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(54) **COATING DEVICE, CORRESPONDING COATING UNIT, MACHINE AND USE**

(57) Coating device (40, 42) for applying liquid to a web (W), the coating device comprising a coating liquid source (46), a liquid applicator roller (48) adapted to apply coating liquid (44) to a web, a transfer device (50) adapted to transfer the coating liquid from the coating liquid source to the applicator roller. The transfer device is adapted to apply the coating liquid according to a first defined application form onto the liquid applicator roller (48), and to apply the coating liquid according to a second defined application form onto the liquid application roller (48), different from the first application form. The coating device is adapted to adjust the coating liquid application rate.

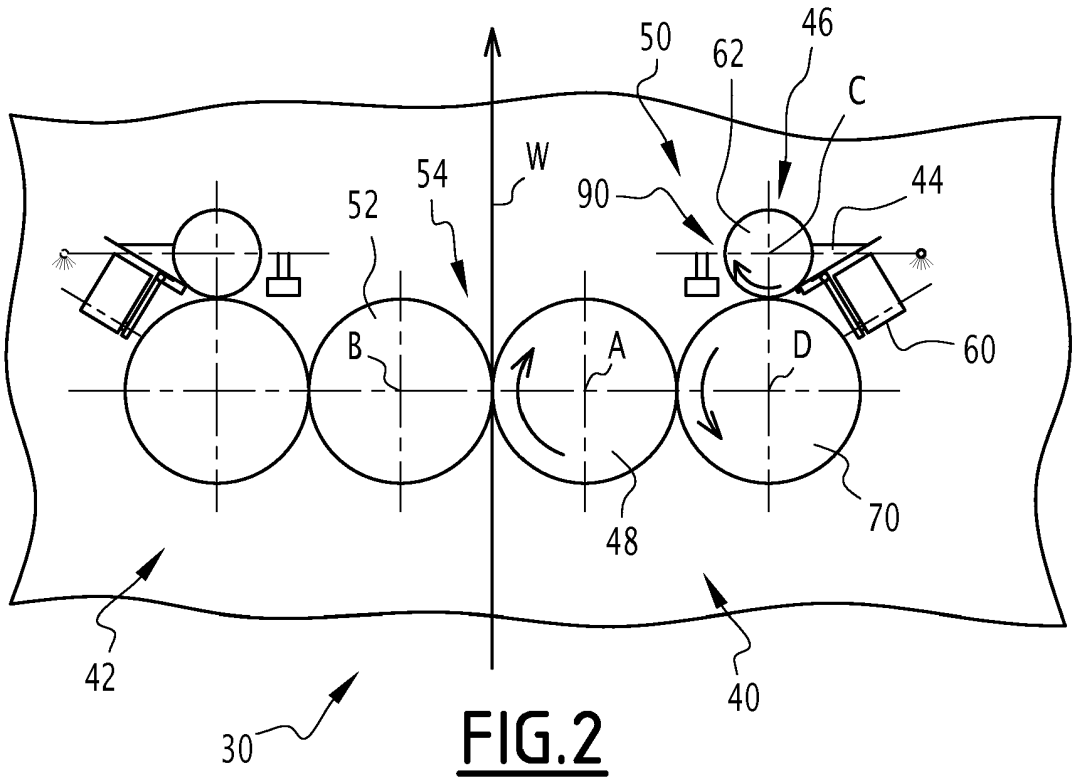

FIG.2

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Description

[0001] The present invention concerns a coating device according to the preamble of claim 1.

[0002] Such a coating device is known from US4,704,296. Other coating devices are disclosed in WO2009/106822, WO94/17928 and US2015/0231875.

[0003] The known coating devices do not provide full satisfaction, in particular as they have a generally a fixed application width and a fixed application coverage and are not adapted to coat webs with different widths from one production run to another.

[0004] The objective of the invention is therefore to increase the flexibility of a coating device and this with economic and practical means.

[0005] Also, the known coating devices are not capable of applying an in width adjustable, continuous coating surface layer to the web.

[0006] In order to overcome at least one of these drawbacks, the object according to the present invention is a coating device according to claim 1.

[0007] According to preferred embodiments, the coating device may include one, several or all of the features of the dependent claims 2 to 10, in all technically feasible combinations.

[0008] The object of the invention is also a coating unit according to claim 11 and a machine according to claim 12.

[0009] A further object of the invention is a use according to one of claims 13 to 15.

[0010] Exemplary embodiments of the invention will now be described in detail with reference to the drawings, wherein:

Figure 1 is a schematic view of a printing press according to the invention;
Figure 2 shows detailed portion of a coating unit of the printing press of Figure 1 according to the invention;
Figure 3 shows a schematic top view of a coating device of the coating unit of Figure 2, during coating of a web having a first width, and
Figure 4 shows a schematic top view of the coating device of Figure 3, during coating of a web having a second width.

