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(54) **Apparatus and method for printing on yarns and fabric obtained from the printed yarns**

Vorrichtung und Verfahren zum Drucken auf Garnen und Gewebe aus solchen bedruckten Garnen

Dispositif et procédé pour imprimer sur des fils et tissu obtenu à partir de ces fils imprimés

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EP 1 520 924 B1

Description

[0001] The present invention refers to an apparatus for printing on yarns, to a method for printing on yarns and to a fabric obtained with said printed yarns.

[0002] In the textile field it is known a method for printing on fabrics, generally cotton or cotton mixtures, which are made to pass through print rollers so as to obtain a printed fabric.

[0003] It appears obvious that said printing method is not very versatile and that it is very limiting because of the limited number of chromatic effects that can be printed on the fabric. In fact, said chromatic effects are limited exclusively to the configuration of the print rollers.

[0004] In the textile field it is known as "chinè" a fabric obtained by weaving on a loom handicraft printed cotton yarns collected on a beam.

[0005] This method of handicraft printing cotton yarns consists in weaving the warp cotton threads with few weft threads to the centimetre so as to form a fabric with sufficient consistency to allow printing and fixing of the colours with printing procedures used for cotton or mixed fabrics.

[0006] The printed fabric obtained in this manner undergoes a process of undoing wherein the weft threads are removed and the printed warp threads are rewound on beams for weaving. During weaving said printed warp threads are used and the desired weft threads are inserted to obtain chinè fabric.

[0007] It is obvious that said handicraft procedure proves to be very costly. Furthermore, it allows production of fabrics of limited height (maximum 150 cm), which cannot be employed for home textile sector, for which large fabric widths are required.

[0008] A printing procedure on yarns in warp beams, called "transfer printing", is also known, which consists in transferring with a hot calender, from a paper to the threads of the beam, a drawing previously printed on the paper.

[0009] This transfer printing procedure is possible only with polyester or polyester mixtures yarns, as the dyes fix only to the polyester part contained in the yarn. As a result, this procedure is very limiting and cannot be carried on cotton yarns.

[0010] GB 2 059 876 discloses a method and apparatus for printing a sheet of yarns, such as a tufted carpet.

[0011] An object of the present invention is to eliminate the drawbacks of the prior art, providing an apparatus and a method for printing on yarns that are highly versatile and suitable to be applied to various types of yarns and particularly to cotton yarns.

[0012] Another object of the present invention is to provide an apparatus for printing on yarns that is cheap and simple to make.

[0013] Another object of the present invention is to provide a method for printing on yarns of industrial type that allows a high production speed in automatic mode and at a low cost.

[0014] These objects are achieved according to the invention through the apparatus and the method whose characteristics are listed in appended independent claims 1 and 10, respectively.

[0015] Another object of the present invention is to provide a fabric made from printed yarns that is not excessively expensive, does not have strict size and colours limitations and makes it possible to obtain a multitude of chromatic variables.

[0016] Advantageous embodiments of the invention are apparent from the dependent claims.

[0017] The apparatus for printing on yarns according to the invention comprises:

- a feeding station comprising a beam wherein a plurality of yarns to be printed are wound,
- a printing station comprising a plurality of print rollers able to print dyes onto the yarns unwound from said beam,
- a drying station able to carry out drying and fixing of the dye printed on said yarns leaving the printing station, and
- a beaming station able to collect on a warp beam said printed and dried yarns leaving the drying station.

[0018] Thus, the warp beam with the printed yarns is ready to be disposed in a loom for weaving so as to obtain a fabric with printed warp yarns and neutral or dyed weft yarns. In this manner an infinite range of chromatic effects can be obtained, according to the colours of the warp threads used.

[0019] The advantages of the invention, providing a totally industrialised and automated apparatus and method for printing warp yarns, which will subsequently be woven to obtain various types of fabric with a chinè effect, are evident.

[0020] Further characteristics of the invention will be made clearer by the detailed description that follows, referring to a purely exemplary and therefore non-limiting embodiment thereof, illustrated in the appended drawings, in which:

- figure 1 is a diagrammatic side elevational view of an apparatus for printing on yarns according to the invention;
- figure 1A is an enlarged view of the drying station and of the beaming station of the apparatus of figure 1, and
- figure 2 is a plan view of the apparatus of figure 1, taken substantially along a horizontal plane coinciding with the feed surface of the yarns.

