a strip material, at the outlet of a printing unit 1 as described above for the rotogravure printing of said material, comprising the steps of

- providing said printing unit 1 as described above;
- printing by means of said printing unit 1 said sheet or roll material 74,
- treating said sheet or roll material 74, at the outlet of the pressure roller 10, by means of said electrostatic neutralization bar 110.

[0105] In accordance with an embodiment, the method further comprises the steps of:

- providing an anti-static outlet bar 72 interposed between the pressure roller 10 and the electrostatic bar 110;
- treating the sheet or roll material 74 by means of said anti-static outlet bar 72 before said step of treating said sheet or roll material 74 by means of said electrostatic neutralization bar 110.

[0106] In accordance with an embodiment, the method further comprises the following steps:

- providing a drying oven arranged downstream of said electrostatic neutralization bar 110 with respect to a feeding direction of said sheet or roll material 74;
- drying said sheet or roll material 74 by means of said drying oven after said step of treating said sheet or roll material 74, at the outlet of the pressure roller 10, by means of said electrostatic neutralization bar 110.

[0107] Those skilled in the art may change and adapt the embodiments of the device described above, and replace elements with others which are functionally equivalent, in order to meet contingent needs, without thereby departing from the scope of the following claims. Each of the features described as belonging to a possible embodiment may be achieved independently of the other embodiments described.

[0108] It should be noticed that the Figures are not necessarily to scale.

[0109] All the features described herein may be combined according to any combination, except for the com-

binations in which at least some of such features are mutually exclusive.

Claims

1. A printing unit (1) for the rotogravure printing of a sheet or roll material (74), comprising:

- a printing roller (20), defining a printing roller rotation axis (22) and an outer printing roller lateral surface (21);

- a pressure roller (10) comprising a pressure roller body (11) and a pressure roller sleeve (30) which is fitted, or fittable, onto said pressure roller body (11), said pressure roller body (11) defining a pressure roller rotation axis (12) and a pressure roller body lateral surface (13); said pressure roller sleeve (30) having a tubular shape defining an outer sleeve lateral surface (31) and an inner sleeve lateral surface (33), said pressure roller sleeve (30) comprising an outer layer (32) made of elastomeric material delimited by said outer sleeve lateral surface (31);

- pressing means (60) for pressing said pressure roller (10) against said printing roller (20), so that a rotation of said pressure roller (10) and of said printing roller (20) is capable of feeding the sheet or roll material (74) interposed between said outer printing roller lateral surface (21) and said outer sleeve lateral surface (31) according to a feeding direction (73) of the material (74);

- an electrostatic printing aid apparatus (50) associated with said pressure roller (10) and configured to transmit electrostatic charges having a first electrical polarity to said outer lateral surface (31) of said sleeve (30);

- an electrostatic bar (110) arranged at the outlet with respect to said pressure roller (10) according to said feeding direction (73) of the material (74), and adapted to face said material (74), wherein said electrostatic bar (110) is configured to transmit electrostatic charges having a second electrical polarity opposite to the first electrical polarity to said material (74), so as to neutralize residual electric charges having the first electrical polarity, which remained associated with said material (74) downstream of said pressure roller (10).

2. A printing unit (1) according to claim 1, wherein said electrostatic bar (110) comprises at least one row of electrodes, and an electrostatic generator connected to said electrodes.

3. A printing unit (1) according to claim 2, wherein said electrodes are adapted to supply a preset electrical

voltage and to be crossed by a preset current, during use.

4. A printing unit (1) according to claim 3, wherein the preset voltage and/or the preset current are adjustable.

5. A printing unit (1) according to at least one preceding claim, wherein the electrostatic generator is supplied with low voltage, preferably about 24 Volts.

6. A printing unit (1) according to at least one preceding claim, wherein the charge generator is incorporated within said electrostatic discharge bar (110).