[0011] With reference to Figure 1 there is shown a printing press 2 according to the invention. The printing press 2 comprises an unwind section 4, a print section 8, a coating section 10 and a rewind section 12. The printing press 2 is a web fed offset printing press.

[0012] The unwind section 4 comprises a splicer/unreel unit 16 adapted to unreel a web W from a web roll.

[0013] The print section 8 comprises at least one print unit 18 and in the present case two print units 18. According to the number of colors to be printed the print section 8 can comprise one, two, three, four, five or more print units 18. Each print unit 18 is preferably an offset print unit comprising one or two impression pairs, consisting of a blanket cylinder and a plate cylinder, adapted to print on the web W.

[0014] The rewind section 12 comprises a rewind unit 24 adapted to rewind the web W after it has been printed by the print units 18 and after it passed through the coating section 10.

[0015] The coating section 10 comprises a coating unit 30 adapted to coat the web W with a coating liquid.

[0016] The printing press 2 defines a direction of travel of the web W from the unwind section 4 to the rewind section 12. The terms "upstream" and "downstream" will be used in the following with respect to the travel direction.

[0017] The coating unit 30 is in Figure 1 arranged downstream of the print unit 18 and in particular downstream of the most downstream of the print units 18 of the printing press 2 and is arranged upstream of the rewind section 12. The coating section 10 is therefore a post-print coating section 10.

[0018] Alternatively, and not shown, the coating section 10 is a pre-print coating section and the coating unit 30 is arranged upstream of a print unit 18 and is in particular arranged upstream of the most upstream of the print units 18. The coating section 10 is in this case a pre-coating section adapted to apply coating liquid to the web W before it enters the print units 18.

[0019] Still alternatively, the coating section 10 is not part of a printing press, but is part of a not depicted offline coater. The offline coater comprises an unwind section 4, a coating section 10 fed by the unwind section 4 and a rewind section 12 rewinding the web W coated by the coating section 10. The offline coater does not comprise print units 18.

[0020] Figure 2 shows a portion of the coating unit 30 in greater detail. The coating unit 30 comprises a first coating device 40 and a second coating device 42.

[0021] The first 40 and second 42 coating devices are similar or identical as far as the disclosed features are concerned. Consequently, in the following the first coating device 40 will be explained and will be referred to as "coating device 40" unless otherwise specified. The second coating device 42 has the same features as those disclosed with respect to the first coating device 40.

[0022] The coating device 40 is adapted for applying a coating liquid 44 to the web W.

[0023] The coating liquid is for example a liquid having one or more of the following features:

- Water based coating, in particular for paper web
- Primer
- Lacquer
- Glue
- UV-based coatings, in particular for a plastic foil web
- Solvent-based coatings, in particular for paper web

[0024] The coating liquid 44 can have a fluid viscosity of between 30 cSt and 15000 cSt. In particular, the coat-

ing liquid has a fluid viscosity of less than 9000 cSt or of less than 8000 cSt.

[0025] In particular, the coating liquid has a viscosity of between 30 cSt and 100 cSt.

[0026] The viscosity is measured at room temperature (20°C).

[0027] The device can also operate with liquids having a high viscosity in the range of 9000 to 11000 cSt, such as ink (typically having a viscosity of 10.000 cSt).

[0028] The invention is unique due to the combination and cooperation of the following main parts;

[0029] The coating device 40 comprises a coating liquid source 46, a liquid applicator roller 48, adapted to apply the coating liquid 44 to the web, and a transfer device 50 adapted to transfer the coating liquid 44 from the coating liquid source 46 to the liquid applicator roller 48.

[0030] The transfer device 50 is adapted to apply the coating liquid 44 according to a first defined application form onto the liquid applicator roller 48 and to apply the coating liquid 44 according to a second defined application form onto the liquid applicator roller, the second defined application form being different from the first defined application form.

[0031] The first defined application form consists of at least one stripe of coating liquid extending around the circumference of the liquid applicator roller 48, having a given width W1 measured parallel to the axis of the liquid applicator roller 48, or transverse to the travel direction of the web. This stripe of coating liquid is subsequently applied onto the web in the travel direction of the web.

[0032] Alternatively, the first defined application form consists of more than one stripe of coating liquid extending around the circumference of the liquid applicator roller 48, each stripe having a given width W1 measured parallel to the axis of the liquid applicator roller 48 or transverse to the travel direction of the web. The stripes are spaced apart from each other and can have the same or different widths. These stripes of coating liquid are subsequently applied onto the web in the travel direction of the web.