[0021] An apparatus for printing yarns according to the invention, denoted as a whole with reference numeral 100, is described with the aid of the figures.

[0022] The apparatus 100 comprises a feeding station 1 which provides for a warp beam 10 prepared by warping/sizing with a suitable quantity and number of yarns, which must make up the fabric to be obtained.

[0023] The warp beam 10 consists of a mandrel 11 rotatably mounted on cradles 12 supported by a frame 13. A plurality of warp yarns 14 is wound on the mandrel 11. The yarns 14 can preferably be of different materials of the cotton type such as, for example, cotton alone or mixed (cotton/polyester, cotton/viscose).

[0024] The warp yarns 14 are unwound from the beam 10 and fed towards a printing machine 2. The printing machine is substantially similar to a printing machine commonly used for printing fabrics.

[0025] For this purpose, the printing machine 2 is provided with a base 20, wherein an endless loop conveyor 21 is disposed. The conveyor 21 provides a belt consisting of a plurality of layers of rubber, for example seven layers. The conveyor 21 is motorized and driven in anti-clockwise rotation and defines a horizontal feed surface in the direction of the arrow F (figure 2).

[0026] The yarns 14 coming from the beam 10 are fed on the conveyor belt 21, disposed parallel to each other and of the same number as the warp threads destined to form the fabric.

[0027] A plurality of print rollers 22, disposed in a row with each other in the direction of feeding of the yarns 14, are positioned on the conveyor belt 21. Each print roller 22 is rotatably mounted on a support 23 and driven in rotation by a relative drive system set in synchronism with the drive system of the conveyor 21.

[0028] The axes of the print rollers 22 are parallel to each other and parallel to the feed surface of the conveyor 21. The print rollers 22 rotate in a clockwise direction. In this manner, the yarns 14 which pass between the conveyor belt 21 and the print rollers 22 are made to advance in the direction of the arrow F.

[0029] The print dyes are contained in a plurality of tanks 24 (figure 2) disposed on board of the machine. The families of pigment, reactive, indanthrene, dispersed dyes and the like can be used as dyes. Each colour tank 24 is hydraulically connected to a respective print roller 22 by means of a pump, which is responsible for feeding the colour into the print roller 22.

[0030] The print rollers 22 have an outer sleeve made up of an engraved copper membrane. Inside the print rollers there are provided movable metal rods, which spread the colour into the engraved parts of the copper sleeve.

[0031] Beneath the feed surface of the conveyor 21 there are positioned magnets in register with the metal rods of the print rollers 22. As a result, the magnets attract the metal rods toward the conveyor 21 causing distribution of the colour into the engravings of the print rollers 22. Thus, by regulating the magnetic retention strength of the magnets, distribution of the colour into the engravings of the print rollers 22 is regulated.

[0032] In the bottom part of the base 20 there are pro-

vided washing means which are responsible for washing the belt of the conveyor 21 during its return stroke so as to remove the colour left by the print rollers 22 which would otherwise soil the yarns 14 during printing. In this manner the upper horizontal yarn-feeding surface of the belt of the conveyor 21 is always clean.

[0033] With reference to the figures a printing station 2 of the flat type with an endless loop conveyor belt 21 has been described. However, a rotary machine could also be provided wherein the flat conveyor belt 21 is replaced by a cylindrical drum and the print rollers 22 can be fed with colour through other types of doctor blade assemblies and/or of inking rollers.

[0034] On leaving the printing station 2, the yarns 14 are fed towards a pre-drying station 3 for a first drying of the dyes deposited in the printing station 2, without any contact with contact members. In fact the yarns 14 impregnated with dye would contaminate any other contact member also altering the design printed on the yarns, which subsequently touch the contact member contaminated with dye.

[0035] As shown better in Figure 1A, the pre-drying station 3 comprises infrared panels 30 provided with radiant sources which emit waves in the infrared range (2-4 μm), so as to develop heat at a temperature of about 800°C. In addition to or in place of the infrared panels 30, microwave panels provided with microwave radiant sources, such as a magnetron, can be provided. In addition to or in place of the infrared and/or microwave panels 30, banks of air dryers 31, such as air blowers, are provided.