7. A printing unit (1) according to at least one preceding claim, wherein the electrostatic printing aid apparatus (50) comprises a non-contact, or top-loading, electrostatic charge bar (53), configured to transmit the electrostatic charges having the first electrical polarity from the exterior of the pressure roller to the outer lateral surface (31) of the sleeve (30), avoiding an electrical contact with said outer lateral surface (31) of said sleeve (30).

8. A printing unit (1) according to claim 7, wherein the outer sleeve layer (32) made of elastomeric material is semiconductive.

9. A printing unit (1) according to at least one claim from 1 to 6, wherein the electrostatic printing aid apparatus (50) comprises an electrostatic charge transmitter (51) of the direct charging type, configured to transmit, to the outer lateral surface (31) of the sleeve (30), the electrostatic charges having the first electrical polarity from the interior of the pressure roller (10) towards the exterior of the pressure roller (10), through said sleeve (30), by means of a direct electrical connection between the electrostatic charge transmitter and the pressure roller body lateral surface (13).

10. A printing unit (1) according to claim 9, wherein the outer sleeve layer (32) made of elastomeric material is conductive.

11. A printing unit (1) according to at least one preceding claim, comprising at least one anti-static outlet bar (72) interposed between said pressure roller (10) and said electrostatic bar (110), said anti-static outlet bar (72) comprising at least one row of electrodes and an electrostatic discharge generator, said electrodes being adapted to face said sheet or roll material (74) at the outlet with respect to said pressure roller (10), and adapted to be excited, by means of said generator, with electrostatic charges of alternating sign over time, so as to remove both the positive and the negative charges from the material (74) at

the outlet with respect to the pressure roller (10).

12. A printing unit (1) according to at least one preceding claim, comprising at least one anti-static inlet bar (71) arranged at the inlet with respect to the pressure roller (10) according to the feeding direction (73) of the sheet or roll material (74), said anti-static inlet bar (71) comprising at least one row of electrodes and an electrostatic discharge generator, said electrodes being adapted to face said sheet or roll material (74) at the inlet with respect to the pressure roller (10), and adapted to be excited, by means of said generator, with electrostatic charges of alternating sign over time, so as to remove both the positive and the negative charges from the material (74) at the inlet with respect to the pressure roller (10).