[0033] The second defined application form consists of at least one stripe of coating liquid extending around the circumference of the liquid applicator roller 48, having a given width W2 measured parallel to the axis of the liquid applicator roller 48, or transverse to the travel direction of the web. This stripe of coating liquid is subsequently applied onto the web in the travel direction of the web.

[0034] Alternatively, the second defined application form consists of more than one stripe of coating liquid extending around the circumference of the liquid applicator roller 48, each stripe having a given width W2 measured parallel to the axis of the liquid applicator roller 48 or transverse to the travel direction of the web. These stripes are spaced apart from each other and can have the same or different widths. The stripes of coating liquid are subsequently applied onto the web in the travel direction of the web.

[0035] The first defined application form is for example a stripe of liquid having a width identical to the width of the web W and being aligned, in the direction transverse to the travel direction of the web and parallel to the web plane, with the web W. Consequently, the liquid applicator roller 48 transfers coating liquid to the web W over the whole width of the web so that the complete surface of the web W passing through the coating section 10 is coated with coating liquid 44. On Figure 3, the coating unit 30 is depicted with a web W having a first width W1. The first defined application form is a stripe of liquid having a width W1 identical, or essentially identical, to the width W1 of the web W and being aligned with the web W. Consequently, the liquid applicator roller 48 transfers coating liquid 44 to the web W over the whole width W1 of the web so that the complete surface of the web W passing through the coating section 10 is coated with coating liquid 44. On Figure 4, the coating unit 30 is depicted with a web W having a second width W2. The second defined application form is a stripe of liquid having a width W2 identical, or essentially identical, to the second width W2 of the web W and being aligned with the web W. Consequently, the liquid applicator roller 48 transfers coating liquid to the web W over the whole width W2 of the web, so that the complete surface of the web W passing through the coating section 10 is coated with coating liquid 44.

[0036] The liquid applicator roller 48 has a transfer surface, for example made of rubber or of another elastic material. The liquid applicator roller 48 is rotatable about an axis A.

[0037] The coating device 40 comprises a counter coating roller 52. The counter coating roller 52 is rotatable about an axis B. The counter coating roller 52 and the liquid applicator roller 48 form together a coating nip 54 through which the web W to be coated passes in order to receive the coating liquid 44 from the liquid applicator roller 48.

[0038] The coating device 40 comprises several applicator elements 56, each of the applicator elements 56 being adapted to selectively inhibit or permit transfer of coating liquid 44 from the coating liquid source 46 to the liquid applicator roller 48. In particular, the coating device 40 comprises at least two or at least four applicator elements 56. In the present case, as shown on Figure 3, the coating device 40 comprises eighteen coating elements 56. According to the invention each of the applicator elements 56 is a coating liquid key comprising a coating blade 58 and an actuator 60 adapted to modify the position of the associated coating blade 58 between an inhibition position and permission position. Each coating blade 58 has a width comprised between 10 mm and 30 mm and in particular between 20mm and 28 mm. The width can be in particular 20 or 25mm.

[0039] The transfer device 50 comprises also a fountain roller 62 associated with the applicator elements 56. The fountain roller 62, or at least its circumferential sur-

face, is made preferably of steel. The applicator elements 56 are adapted to inhibit or permit transfer of coating liquid 44 from the coating liquid source 46 to the fountain roller 62. More precisely, each actuator 60 is adapted to modify the distance of the associated coating blade 58 with respect to the fountain roller 62. In the inhibition position of the coating blade 58, the coating blade 58 is in contact with the fountain roller 62 or sufficiently close to the fountain roller 62, so that during rotation of the fountain roller 62 no coating liquid 44 is drawn from the coating liquid source 46 at the location of the coating blade, and consequently no coating liquid 44 is transferred to the liquid applicator roller 48. In the permission position of the coating blade 58, the coating blade 58 is spaced apart from the surface of the fountain roller 62 such that upon rotation of the fountain roller 62, coating liquid 44 is withdrawn from the coating liquid source 46 at the location of the coating blade 58 and consequently a stripe of coating liquid 44 is transferred to the transfer roller 48.

[0040] An economic design of the coating device is depicted in Figure 3. The transfer device 50 comprises a strip 64, which is preferably made of metal, and which comprises a base 66 and tongues 68 formed integrally of one piece. The base 66 links each of the tongues 68 one to another and each of the tongues 68 forms one of the coating blades 58.

[0041] The coating device 40 comprises furthermore a ductor roller 70 adapted to receive coating liquid from the fountain roller 62 and adapted to transfer the coating liquid 44 to the liquid applicator roller 48.

[0042] The ductor roller 70, or at least its circumferential surface, is made preferably of steel.