[0036] Lastly, the yarns 14 coming from the printing station 2 pass without any contact through the pre-drying station 3 in which they are partially dried so as to be able to come into contact with other contact members without contaminating them with dyes. For a complete drying of the yarns 14 and for a perfect fixation of the dyes the yarns 14, leaving the pre-drying station 3, are directed to a post-drying station 4 in which they complete drying through contact with other contact members.

[0037] The post-drying station 4 provides a plurality of steam-heated drying rollers (41, 42, 43, 44) around which the yarns 14 are made to pass. By way of example, in the figures there is illustrated a drying roller configuration which provides a first drying roller 41 at the exit from the infrared panels 30, three fixed guide rollers able to guide the yarns 14 towards a synchronising movable roll 48 which adjusts drawing of the yarns 14 to synchronise the speed of travel of the printing station 2 with the speed of travel of the post-drying station 4.

[0038] Downstream of the movable roll 48 another guide roller 49 is disposed, which guides the yarns 14 towards a set of three drying rollers (42, 43, 44). Downstream of the last drying roller 44 an exit calender 50 is disposed, consisting of two opposed and counter-rotating rollers, which serve to draw the yarns 14.

[0039] Downstream of the exit calender 50 a beaming station 6 is provided. Between the exit calender 50 and

the beaming station 6 another synchronising movable roll 51 is interposed, which serves to adjust pulling of the yarns 14 to synchronise the pulling speed of the calender 50 of the post-drying station with the drawing speed of the beaming station 6.

[0040] The beaming station 6 has a beaming or sizing head 60 able to wind the printed and dried yarns 14 into a beam 61 ready for weaving by means of a loom. In the sizing head a comb with V-shaped sectors is disposed, which serves to bring the yarns to the exact size of the fabric that is to be obtained.

[0041] As a result a beam 61 of printed warp yarns is obtained, ready to be woven with the insertion of raw or printed weft yarns of the desired quality and density, so as to obtain a chinè fabric in a completely industrialised and automated manner.

[0042] It should be noted that with said beam 61 of printed warp yarns according to the invention, fabrics of large width can be obtained, ranging up to about 320 cm, which is the maximum width obtainable with the current printing machines for fabrics and is bound to the size of the print rollers 22.

[0043] Furthermore, by alternating warp yarns with different dyeing colours, countless chromatic motifs can be obtained on the fabric made with the warp yarns printed according to the invention.

[0044] Thanks to the apparatus according to the invention, this chinè effect is not limited only to flat, cotton fabrics but can also be extended to terry clothes, such as towels, robes, beach towels, bath towels and the like or to ladderproof warp fabrics or other types of fabrics. Furthermore, said chinè effect is not limited only to fabrics in particular fields in which a reduced fabric width is required, but can also be extended to fabrics in the field of clothing or of home sector, such as tablecloths, bedspreads and the like, in which a greater fabric width is required.

[0045] Numerous variations and modifications of detail within the reach of a person skilled in the art can be made to the present embodiment of the invention without thereby departing from the scope of the invention as set forth in the appended claims.

Claims

1. An apparatus (100) for printing yarns (14) comprising:

- a feeding station (1) suitable to feed a plurality of yarns (14) to be printed,
- a printing station (2) comprising a plurality of print rollers (22) able to print dyes onto the yarns (14) fed from said feeding station (1),
- a drying station (3, 4) able to carry out drying and fixing of the dye printed on said yarns (14) leaving the printing station (2), and
- a beaming station (6) able to collect on a warp

beam (61) said printed and dried yarns leaving the drying station (3, 4)

characterised in that

said feeding station (1) comprises a beam (10) wherein said plurality of yarns (14) to be printed are wound, and

said drying station comprises:

- a pre-drying station (3) able to perform a first drying of the dye printed on said yarns (14), avoiding any contact of the yarns with any contact organs, and
- a post-drying station (4) disposed downstream of said pre-drying station to perform a complete drying of the dye printed on said yarns (14), by

means of contact of the yarns with organs of contact, and

said pre-drying station (3) comprises infrared panels (30) provided with a radial source in the infrared range, or microwave panels provided with a radiation source in the microwave range.