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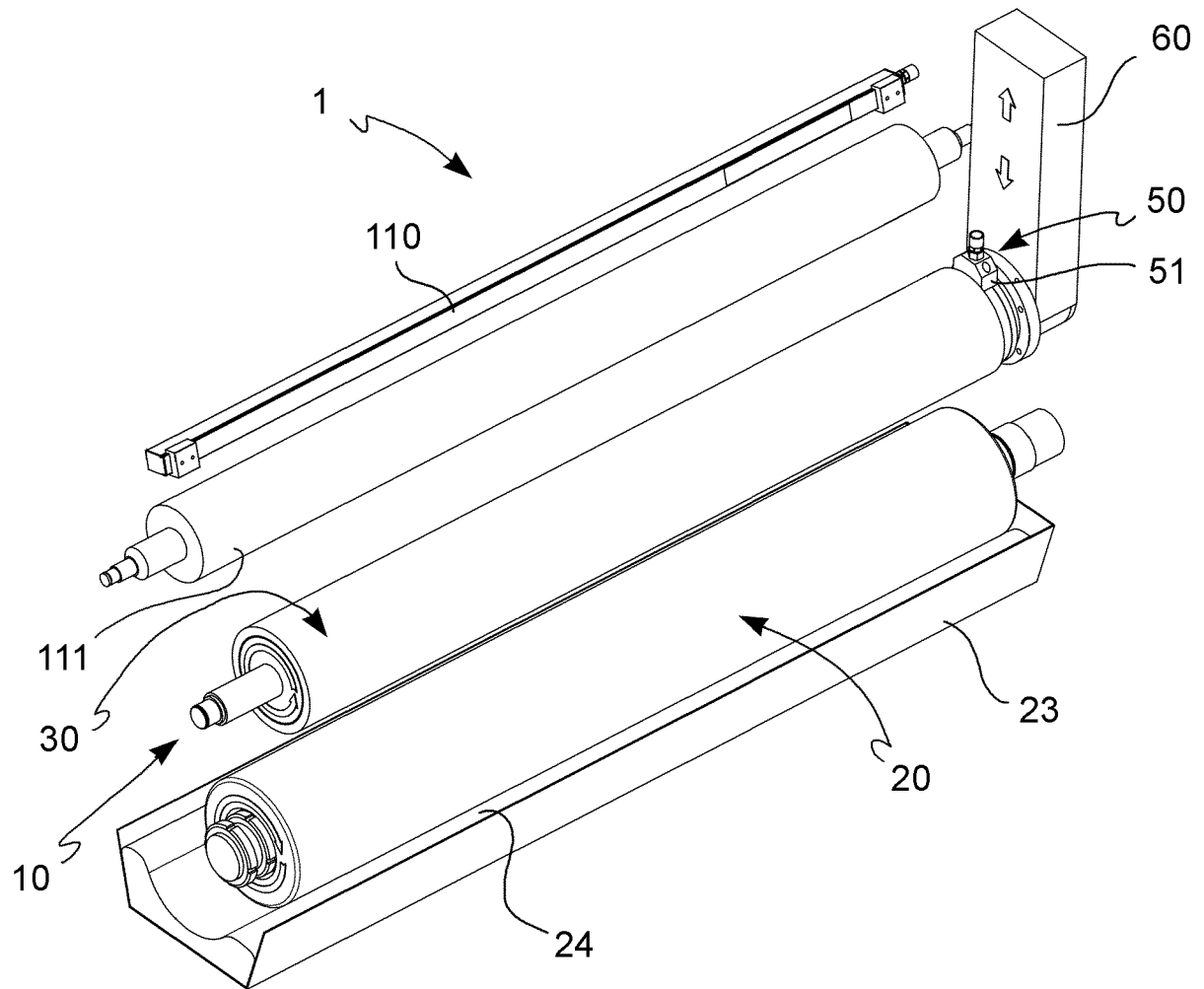