[0043] The coating device 40 comprises also a control unit 80 adapted to control each of the applicator elements 56 to selectively inhibit or permit, at the location of each applicator element 56, transfer of coating liquid from the coating liquid source to the liquid applicator roller.

[0044] The coating device 40 is therefore adapted to create a first defined application form having the first width. Such a first application form is for example shown on Figure 3 where the eight central coating blades 58 are in the permission position and five coating blades 58 on each side of the central coating blades 58 are in the inhibition position. Thus the first application form is a coating stripe having a width of eight coating blades.

[0045] On figure 4 only four central coating blades 58 are in the permission position and the remaining coating blades 58 are in an inhibition position. Consequently, the second application form is a coating stripe having a width of four coating blades 58.

[0046] The application form can be any combination of strips of coating liquid on the web generated by the coating blades 58. Each of the coating blades 58 is either in the permission position or in the inhibition position, and can be moved individually and independently from each of the remaining coating blades 58 in the permission or inhibition position.

[0047] The coating device 40 comprises also motors 82, 84, 86 respectively coupled to the fountain roller 62, the ductor roller 70 and the liquid applicator roller 48 for driving these rollers around their respective axes.

[0048] The coating device 40 comprises also an adjustment device 90. The adjustment device 90 comprises a displacement mechanism adapted to modify the distance of the fountain roller 62 with respect to the ductor roller 70. The distance of the fountain roller 62 with respect to the ductor roller 70 influences the flow of coating liquid, in particular the smoothness and stability of the coating liquid film, transferred from the fountain roller 62 to the ductor roller 70. Consequently, the liquid application quality can be modified or set as a whole over the defined application width.

[0049] Generally, the coating device is adapted to apply the coating liquid over the whole first and/or second defined application forms or over the whole first and/or second width with a constant liquid application rate.

[0050] The coating device 40 is adapted to adjust the thickness of the coating liquid film applied to the web by the liquid applicator roller 48. The thickness of the coating liquid film is preferably adjusted so as to be constant over the whole width of the given application form. In other terms, for a given application form, the or each coating stripe has a constant thickness and the thickness of the stripes is identical. To this end, the coating liquid thicknesses on each of the ductor roller 70 and the applicator roller 48 are also constant over the width and can be adjusted.

[0051] The adjustment of the coating liquid thickness is achieved by adjusting the permission position of the coating blades 58 with respect to the fountain roller 62, i.e. the distance of the coating blade 58 with respect to the cylindrical surface of the fountain roller 62. The adjustment of the coating liquid thickness can also comprise changing the rotational speed of the fountain roller.

[0052] The second coating device 42 has the same features as the first coating device 40. More particularly, the second coating device 42 is adapted to apply a coating liquid to the web surface opposite to the web surface onto which the first coating device 40 applies the coating liquid.

[0053] In the embodiment depicted on Figure 2, the first and second coating devices share some elements. These elements are the liquid applicator roller 48 and the counter coating roller 52. The liquid applicator roller 48 of the first coating device 40 is the counter coating roller of the second coating device 42 and the counter coating roller 52 is the liquid applicator roller of the second coating device 42.

[0054] The use of the coating unit 30 or the coating device 40, 42 is as follows:

A first web having a first web width is driven through the coating unit 30 and traverses the nip 54. The first web is for example a web used in a first print job. During subsequent print jobs, when the first web has been taken out of the device, a second web having

a second width can be inserted in the device. At any given instance only one web is driven through the nip 54.

[0055] Each of the applicator elements 56 are set to the inhibition or permission position according to the first defined application form and the rollers 48, 70, 62 are driven by the motors 86, 84, 82 respectively.

[0056] The coating liquid is transferred at the locations at which the applicator elements are in the permission position to the fountain roller 62, from the fountain roller 62 to the ductor roller 70, from the ductor roller 70 to the liquid applicator roller 48 and from the liquid applicator roller 48 to the web W.

[0057] Thus the use comprises the step of coating the first web having the first web width with the coating device by applying the first application form on the first web.

[0058] When coating the first web a coating liquid film is created on the first web, the liquid film having a uniform thickness over its whole form, in particular over the whole first web width.

[0059] When the first web has been coated and the first web has left the coating unit 30, for example at the end of a first coating or print job, a second web, for example used for a second coating or print job different from the first coating or print job, is introduced in the coating unit 30. The second web has a second width, different from the first web width.

[0060] Subsequently, the second web having a second web width, different from the first web width, is driven through the coating unit 30 and traverses the nip 54.

[0061] Each of the applicator elements 56 are set to the inhibition or permission position according to the second defined application form and the rollers 48, 70, 62 are driven by the motors 86, 84, 82 respectively.