2. An apparatus (100) according to claim 1, **characterised in that** said pre-drying station comprises infrared panels (30) and microwave panels.

3. An apparatus (100) according to claim 1 and 2, **characterised in that** said pre-drying station (3) further comprises air dryers (31) provided with air blowers.

4. An apparatus (100) according to any one of the preceding claims, **characterised in that** said post-drying station (4) comprises steam-heated cylinders (41, 42, 43, 44) around which said yarns (14) coming from the pre-drying station (3) are made to pass.

5. An apparatus (100) according to any one of the preceding claims, **characterised in that** it comprises:

- a first movable roll (48) disposed between the printing station (2) and the post-drying station (4) to adjust pulling of the yarns (14) to synchronise their speed of travel in the printing station with their speed of travel in the post-drying station (4); and
- a second movable roll (51) disposed between the post-drying station (4) and the beaming station (6) to adjust pulling of the yarns (14) to synchronise their speed of travel in the post-drying station (4) with their speed of travel in the beaming station (6).

6. An apparatus (100) according to any one of the preceding claims, **characterised in that** it comprises an exit calender (50), consisting of two counter-rotating drawing rollers disposed at the exit from said

post-drying station (4).

7. An apparatus (100) according to any one of the preceding claims, **characterised in that** said printing station (2) comprises an endless loop conveyor (21) which defines a horizontal feed surface on which said print rollers (22) are disposed.

8. An apparatus (100) according to any one of the preceding claims, **characterised in that** said print rollers (22) comprise:

- a pump for feeding the dye on their inside,
- an outer engraved copper membrane, and
- a plurality of metal rods co-operating by magnetic retention with a plurality of magnets to regulate the amount of dye to be distributed in the engravings of the membrane.

9. An apparatus (100) according to any one of the preceding claims, **characterised in that** said beaming station (6) comprises:

- a beaming or sizing head (60) to collect the printed yarns (14) in the beam (61), and
- a comb with V-shaped sectors to bring the yarns to the exact measurement of the fabric to be woven.

10. A method for printing on yarns (14), particularly on cotton or cotton mixtures, comprising the following stages:

- feeding of yarns (14),
- printing of dye on said yarns (14) by means of a printing machine for fabrics,
- drying of the printed dye; and
- beaming of the printed and dried yarns in a warp beam (61).

characterised in that

said yarns are fed by a warp beam (10),
said drying stage comprises the following steps:

- a pre-drying step, in which the dye printed on the yarns is dried avoiding any contact of the yarns with any contact elements, and
- a post-drying step, in which the dye printed on the yarns is completely dried by means of contact with contact organs, and

said pre-drying step comprises drying by means of infrared or microwaves or air blowers.

11. A method according to claim 10, **characterised in that** said pre-drying step comprises drying by means of infrared and microwaves.

12. A method according to claim 10 or 11, **characterised in that** said pre-drying step comprises drying by means of air blowers.

13. A method according to any one of the claims 10 to 12, **characterised in that** said post-drying step comprises drying by means of contact with steam-heated cylinders.

Patentansprüche

1. Vorrichtung (100) zum Bedrucken von Garnen (14), umfassend:

- eine Zuführstation (1), die sich zur Zuführung mehrerer zu bedruckender Garne (14) eignet,
- eine Druckstation (2), die mehrere Druckwalzen (22) umfasst, welche Farben auf die von der Zuführstation (1) zugeführten Garne (14), drucken,
- eine Trocknungsstation (3, 4), welche in der Lage ist, die Farbe, die auf die von der Druckstation (2) kommenden Garne (14) gedruckt wurde, zu trocknen und zu fixieren, und
- eine Bäumstation (6), die in der Lage ist, die bedruckten und getrockneten Garne, welche die Trocknungsstation (3, 4) verlassen, auf einem Garnbaum (61) zu sammeln,

dadurch gekennzeichnet, dass

die Zuführstation (1) einen Baum (10) zum Aufwinden mehrerer zu bedruckender Garne (14) umfasst, und dass die Trocknungsstation umfasst:

