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(71) Applicant: **Menphis S.p.A.**
22070 Casnate con Bernate (Como) (IT)

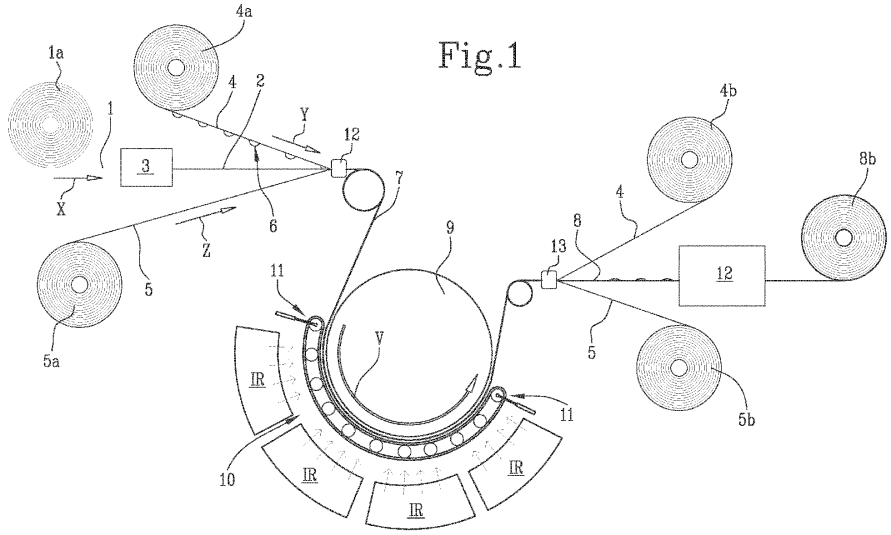
(72) Inventor: **MENIN, GILBERTO**
22100 COMO (IT)

(74) Representative: **Inchingalo, Simona**
Bugnion S.p.A.
Viale Lancetti, 17
20158 Milano (IT)

(54) A METHOD FOR PRINTING A RIBBON

(57) A method for printing a ribbon, comprising the steps of:
- feeding a ribbon (1) along a feeding path (X),
- impregnating said ribbon (1) with a predetermined amount of acidic or alkaline solution thereby obtaining an impregnated ribbon (2),
- feeding a first tape (4) and a second tape (5) consisting of a plastic material on which at least one dye layer (6, 6') comprising pigments of acidic and/or reactive pigments, or pigments of basic colors, is applied,
- coupling the impregnated ribbon (2) to the first and second tapes (4, 5) consisting of a plastic material, defining a multi-layer belt (7),
- making two continuous and parallel weld seams (A) at respective side edges (7') of the multi-layer belt (7),
- advancing the multi-layer belt (7) along a vaporization path (V) where the multi-layer belt (7) is heated on both sides, so as to vaporize at least partially the predetermined amount of acidic or alkaline solution for activating the reaction of the dyes with the impregnated acidic or alkaline solution and obtaining a migration of the dyes from the dye layer (6, 6') towards the ribbon (1) forming a printed ribbon (8),
- making two continuous cutting lines (B), parallel to the two continuous weld seams (A), so as to trim the side edges (7') of the multi-layer belt (7),
- decoupling the multi-layer belt (7).

Fig.1



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Description

[0001] The present invention relates to a method for printing a ribbon.

[0002] In particular, the invention makes it possible to produce semi-finished products for clothing, upholstery materials, furnishings, manufactured goods and technical items.

[0003] Wet printing on textiles, such as cotton, generally involves an initial impregnation step in which an aqueous dispersion is brought into contact with the fabric, a subsequent colour application step and a final hot-air drying step.

[0004] Some steaming techniques are also known, which improve the fixation of colours on the fabric before drying.

[0005] These techniques involve passing the piece of fabric, during a batch or continuous (roll-to-roll) process, through a large "vaporization chamber" in which the aqueous dispersion retained by the fabric is partially evaporated in order to facilitate the solubilization of the colour and its migration towards the fabric.

[0006] This makes the reaction of the colour with the fabric fibre more effective and the bond chemically strong.

[0007] However, the Applicant has noted that this process is energy-intensive and requires machines of very large dimensions.

[0008] Indeed, a vaporization chamber requires large spaces, large amounts of energy to heat the chamber and requires compliance with strict regulations (safety requirements, safety distances, emergency procedures).

[0009] A large climatic chamber also requires careful management of internal temperature gradients so that no portion of the fabric undergoes uneven treatment.

[0010] In this context, the technical task underlying the present invention is to propose a method for printing a ribbon which overcomes one or more of the drawbacks of the prior art mentioned above.

[0011] In particular, it is an object of the present invention to make available a method for printing a ribbon that enables the effectiveness and efficiency of the production process to be increased.

[0012] The defined technical task and the specified aims are substantially achieved by a method for printing a ribbon, comprising the technical characteristics set forth in one or more of the appended claims.