FIG. 1

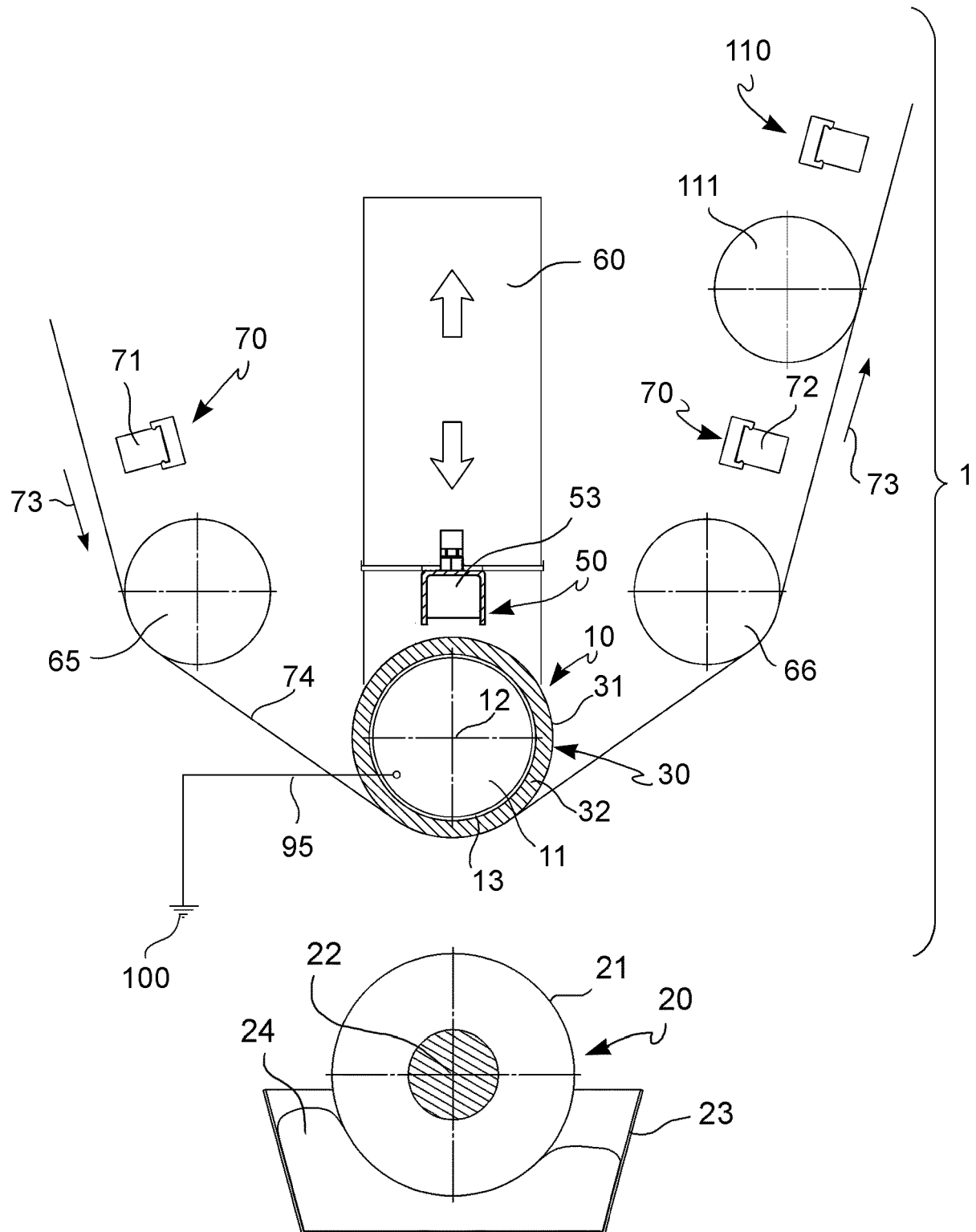


FIG. 2

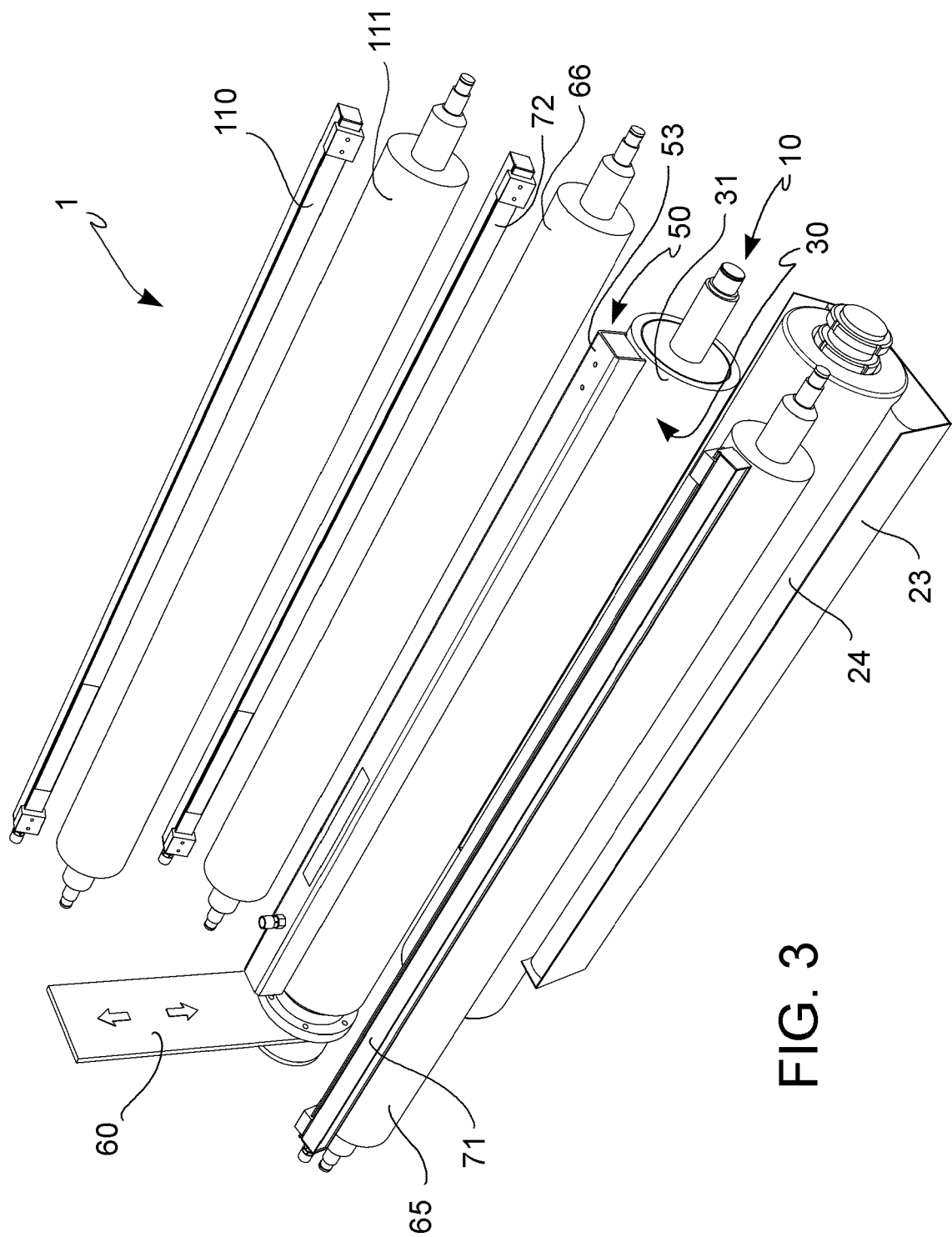