- eine Vortrocknungsstation (3), welche in der Lage ist, eine erste Trocknung der auf die Garne (14) aufgedruckten Farbe auszuführen, indem jeder Kontakt der Garne mit irgendeinem Kontaktorgan vermieden wird, und
- eine Nachtrocknungsstation (4), die der Vortrocknungsstation nachgeschaltet ist, um eine vollständige Trocknung der auf die Garne (14) aufgedruckten Farbe durch Kontakt der Garne mit Kontaktorganen auszuführen, und die Vortrocknungsstation (3) Infrarotplatten (30) mit einer strahlenförmigen Quelle im Infrarotbereich oder Mikrowellenplatten umfasst, die mit einer Strahlenquelle im Mikrowellenbereich versehen sind.

2. Vorrichtung (100) nach Anspruch 1, **dadurch gekennzeichnet, dass** die Vortrocknungsstation Infrarotplatten (30) und Mikrowellenplatten umfasst.

3. Vorrichtung (100) nach Anspruch 1 und 2, **dadurch gekennzeichnet, dass** die Vortrocknungsstation (3) ferner Lufttrockner (31) umfasst, die mit Luftge-

bläsen versehen sind.

4. Vorrichtung (100) nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** die Nachtrocknungsstation (4) Dampfzylinderwalzen (41, 42, 43, 44) umfasst, um welche die aus der Vortrocknungsstation (3) austretenden Garne (14) geführt werden. 5

5. Vorrichtung (100) nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** sie umfasst: 10
 - eine erste bewegliche Rolle (48), die zwischen der Druckstation (2) und der Nachtrocknungsstation (4) angeordnet ist, um das Ziehen der Garne (14) zu justieren, damit ihre Fahrgeschwindigkeit in der Druckstation mit ihrer Fahrgeschwindigkeit in der Nachtrocknungsstation (4) synchronisiert ist, und 15
 - eine zweite bewegliche Rolle (51), die zwischen der Nachtrocknungsstation (4) und der Bäumstation (6) angeordnet ist, um das Ziehen der Garne (14) zu justieren, damit ihre Fahrgeschwindigkeit in der Nachtrocknungsstation (4) mit ihrer Fahrgeschwindigkeit in der Bäumstation (6) synchronisiert ist. 20 25

6. Vorrichtung (100) nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** sie einen Ausgangskalandar (50) mit zwei Zugwalzen in Gegendrehung umfasst, die am Ausgang der Nachtrocknungsstation (4) angeordnet sind. 30

7. Vorrichtung (100) nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** die Druckstation (2) einen Endlosbandförderer (21) umfasst, der eine horizontale Zuführfläche definiert, auf welcher die Druckwalzen (22) angeordnet sind. 35 40

8. Vorrichtung (100) nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** die Druckwalzen (22) umfassen: 45
 - eine Pumpe zur Zuführung der Farbe auf ihre Innenseite,
 - eine äußere Gravurkupfermembran, und
 - mehrere Metallstäbe, die durch magnetische Retention mit mehreren Magneten zusammenwirken, um die in den Gravuren der Membran zu verteilenden Farbmengen zu regeln. 50

9. Vorrichtung (100) nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** die Bäumstation (6) umfasst: 55
 - einen Garnbaum- oder Kalibrierkopf (60), um die bedruckten Garne (14) im Garnbaum (61)

zu sammeln, und

- einen Kamm mit V-förmigen Sektoren, um die Garne auf das genaue Maß des zu webenden Stoffes zu bringen.

10. Verfahren zum Bedrucken von Garnen (14), insbesondere auf Baumwolle oder Baumwollgemische, umfassend die folgenden Stufen:

- Zuführung von Garnen (14),
- Aufdrucken von Farbe auf die Garne (14) mit Hilfe einer Druckmaschine für Gewebe,
- Trocknen der aufgedruckten Farbe, und
- Bäumen der bedruckten und getrockneten Garne in einem Garnbaum (61),

dadurch gekennzeichnet, dass

die Garne über einen Garnbaum (10) zugeführt werden,

die Trocknungsstufe folgende Schritte umfasst:

- einen Vortrocknungsschritt, bei welchem die auf die Garne gedruckte Farbe getrocknet wird, wobei jeder Kontakt der Garne mit irgendeinem Kontaktelement verhindert wird, und
- einen Nachtrocknungsschritt, bei welchem die auf die Garne gedruckte Farbe vollständig durch Kontakt mit Kontaktorganen getrocknet wird, und

der Vortrocknungsschritt das Trocknen mit Hilfe von Infrarot- oder Mikrowellen oder Luftgebläsen umfasst.