[0013] In particular, the present invention provides a method for printing a ribbon, comprising the steps of:

- feeding a ribbon along a feeding path,
- impregnating said ribbon with a predetermined amount of acidic or alkaline solution thereby obtaining an impregnated ribbon,
- feeding a first tape consisting of a plastic material and a second tape consisting of a plastic material along respective feeding paths, wherein at least one dye layer comprising pigments of acidic and/or reactive pigments, or pigments of basic colors, is applied to at least one of said first and second tapes consisting of a plastic material,
- coupling the impregnated ribbon to the first and second tapes consisting of a plastic material so that the impregnated ribbon is interposed between the tapes consisting of a plastic material, forming a multi-layer belt and so that said at least one dye layer is arranged in contact with the impregnated ribbon,
- making two continuous weld seams parallel to the feeding path at respective side edges of the multi-layer belt so as to constrain the impregnated ribbon to the first and second tapes consisting of a plastic material,
- advancing the multi-layer belt along a vaporization path where the multi-layer belt is heated on both sides, defined by the tapes consisting of a plastic material, so as to vaporize at least partially the predetermined amount of acidic or alkaline solution for activating the reaction of the dyes with the impregnated acidic or alkaline solution and obtaining a migration of the dyes from the dye layer towards the ribbon forming a printed ribbon,
- making two continuous cutting lines, parallel to the two continuous weld seams, interposed between or at the continuous weld seams, so as to trim the side edges of the multi-layer belt, and
- decoupling the multi-layer belt by separating the first and second tapes consisting of a plastic material from the printed ribbon. Advantageously, the coupling of the tapes consisting of a plastic material with the ribbon material makes it possible to create a multi-layer "sandwich" type belt within which the vaporization process of the acid or alkaline substances is confined as they progress along the vaporization path.

[0014] The layer of dyes, defining the decorative pattern that will be transferred onto the ribbon material to be printed, is therefore forced to come into contact with the face of the ribbon material to be treated and does so within a sandwich that limits it both above and below.

[0015] Therefore, the vaporization volume is reduced significantly with respect to the climatic chamber of the prior art; such volume (now reduced to the size of the multi-layer belt) allows more efficient control of the hygrothermal conditions, preventing the occurrence of temperature gradients that may adversely affect the colour yield of the final product.

[0016] The method according to the present invention therefore makes it possible to reduce production costs and increase the level of control over the surrounding conditions.

[0017] The dyes migrate to the ribbon material upon heating and the acidity in the impregnation fixes them onto the ribbon material in an efficient and controlled manner.

[0018] Advantageously, the colours react with the

moisture, generated by heating the multi-layer belt and present between the two plastic tapes, and migrate towards the ribbon material, leaving the plastic films behind.

[0019] In other words, the water that has soaked the material to be decorated evaporates, thus bringing the right degree of moisture and creating the conditions to dissolve the colour present on the plastic films.

[0020] It allows efficient control of the operating conditions of the vaporization process.

[0021] In fact, by exploiting the substantial impermeability of the plastic material and by sealing the lateral edges (also called "selvages") of the sandwich, two thin laterally closed chambers are defined (a first chamber being defined between the first tape consisting of plastic material and the impregnated ribbon material and a second chamber being defined between the second tape consisting of plastic material and the impregnated ribbon material) inside which the steam generated along the vaporization path is trapped.

[0022] The sandwich therefore remains "open" (i.e. not sealed/welded) only at the front, with respect to the feed/forward direction (up to the separation of the plastic tapes) and at the back (from the coupling of the plastic tapes), as if defining a sort of "sleeve".

[0023] The moisture contained in the acid or alkaline solution, which has been locally transformed into steam inside the sleeve (determining a sort of "localized sauna of the ribbon material" which facilitates the correct transfer and fixation of the dyes onto the ribbon material), therefore remains trapped between the two selvages of the sandwich allowing the steam not to disperse laterally (i.e. orthogonally with respect to the advancing direction of the tape), guaranteeing effective control of the vaporization process and improving the efficiency of the printing process. The dependent claims herein incorporated for reference, correspond to different embodiments of the invention.

[0024] Further features and advantages of the present invention will become more apparent from the indicative and thus non-limiting description of a preferred, but non-exclusive, embodiment of a method for printing a ribbon, as shown in the accompanying drawings, wherein:

- Figure 1 shows a first operating diagram in accordance with the printing method of the present invention,
- Figure 2 shows a second operating diagram in accordance with the printing method of the present invention, and
- Figure 3 shows a schematic view from above of a portion of a multi-layer belt obtainable by the printing method of the invention, in which the weld seams and the cutting lines are indicated.

[0025] In particular, a machine layout in accordance with the method according to the present invention is schematically illustrated in the appended figures.

[0026] The method for printing a ribbon material comprises a step of feeding a ribbon 1 along a respective feeding path X (i.e., along a path defining the advancement of the ribbon 1 throughout the printing process) and a step of impregnating the ribbon 1 with a predetermined amount of acidic or alkaline solution defining an impregnated ribbon 2.