[0062] The coating liquid is transferred at the locations at which the applicator elements are in the permission position to the fountain roller 62, from the fountain roller 62 to the ductor roller 70, from the ductor roller 70 to the liquid applicator roller 48 and from the liquid applicator roller 48 to the second web W.

[0063] Thus the use comprises the step of coating the second web having the second web width with the coating device by applying the second application form on the second web.

[0064] When coating the first web a second liquid film is created on the second web, the liquid film having a uniform thickness over its whole application form, in particular over the whole second web width.

[0065] The use can also comprise the step of adjusting the thickness of the coating liquid film applied to the web by the liquid applicator roller 48. The step of adjusting comprises the step of adjusting the permission position of the coating blades 58 with respect to the fountain roller 62.

[0066] The coating device is also adapted to create two or more coating stripes on the web, each coating stripe being generated by one or more adjacent applicator elements 56, and each stripe being separated by a non-coated stripe generated by one or more applicator elements 56 which are in the inhibition position.

[0067] Preferably the fountain roller 62 is driven during coating so as to have a circumferential speed lower than the circumferential speed of the ductor roller 70 or the liquid applicator roller 48.

[0068] Preferably the ductor roller 70 is driven during coating so as to have a circumferential speed identical to the speed of the web W and the liquid applicator roller 48.

[0069] The liquid applicator roller 48 is preferably made from rubber and runs at the speed of the web W. The pressure between liquid applicator roller 48 and ductor roller 70 can be controlled and adjusted.

[0070] The expressions "width" is generally used in the present disclosure as being taken along a direction extending transverse to the direction of travel of the web through the device and in the plane of the web. This direction is generally identical to the direction of the axis of the rollers, in particular the liquid applicator roller 48.

[0071] Also, the term "application form" designating one or more stripes of coating liquid on the roller 48 which is/are subsequently transferred onto the web, the use of this term in relation to the roller or web is interchangeable.

[0072] The defined coating width is changeable, so as to be adapted to different widths of different webs, narrower than the web and even multiple stripes.

[0073] The device according to invention is particularly advantageous, as the application form as well as the coating liquid film thickness can be changed or adjusted without changing the configuration of the device, i.e. without exchanging elements in the device for other element, such as exchanging liquid applicator rollers. The coating can therefore be adapted rapidly, and even during a production run.

The elements of the device are also of relatively simple design.

Claims

1. A coating device (40, 42) for applying liquid to a web (W), the coating device comprising

   - a coating liquid source (46),
   - a liquid applicator roller (48) adapted to apply coating liquid (44) to a web,
   - a transfer device (50) adapted to transfer the coating liquid from the coating liquid source to the applicator roller,

   characterized in that the transfer device is adapted:

   to apply the coating liquid according to a first defined application form, comprising at least one stripe of coating liquid, onto the liquid applicator roller (48), and

to apply the coating liquid according to a second defined application form, comprising at least one stripe of coating liquid, onto the liquid application roller (48), different from the first application form.

2. The coating device according to claim 1, wherein the transfer device comprises at least two applicator elements (56), in particular at least four applicator elements, that are each adapted to selectively inhibit or permit transfer of coating liquid from the coating liquid source to the liquid applicator roller.

3. The coating device according to claim 2, wherein each of the applicator elements (56) is a coating liquid key, comprising a coating blade (58) and an actuator (60) adapted to modify the position of the associated coating blade between an inhibition and permission position.

4. The coating device according to any one of the claims 2 or 3, wherein the coating device comprises a fountain roller (62) associated with the applicator elements and the applicator elements are adapted to inhibit or permit transfer of coating liquid (44) from the coating liquid source to the fountain roller, in particular each actuator (60) being adapted to modify the distance of the associated coating blade with respect to the fountain roller.

5. The coating device according to claim 3 or according to claims 3 and 4 taken together, wherein the transfer device comprises a strip (64), preferably made of metal, comprising tongues (68) and a base (66), wherein the tongues and base are formed integrally of one piece and wherein the base links the tongues one to another and wherein each of the tongues forms one of the coating blades.

6. The coating device according to any one of the preceding claims, wherein the first defined application form has a first width (W1) and the second defined application form has a second width (W2), different from the first width.

7. The coating device according to any one of the preceding claims, wherein the coating device is adapted to apply the coating liquid over the whole first and/or second defined application forms or over the whole first and/or second width with a constant liquid application rate and in particular wherein the coating device is adapted to adjust this liquid application rate which is constant over the whole first and/or second width.