11. Verfahren nach Anspruch 10, **dadurch gekennzeichnet, dass** der Vortrocknungsschritt das Trocknen mit Hilfe von Infrarot- und Mikrowellen umfasst. 35

12. Verfahren nach Anspruch 10 oder 11, **dadurch gekennzeichnet, dass** der Vortrocknungsschritt das Trocknen mit Hilfe von Luftgebläsen umfasst. 40

13. Verfahren nach Anspruch 10 oder 12, **dadurch gekennzeichnet, dass** der Nachtrocknungsschritt das Trocknen durch Kontakt mit Dampfzylinderwalzen umfasst. 45

Revendications

1. Appareil (100) pour imprimer des fils (14) comprenant : 55
 - un poste d'alimentation (1) convenant à l'introduction d'une pluralité de fils (14) à imprimer,
 - un poste d'impression (2) comprenant une pluralité de rouleaux d'impression (22) capable d'imprimer des colorants sur les fils (14) intro-

duits à partir dudit poste d'alimentation (1),
 - un poste de séchage (3, 4) susceptible d'effectuer le séchage et la fixation du colorant imprimé sur lesdits fils (14) quittant le poste d'impression (2), et
 - un poste d'ensouplage (6) susceptible de recueillir sur une ensouple de chaîne (61) lesdits fils imprimés et séchés quittant le poste de séchage (3, 4),

caractérisé en ce que,

ledit poste d'alimentation (1) comprend une ensouple (10) dans laquelle ladite pluralité de fils (14) à imprimer sont enroulés, et

ledit poste de séchage comprend :

- un poste de pré-séchage (3) susceptible de réaliser un premier séchage du colorant imprimé sur lesdits fils (14), en évitant tout contact des fils avec tous organes de contact, et
- un poste de post-séchage (4) disposé en aval dudit poste de pré-séchage afin de réaliser un séchage complet du colorant imprimé sur lesdits fils (14), au moyen du contact des fils avec des organes de contact, et

ledit poste de pré-séchage (3) comprend des panneaux à infrarouges (30) munis d'une source rayonnante dans le domaine de l'infrarouge ou des panneaux à micro-ondes munis d'une source de rayonnement dans le domaine des micro-ondes.

2. Appareil (100) selon la revendication 1, **caractérisé en ce que** ledit poste de pré-séchage comprend des panneaux à infrarouges (30) et des panneaux à micro-ondes.

3. Appareil (100) selon la revendication 1 et 2, **caractérisé en ce que** ledit poste de pré-séchage (3) comprend en outre des sècheurs à air (31) munis de soufflantes à air.

4. Appareil (100) selon l'une quelconque des précédentes, **caractérisé en ce** ledit poste de post-séchage (4) comprend des cylindres chauffés à la vapeur d'eau (41, 42, 43, 44) autour desquels on fait passer lesdits fils (14) provenant du poste de pré-séchage (3).

5. Appareil (100) selon l'une quelconque des précédentes, **caractérisé en ce qu'il** comprend :

- un premier rouleau déplaçable (48) disposé entre le poste d'impression (2) et le poste de post-séchage (4) afin d'ajuster la traction des fils (14) pour synchroniser leur vitesse de parcours dans le poste d'impression avec leur vitesse de parcours dans le poste de post-sécha-

ge (4); et

- un deuxième rouleau déplaçable (51) disposé entre le poste de post-séchage (4) et le poste d'ensouplage (6) afin d'ajuster la traction des fils (14) pour synchroniser leur vitesse de parcours dans le poste de post-séchage (4) avec leur vitesse de parcours dans le poste d'ensouplage (6).

6. Appareil (100) selon l'une quelconque des précédentes, **caractérisé en ce qu'il** comprend une calandre de sortie (50) constituée de deux rouleaux de traction contrarotatifs disposés à la sortie dudit poste de post-séchage (4).