[0027] The ribbon 1 thus after being unwound, for example from a reel 1a of continuous ribbon 1, passes through an impregnation station 3 within which it is impregnated with the predetermined amount of acid or alkaline solution.

[0028] Preferably, the ribbon 1 may be a woven ribbon, for example a cotton ribbon, and the impregnation step in this case may be achieved by soaking the ribbon 1 for a predetermined amount of soaking time in a container containing the acid or alkaline solution, not illustrated, and then squeezing the woven ribbon 1 between two squeeze rollers, not illustrated, so that the woven ribbon 1 becomes impregnated with the predetermined amount of acid or alkaline solution, thus defining the impregnated ribbon 2. The predetermined amount of acid or alkaline solution retained in the ribbon 1 is proportional to weight and may vary depending on the type of material used.

[0029] In other words, the impregnation process of the ribbon 1 takes place through the so-called "foularding" (or "padding") technique, whereby the ribbon 1 passes through a device, called a "foulard", which allows it to be impregnated and then lightly squeezed, with specific chemicals defining the acid or alkaline solution, which imparts water to the ribbon 1 and regulates the level of acidity necessary to fix the colours.

[0030] In fact, after immersion in the container, the squeezing that follows allows the acid or alkaline solution to be pushed into the fibres of the ribbon 1 and the excess to be removed; therefore the ribbon 1 will be moistened. Advantageously, the impregnation process just described allows the ribbon 1 to be moistened using a reduced quantity of liquid compared to the known technique, in fact the squeezing after immersion allows the ribbon 1 to be sufficiently moistened and the excess liquid to be replenished, which can be reused.

[0031] The amount of acid or alkaline solution impregnated in the ribbon 1 therefore depends on the level of squeezing of the rollers, which in turn depends on numerous factors: speed of passage between the rollers, pressure exerted by the rollers, materials of which the rollers are made (which determine their hardness), size of the rollers (which determines the width of the squeezing area).

[0032] A low aqueous residue is required for the dyes to react properly, so it is not necessary for the ribbon 1 to be completely soaked in acidic or alkaline substances.

[0033] For example, if the solution is alkaline, i.e. in alkaline pH normally for potassium carbonate, reactive colours on cellulose fibres (e.g. cotton, viscose, linen, hemp) will be dyed and printed in alkaline pH.

[0034] Alternatively, the impregnation step may be car-

ried out by spraying a predetermined amount of acid or alkaline solution on the ribbon 1 for a specified period of time.

[0035] According to a possible embodiment of the method, the ribbon 1 may comprise a support ribbon on which a plurality of parallel threads are arranged, impregnable with the predetermined amount of acid or alkaline solution and suitable for being arranged in contact with at least one layer of dyes 6, 6' during the advancing step.

[0036] Preferably the support ribbon is a non-woven fabric. For example, the non-woven fabric can be a felt on which warp threads are arranged for printing. By "warp threads", we mean threads that are parallel to each other and oriented in the direction of motion of the machine or the feed direction X.

[0037] In this case, at the impregnation station, the acid or alkaline solution is transferred to the support ribbon, which in turn moistens the plurality of threads with the predetermined amount of acid or alkaline solution.

[0038] It would be difficult to impregnate the (warp-only) threads directly because they would be damaged: the parallel threads would be subjected to high torsional stresses caused by the impregnation, which would cause problems downstream when weaving them.

[0039] Advantageously, the support ribbon allows the threads to be moistened, thus defining the impregnated ribbon 2.

[0040] Preferably the acid or alkaline solution comprises water and at least one ammonium salt, e.g. ammonium acetate, ammonium sulphate, ammonium citrate. Ammonium salts allow acidity to develop with heat.

[0041] The method comprises a step of feeding a first tape 4 consisting of a plastic material and a second tape 5 consisting of a plastic material along respective feeding paths Y, Z, wherein at least one dye layer 6, 6' comprising reactive and/or acidic colour pigments, according to a preferred embodiment, is applied to at least one of the first tape 4 and the second tapes 5.

[0042] According to a possible alternative embodiment, however, the dye layer 6, 6' may comprise pigments of basic colours.

[0043] In particular, in the embodiment illustrated in figure 1, the dye layer 6 is only applied on the first tape 4 consisting of a plastic material.

[0044] According to a possible embodiment of the present invention, the method may comprise a step of applying the dye layer 6, 6' prior to the step of feeding the tapes 4, 5 consisting of a plastic material.

[0045] Preferably the two tapes 4, 5 are unwound from respective reels 4a, 5a of continuous tapes 4, 5.

[0046] Preferably the plastic material of which the two tapes 4, 5 are made can be selected from a group comprising: polyester, polyethylene, polypropylene, PVC, biodegradable plastic material.