FIG. 3

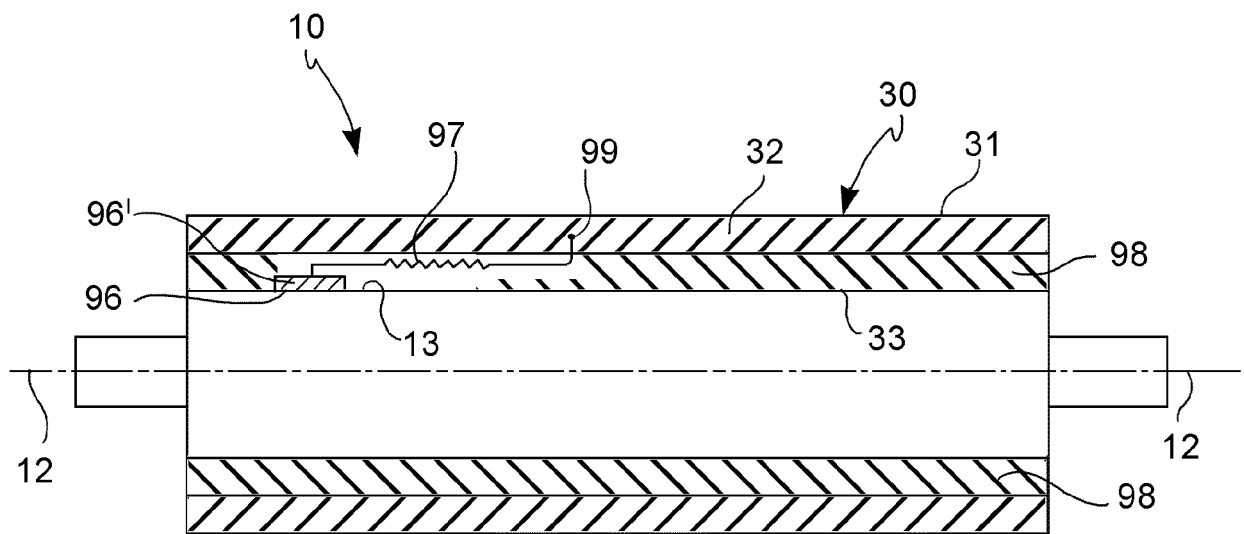


FIG. 4

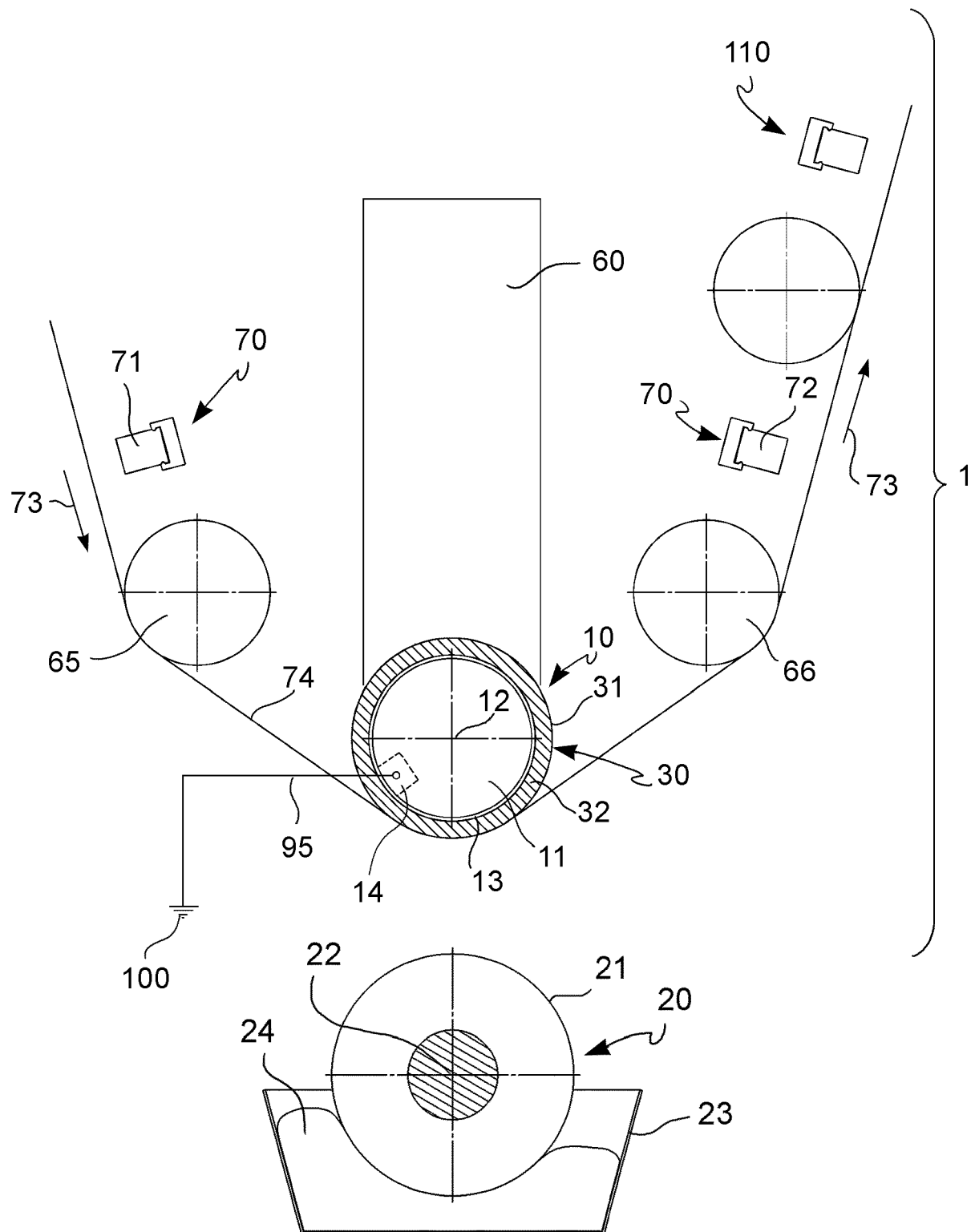