7. Appareil (100) selon l'une quelconque des précédentes, **caractérisé en ce que** ledit poste d'impression (2) comprend un convoyeur à boucle infinie (21) qui définit une surface d'alimentation horizontale sur laquelle sont disposés lesdits rouleaux d'impression (22).

8. Appareil (100) selon l'une quelconque des précédentes, **caractérisé en ce que** lesdits rouleaux d'impression (22) comprennent :

- une pompe pour introduire le colorant sur leur intérieur,
- une membrane de cuivre gravée externe, et
- une pluralité de tiges métalliques fonctionnant de concert par rétention magnétique avec une pluralité d'aimants en vue de réguler la quantité de colorant à distribuer dans les gravures de la membrane.

9. Appareil (100) selon l'une quelconque des précédentes, **caractérisé en ce** ledit poste d'ensouplage (6) comprend ;

- une tête d'ensouplage ou d'encollage (60) pour recueillir les fils imprimés (14) dans l'ensouple (61), et
- un peigne ayant des secteurs en forme de V afin d'amener les fils à la mesure exacte du tissu à tisser.

10. Procédé pour imprimer sur les fils (14), en particulier sur le coton ou des mélanges de coton comprenant les étapes suivantes :

- introduction des fils (14)
- impression du colorant sur lesdits fils (14) au moyen d'une machine d'impression pour tissus,
- séchage du colorant imprimé; et
- ensouplage des fils imprimés et séchés dans une ensouple de chaîne (61)

caractérisé en ce que,

lesdits fils sont introduits par une ensouple de chaîne (10),
ladite étape de séchage comprend les étapes suivantes :

- une étape de pré-séchage, dans laquelle le colorant imprimé sur les fils est séché en évitant tout contact des fils avec tous éléments de contact, et 5
 - une étape de post-séchage, dans laquelle le colorant imprimé sur les fils est séché complètement au moyen d'un contact avec des organes de contact, et 10
- ladite étape de pré-séchage comprend le séchage au moyen d'infrarouges ou de micro-ondes ou de soufflantes à air. 15
11. Procédé selon la revendication 10, **caractérisé en ce que** ladite étape de pré-séchage comprend le séchage au moyen d'infrarouges et de micro-ondes. 20
12. Procédé selon la revendication 10 ou 11, **caractérisé en ce que** ladite étape de pré-séchage comprend le séchage au moyen de soufflantes à air. 25
13. Procédé selon l'une quelconque des revendications 10 à 12, **caractérisé en ce que** ladite étape de post-séchage comprend le séchage au moyen d'un contact avec des cylindres chauffés par de la vapeur d'eau. 30