[0047] The method further comprises a step of coupling the impregnated ribbon 2 to the first and second tapes 4, 5 consisting of a plastic material so that the impregnated ribbon 2 is interposed between the tapes 4, 5 consisting of a plastic material, forming a multi-layer belt 7 and so that said at least one dye layer 6, 6' is arranged in contact with the impregnated ribbon 2.

[0048] In other words, the present invention envisages that the impregnated ribbon 2 is forced between the two tapes 4, 5 so that the dye layers 6, 6' can be arranged in contact with the surfaces to be printed. Advantageously, the method then comprises a step of making two continuous weld seams A parallel to the feed path X at respective side edges 7' of the multi-layer belt 7 (as illustrated in Figure 3) so as to constrain said impregnated ribbon 2 to the first and second tapes 4, 5 consisting of a plastic material.

[0049] Preferably the welding step is carried out by means of an ultrasonic welding device 12.

[0050] The method advantageously comprises a step of advancing the multi-layer belt 7 along a vaporization path V where the multi-layer belt 7 is heated on both sides, i.e. the sides defined by the tapes 4, 5 consisting of a plastic material, so as to vaporize at least partially the predetermined amount of acidic or alkaline solution for activating the reaction of the dyes with the impregnated acidic or alkaline solution and obtaining a migration of the dyes from the dye layer towards the ribbon 1 forming a printed ribbon 8.

[0051] In other words, as illustrated in Figure 3, the multi-layer belt 7 is subjected to welding, preferably by ultrasound, before the multi-layer belt 7 enters the vaporization path V.

[0052] According to a possible embodiment, illustrated in Figure 2, preferably a first dye layer 6 is applied to the first tape 4 consisting of plastic material and a second dye layer 6' is applied to the second tape 5 consisting of a plastic material so that the first and second dye layers 6, 6' are arranged in contact with the ribbon 1 during the advancing step.

[0053] Preferably, moreover, the first and second dye layers 6, 6' are different from each other, so as to enable the creation of two-sided printed ribbons 8.

[0054] In other words, thanks to the present invention, it is possible to print different designs (graphic elements, motifs, patterns, or simply colours/dyes) on the two faces of the ribbon 1.

[0055] Preferably, the multi-layer belt 7 is heated to 100° for a time period comprised between 1 and 2 minutes along the vaporization path V. Preferably the pH of the impregnated ribbon 2 is kept between a value comprised between 3 and 5.

[0056] Preferably, the advancing step is carried out by moving the multi-layer belt 7 at least partially around a heating cylinder 9, whereby the vaporization path V would extend at least partially around the heating cylinder 9.

[0057] The heating cylinder 9, which defines the so-called "calender", can reach a surface temperature of at least 100° and its heating can be achieved by means of diathermic oil or electrical resistances.

[0058] Even more preferably, as illustrated in the proc-

ess layout diagram of Figures 1 and 2, the advancing step is achieved by moving the multi-layer belt 7 between the heating cylinder 9 and a heated conveyor belt 10, for example an aramid belt heated by infrared (IR in the figures illustrates infrared emitters).

[0059] Advantageously, the advancement of the multi-layer belt 7 between the heating cylinder 9 and the heated conveyor belt 10 ensures the same temperature on both sides of the multi-layer belt 7, which is particularly useful for printing on both faces.

[0060] Preferably also the advancing step may comprise a sub-step of pressing the multi-layer belt 7 against the heating cylinder 9 during its advancement, preferably by means of at least one pressure roll 11. In particular, in the example embodiment illustrated in the attached Figures 1 and 2, there are two pressure rolls 11: a first pressure roller 11 arranged at the inlet and a second pressure roll 11 arranged at the outlet of the vaporization path V.

[0061] Advantageously, by pressing the multi-layer belt 7 against the heating cylinder 9, a local pressure can be created to facilitate the step of transferring the dyes, ensuring a more intimate contact of the impregnated ribbon 2 with the two tapes 4, 5 consisting of a plastic material. Preferably, the method comprises a step of adjusting at least one parameter identifying the state of the advancing multi-layer belt 7 impregnated with the predetermined amount of acidic or alkaline solution and coupled with the two plastic tapes 4, 5 consisting of a plastic material along the vaporization path V, selected from: humidity, heating temperature, pH, feed rate, and residence time.

[0062] In fact, the acid or alkaline solution facilitates the migration of colours, but it must be controlled, because if it is too free the final product risks losing definition.

[0063] Therefore, depending on the type of ribbon 1 and the type of print, effect or pattern to be obtained, it is necessary to calibrate these identification parameters, for example by intervening on the degree of impregnation of the acidic or alkaline solution (by calibrating the squeeze ratio of the squeeze rollers), on the temperature to which the multi-layer belt 7 must be subjected and on the time during which it must be heated.

[0064] It is advantageously possible to control the level of hydration and the degree of condensation.

[0065] At the exit from the vaporization path V, the method then provides for a step of making two continuous cutting lines B, parallel to the two weld seams A previously made and interposed between, or at, said continuous weld seams A (Figure 3), so as to trim the side edges 7' of the multi-layer belt 7.