8. The coating device according to at least claim 2, wherein the device comprises a control unit (80) adapted to control each of the applicator elements (56) to selectively inhibit or permit, at the location of each applicator element, transfer of coating liquid from the coating liquid source to the liquid applicator roller.

9. The coating device according to at least claim 4, wherein the coating device comprises a ductor roller (70) adapted to receive coating liquid from the fountain roller and adapted to transfer the coating liquid to the applicator roller.

10. The coating device according to any one of the preceding claims, wherein the coating device comprises a counter-coating roller (52), the counter-coating roller and the applicator roller forming a coating nip (54) through which the web to be coated can pass in order to receive the coating liquid from the applicator roller.

11. A coating unit comprising

- a first coating device (40) according to claim 10 and
- a second coating device (42) according to claim 10, wherein

the counter-coating roller (52) of the first coating device is the applicator roller of the second coating device and wherein the counter-coating roller of the second coating device is the liquid applicator roller (48) of the first coating device.

12. Machine, such as an offline coater or a printing press, in particular offset printing press, comprising

- an unreel section (4),
- a rewind section (12), and
- a coating device or a coating unit, **characterized in that**

the coating device or the coating unit is a coating device or a coating unit according to any one of the preceding claims, in particular, in case the machine is a printing press, the printing press comprises at least one print unit (18), in particular an offset print unit, and **in that** the coating device or the coating unit is arranged either downstream or upstream of the at least one print unit.

13. Use of a coating device according to any one of the claims 1 to 10, of a coating unit according to claim 11 or of a machine according to claim 12, comprising the step of coating a first web having a first web width with the coating device by applying the first defined application form on the first web.

14. Use according to claim 13, wherein the step of coating the first web comprises creating a liquid film on the first web, the liquid film having a uniform thick-

ness over its whole form, in particular over the whole first web width.

15. Use according to claim 13 or 14, comprising the step of coating a second web having a second web width, different from the first web width, with the coating device by applying the second defined application form on the second web.

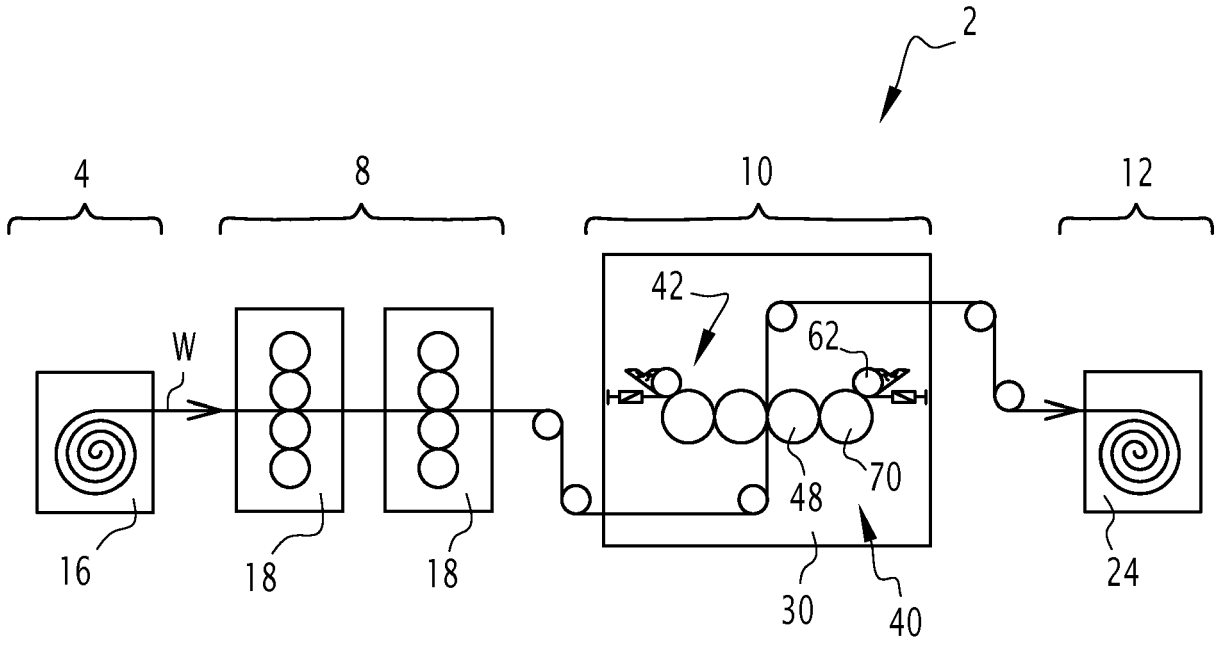
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FIG.1