FIG.5

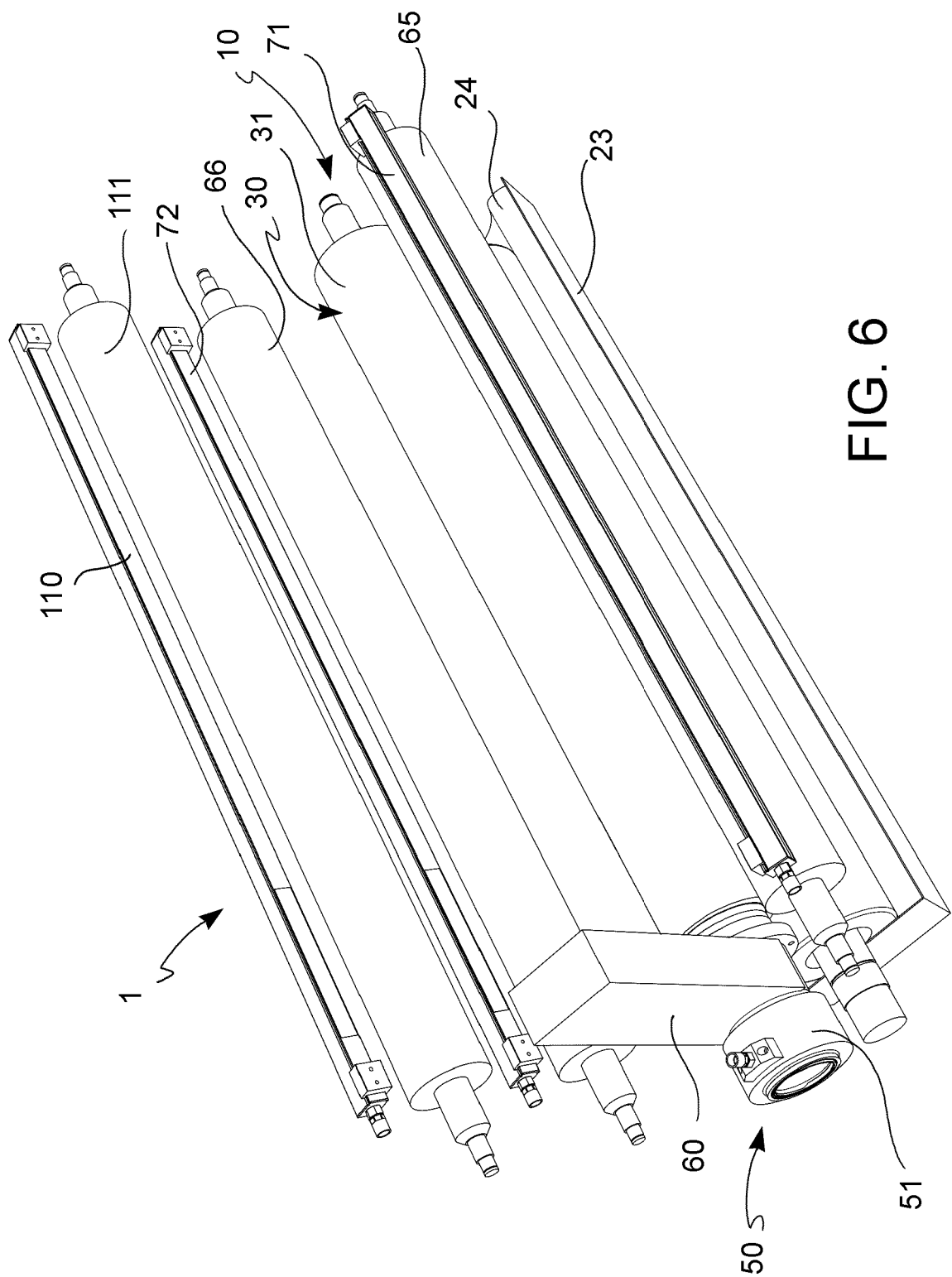


FIG. 6



EUROPEAN SEARCH REPORT

 Application Number
 EP 20 17 5984

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