[0066] Preferably, the cut is made at a cutting station 13 located downstream of the vaporization path V, which allows the selvages of the multi-layer belt 7 to be trimmed in order to "open" the sandwich again.

[0067] The method then comprises a step of decoupling the multi-layer belt 7, exiting the vaporization path V, by separating the first and second tapes 4, 5 consisting of a plastic material from the printed ribbon 8.

[0068] Preferably following the decoupling step, the method may further comprise a step of winding the printed multi-layer ribbon 8 and the tapes 4, 5 consisting of a plastic material into respective reels 8a, 4a, 5b.

[0069] Preferably further, following the decoupling step and prior to the winding step, the method may comprise a step of drying the printed ribbon 8 by heating the printed ribbon 8, preferably to 150 °C, and/or blowing air onto the printed ribbon 8.

[0070] The printed ribbon 8 comes out of the vaporization path V damp, so drying it is advantageous to remove the moisture and fix the colour.

[0071] Preferably, drying is carried out by moving the printed ribbon 8 inside a drying oven 12 comprising, at the top, an infrared emitter, and at the bottom, an infrared-heated aramid pad, not shown, on which the printed ribbon 8 is advanced.

[0072] The present invention achieves the proposed purposes by overcoming the drawbacks complained of in the prior art and by providing an efficient printing method for producing high-quality printed ribbons.

[0073] The transfer of dyes onto the ribbon is carried out inside a multi-layer belt in which the ribbon is sandwiched between two layers of plastic material that allow localised vaporization when coupled and heated. The reaction between the acidic or alkaline solution with which the ribbon is impregnated and the dyes on at least one of the two tapes consisting of a plastic material is thus confined to an environment in which the boundary conditions can be effectively controlled.

[0074] The vaporization chamber necessary for the solubilization of the colour and its migration onto the fabric is thus reduced to a sandwich consisting of the impregnated fabric to be printed and two tapes consisting of a plastic material carrying the colour; advantageously, steam develops locally inside the sandwich, creating a sort of "localized sauna" effect of the fabric which improves the efficiency of the production process. Compared to known printing systems, thanks to the present invention, the fabric, or the warp threads, are subjected to much lower levels of thermal and mechanical stress, allowing printing-dyeing of even particularly delicate or valuable materials that are usually impossible or difficult to print (such as hair, fur, cashmere, silk or other fabrics with low mechanical resistance), which would not withstand the process conditions of known technologies.

[0075] The operating conditions covered by the present invention are more delicate than known techniques and allow for greater control and reproducibility, also thanks to the correct calibration of the amount of water when and where it is needed.

[0076] The invention makes it possible to achieve efficient surface uniformity; in particular, if the design is set as "solid colour", the effect achieved is equivalent to that of a dye, but better because it is free from any defects represented by blotches/stains or in general areas of col-

our which are not homogeneous with the rest of the surface.

[0077] Furthermore, the present invention makes it possible to reduce energy and water consumption by an estimated 90% compared with known techniques. For example, the fixation of acidic dyes and reactive dyes usually used for printing and dyeing natural fibres such as wool, silk and cotton takes 40-50 seconds with the present invention, instead of 15-20 minutes.

[0078] This production process makes it possible to advantageously register the prints on both sides of the fabric (right and wrong side) by carefully controlling the unwinding of the reels that support the decorative films on both sides, transferring the most extraordinary decorative effects to any support.

Claims

1. A method for printing a ribbon, comprising the steps of:

- feeding a ribbon (1) along a feeding path (X),
- impregnating said ribbon (1) with a predetermined amount of acidic or alkaline solution thereby obtaining an impregnated ribbon (2),
- feeding a first tape (4) consisting of a plastic material and a second tape (5) consisting of a plastic material along respective feeding paths (Y, Z), wherein at least one dye layer (6, 6') comprising pigments of acidic and/or reactive pigments, or pigments of basic colors, is applied to at least one of said first and second tapes (4, 5) consisting of a plastic material,
- coupling said impregnated ribbon (2) to said first and second tapes (4, 5) consisting of a plastic material so that said impregnated ribbon (2) is interposed between said tapes (4, 5) consisting of a plastic material, forming a multi-layer belt (7) and so that said at least one dye layer (6, 6') is arranged in contact with said impregnated ribbon (2),
- making two continuous weld seams (A) parallel to the feeding path (X) at respective side edges (7') of the multi-layer belt (7) so as to constrain said impregnated ribbon (2) to said first and second tapes (4, 5) consisting of a plastic material,
- advancing said multi-layer belt (7) along a vaporization path (V) where the multi-layer belt (7) is heated on both sides, defined by said tapes (4, 5) consisting of a plastic material, so as to vaporize at least partially the predetermined amount of acidic or alkaline solution for activating the reaction of the dyes with the impregnated acidic or alkaline solution and obtaining a migration of the dyes from the dye layer (6, 6') towards the ribbon (1) forming a printed ribbon (8),
- making two continuous cutting lines (B), parallel to the two continuous weld seams (A), interposed between or at said continuous weld seams (A), so as to trim the side edges (7') of the multi-layer belt (7),
- decoupling the multi-layer belt (7) by separating the first and second tapes (4, 5) consisting of a plastic material from the printed ribbon (8).