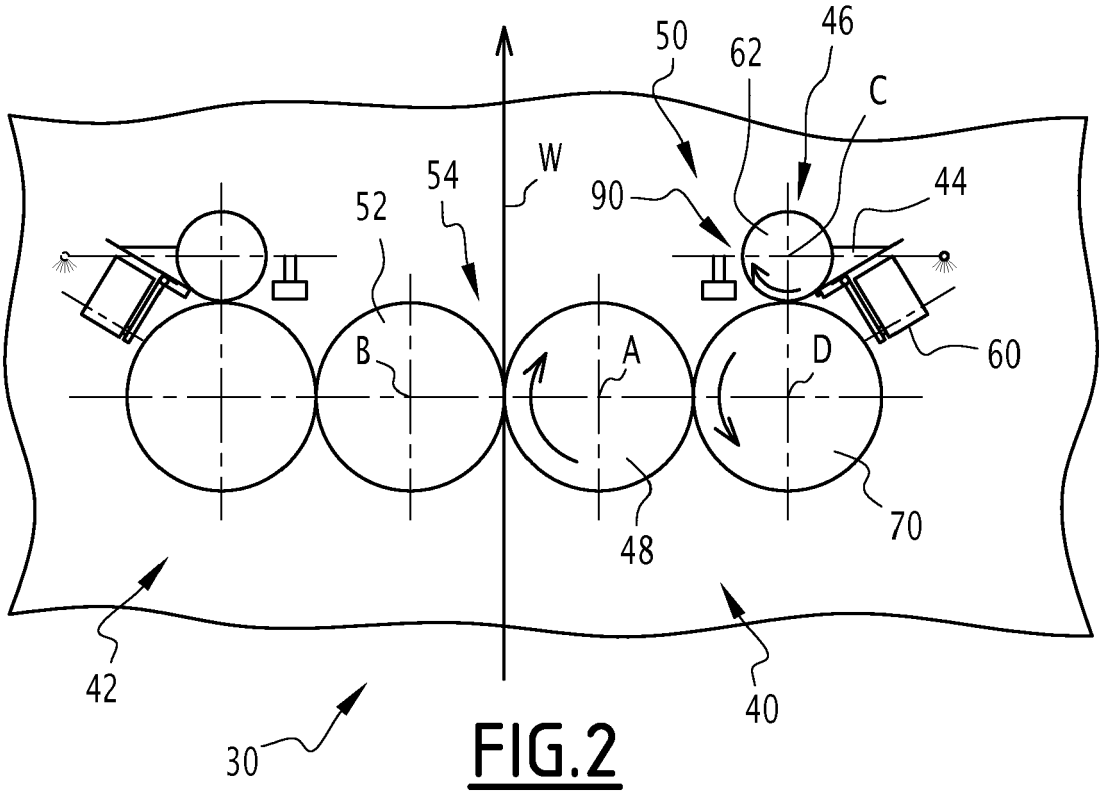
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FIG.2