2. A method according to claim 1, wherein said ribbon (1) is a fabric ribbon and wherein said impregnation step is carried out by:

- immersing the ribbon (1) for a determined immersion time in a container containing said acidic or alkaline solution, and then squeezing said fabric ribbon between two squeeze rollers so that said fabric ribbon is impregnated with said one predetermined amount of acidic or alkaline solution, or
- spraying a predetermined amount of acidic or alkaline solution onto the ribbon (1) for a determined time.

3. A method according to claim 1, wherein said ribbon (1) comprises a support ribbon impregnated with said predetermined amount of acidic or alkaline solution, said support ribbon preferably being a non-woven fabric, and a plurality of parallel impregnable threads adapted to be arranged in contact with said at least dye layer (6, 6') during the advancing step.

4. A method according to one of the preceding claims, wherein said advancing step is carried out by moving the multi-layer belt (7) at least partially about a heating cylinder (9), said vaporization path (V) developing at least partially about the heating cylinder (9).

5. A method according to claim 4, wherein said advancing step is carried out by moving the multi-layer belt (7) between the heating cylinder (9) and a heated conveyor belt (10), preferably an infrared-heated aramid pad.

6. A method according to claim 4 or 5, wherein said advancing step comprises a sub-step of pressing the multi-layer belt (7) against the heating cylinder (9), preferably by means of at least one pressure roll (11).

7. A method according to one of the preceding claims, comprising, after the decoupling step, a step of drying the printed ribbon (8) carried out by heating said ribbon (1), preferably at 150°C, and/or by blowing air onto said printed ribbon (8).

8. A method according to claim 7, wherein said drying is carried out by moving said printed ribbon (8) inside a drying oven comprising, at the top, an infrared emitter, and at the bottom, an infrared-heated aramid pad

on which said printed ribbon (8) is advanced.

9. A method according to one of the preceding claims, wherein said acidic or alkaline solution comprises water and at least one ammonium salt, such as: ammonium acetate, ammonium sulfate, ammonium citrate.

10. A method according to one of the preceding claims, comprising, after the decoupling step, a step of winding the printed ribbon (8) and the tapes (4, 5) consisting of a plastic material.

11. A method according to one of the preceding claims, comprising a step of adjusting at least one identification parameter of the state of the multi-layer ribbon (7) advancing along the vaporization path (V), selected from: humidity, heating temperature, pH, feed rate, and residence time.

12. A method according to one of the preceding claims, wherein a first dye layer (6) is applied to the first tape (4) consisting of a plastic material, and wherein a second dye layer (6') is applied to the second tape (5) consisting of a plastic material so that said first and second dye layers (6, 6') are arranged in contact with said impregnated ribbon (2) during the advancing step.

13. A method according to claim 12, wherein said first and second dye layers (6, 6') are different from each other.

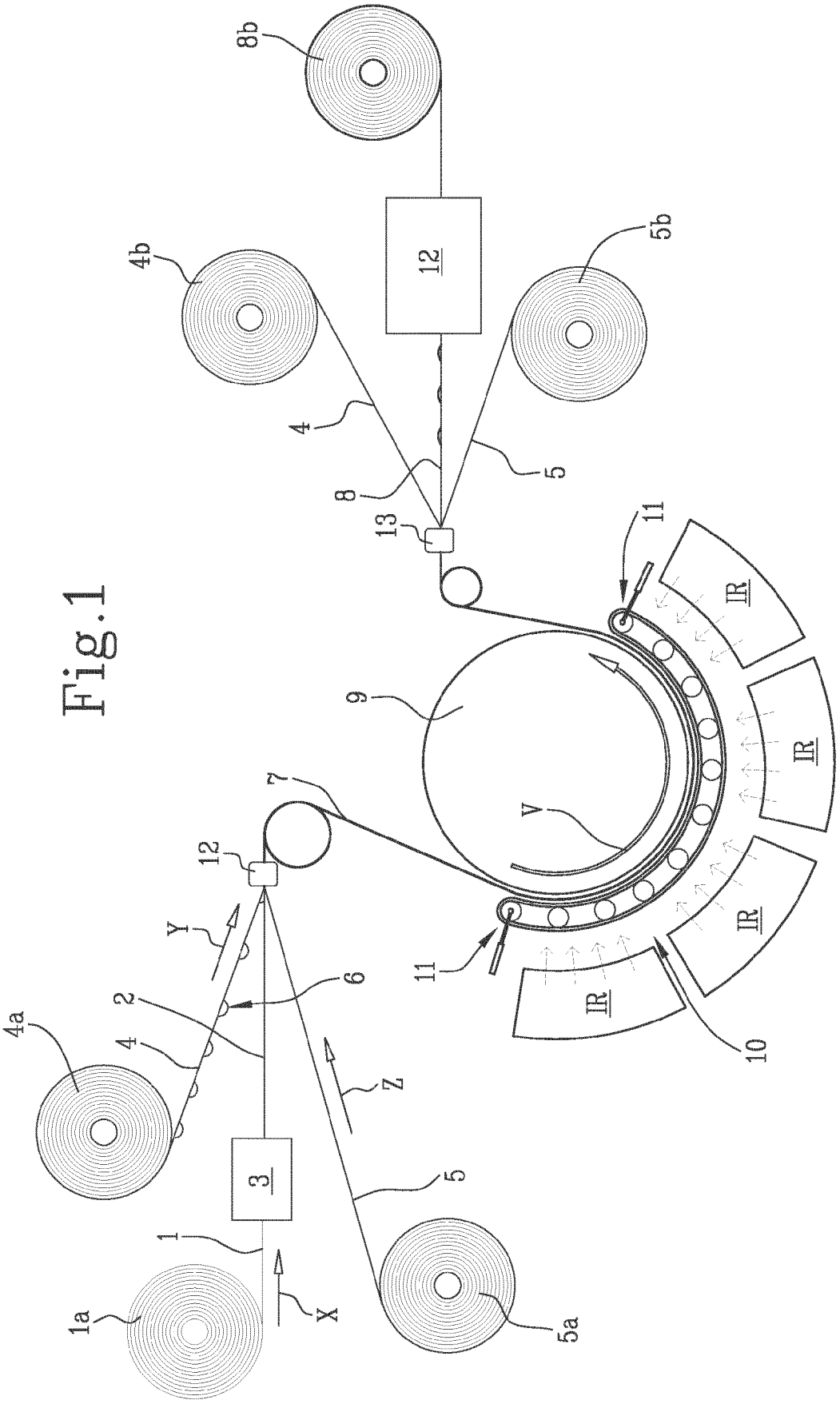


Fig.1

Fig.2

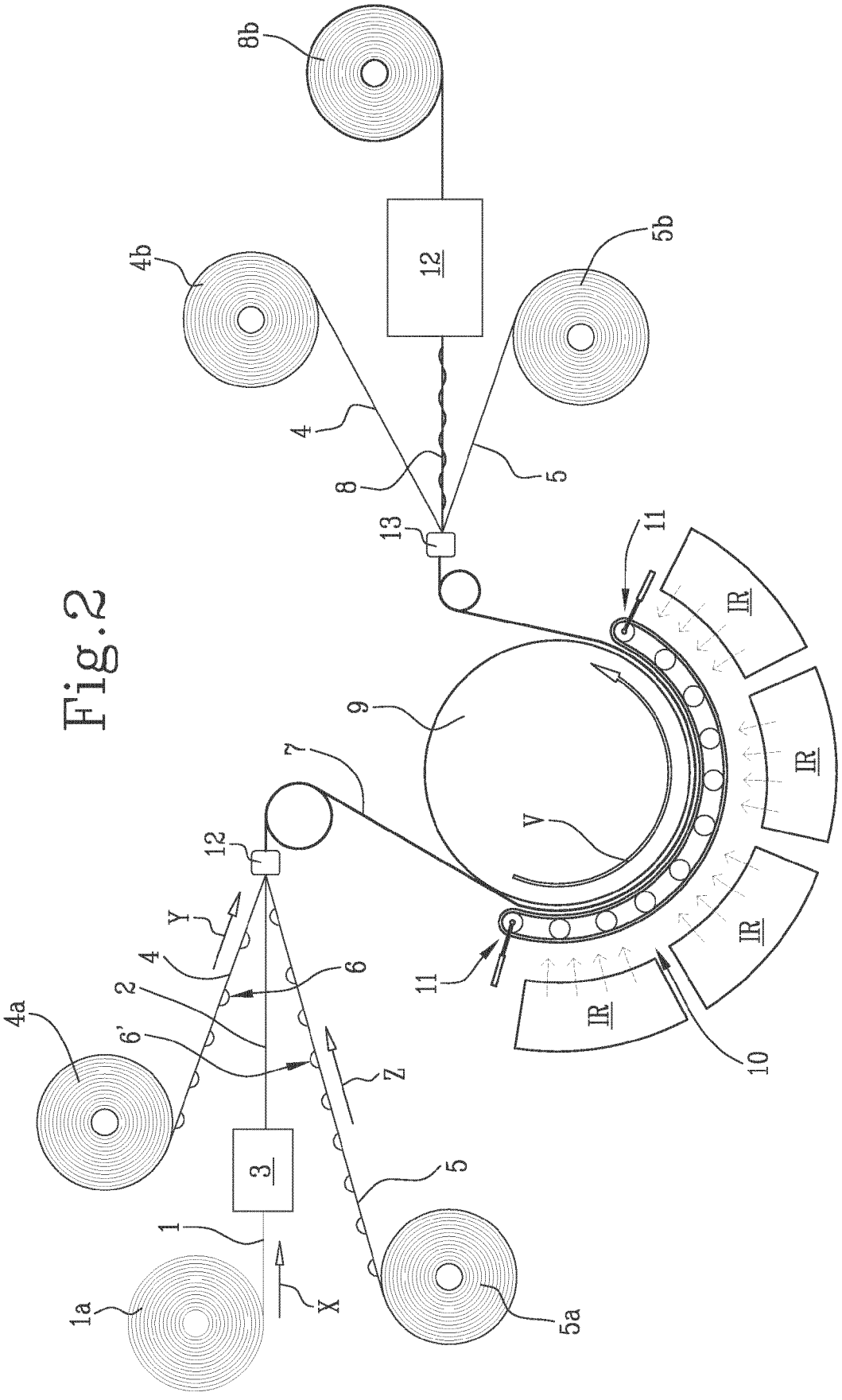
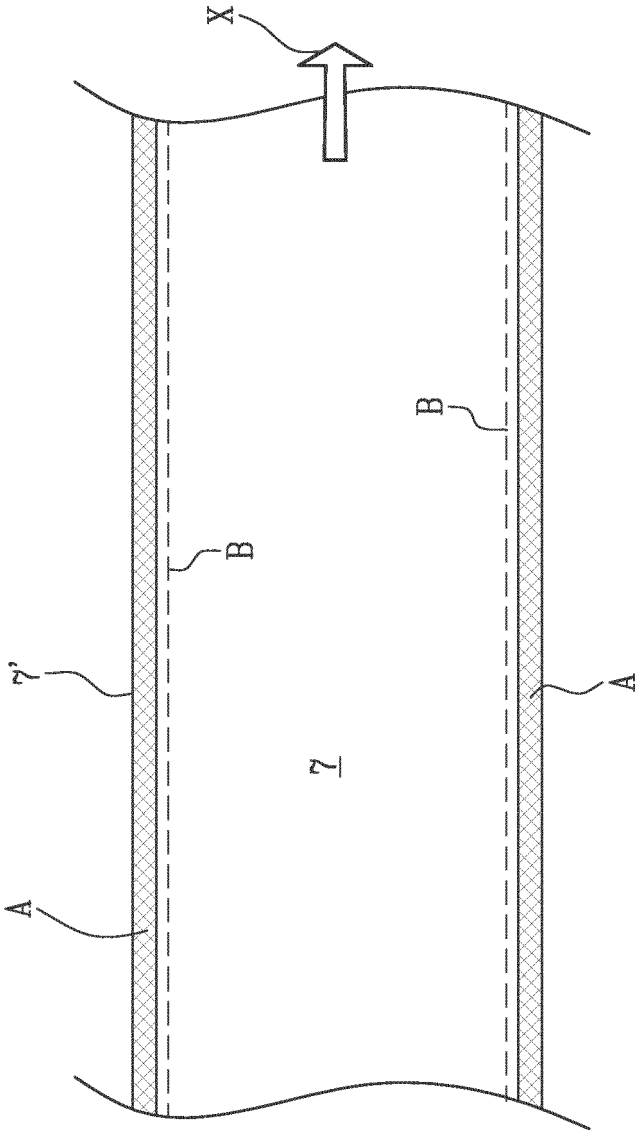


Fig.3



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EUROPEAN SEARCH REPORT

Application Number
EP 21 21 2399

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	IT 2019 0000 5592 A1 (MENPHIS S P A [IT]) 11 October 2020 (2020-10-11) * claim 1; figures 1,2 *	1-13	INV. B41F16/02 D06B11/00 B41M5/035
A	US 4 431 429 A (BOOTH BARRY R [US]) 14 February 1984 (1984-02-14) * column 5, lines 7-17; claim 1; figures 1,2 *	1	
A	WO 2006/053730 A1 (LASA IMPIANTI SRL [IT]; BORTOLATO GIOVANNI [IT]) 26 May 2006 (2006-05-26) * page 2, paragraph 2 - page 3, line 12; claim 1; figures 1,3 *	1	
A	FR 2 024 084 A5 (KANNEGIESSER MASCHINEN) 21 August 1970 (1970-08-21) * page 3, paragraph 18-35; claim 1; figures 1,2 *	1	
			TECHNICAL FIELDS SEARCHED (IPC)
			D06B B41M B41L B41F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	3 May 2022	Uhlig, Robert

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

03-05-2022

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
IT 201900005592 A1	11-10-2020	----------	
US 4431429 A	14-02-1984	NONE	
WO 2006053730 A1	26-05-2006	EP 1827829 A1	05-09-2007
		WO 2006053730 A1	26-05-2006
FR 2024084 A5	21-08-1970	NONE	

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82