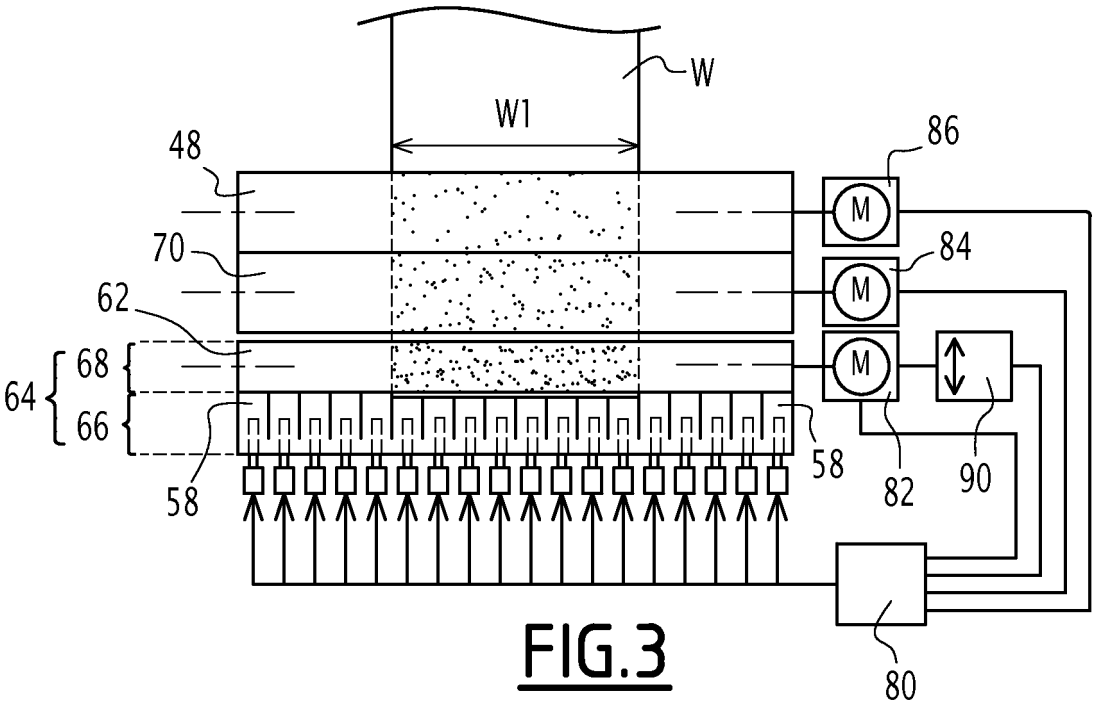
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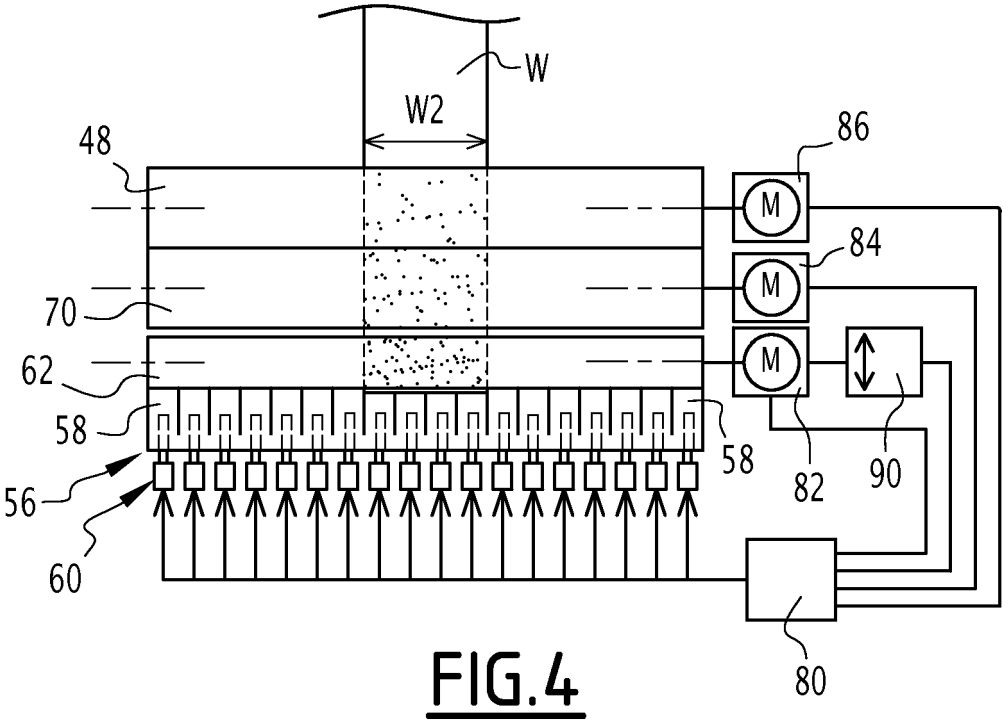
FIG.3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W2
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86
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80

FIG.4

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EUROPEAN SEARCH REPORT

Application Number
EP 17 19 8921

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 2009/320702 A1 (BUECHNER DETLEF ALFONS [DE]) 31 December 2009 (2009-12-31) * paragraphs [0016] - [0030]; figures 1-3 *	1-12	INV. B05C1/08 B41F31/04 B41F31/18 B41F23/08
X	US 2009/235863 A1 (TAKATSUKA TSUTOMU [JP]) 24 September 2009 (2009-09-24) * paragraphs [0045], [0148] - [0182]; figures 1,9-12 *	1-8,10, 13-15	
X	EP 3 132 860 A1 (PAPER CONVERTING MACHINE COMPANY ITALIA S P A [IT]) 22 February 2017 (2017-02-22) * paragraphs [0019], [0027] - [0039]; figures 1,2,3 *	1,6,7, 10,13-15	
X	US 2014/023791 A1 (PELEG EYAL [IL] ET AL) 23 January 2014 (2014-01-23) * paragraphs [0010], [0028] - [0036]; figures 1,2 *	1,13	
X	WO 2014/063731 A1 (HEWLETT PACKARD INDIGO BV [NL]) 1 May 2014 (2014-05-01) * page 2, line 7 - page 4, line 10; figures 1,2 *	1,13	TECHNICAL FIELDS SEARCHED (IPC) B05C B41F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	3 April 2018	D'Incecco, Raimondo

CATEGORY OF CITED DOCUMENTS

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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 17 19 8921

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