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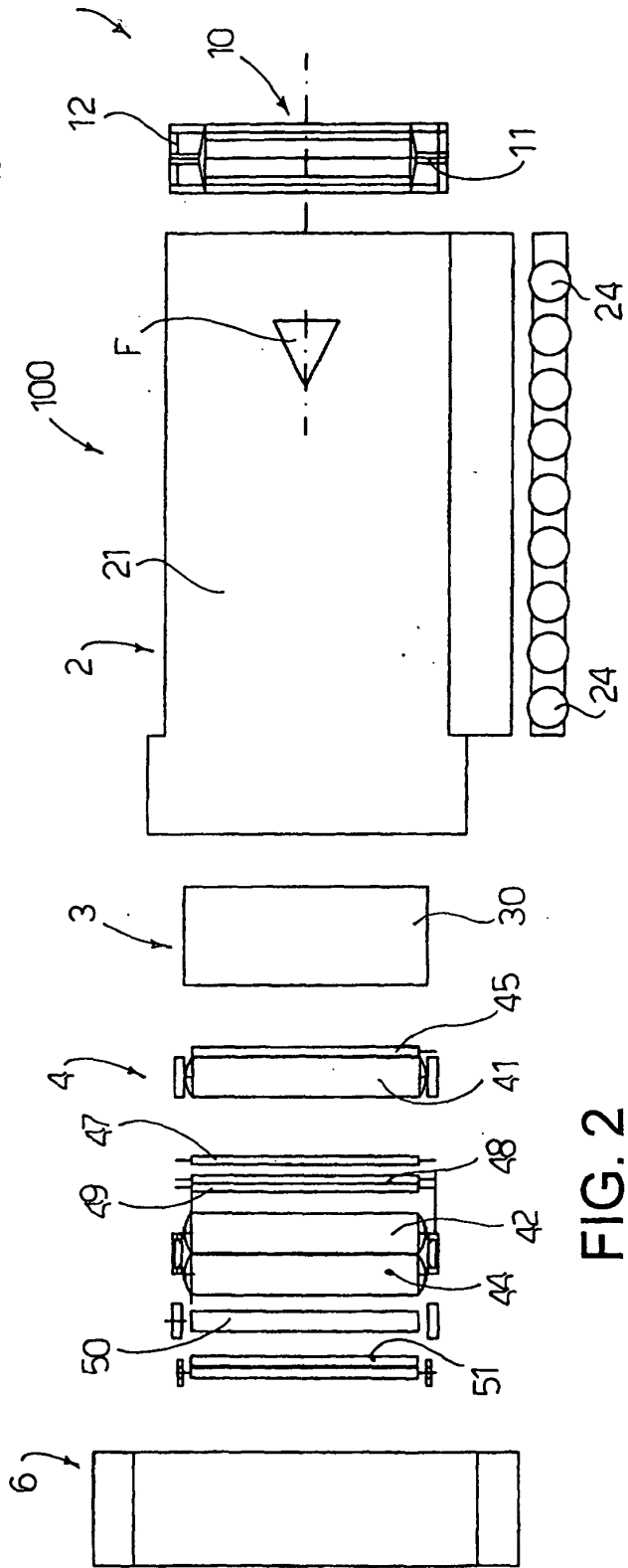
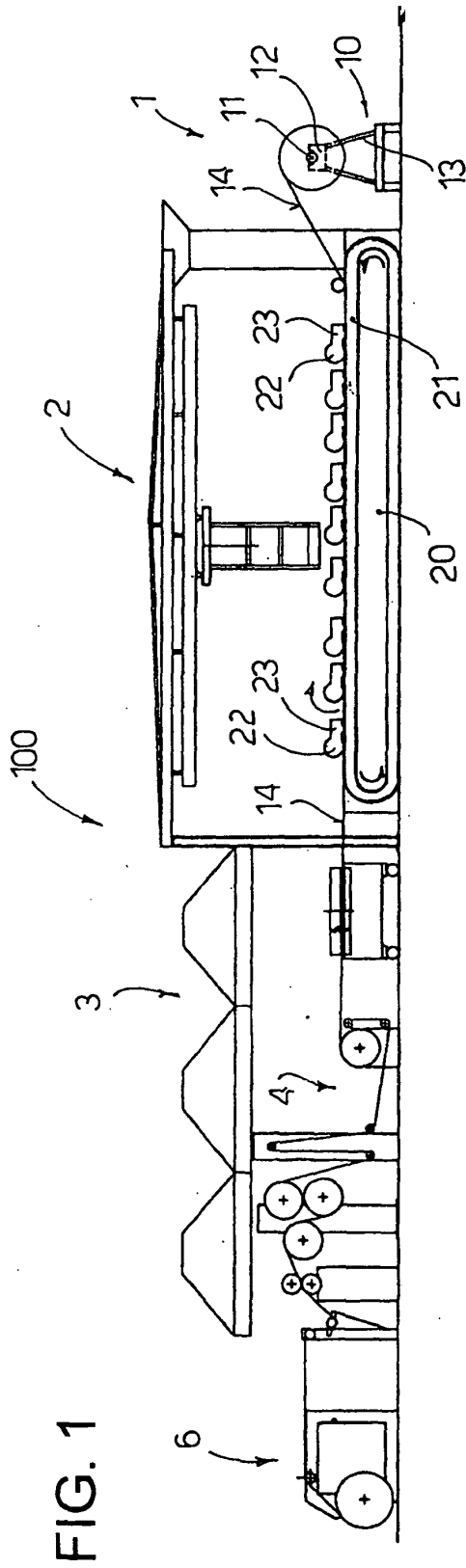


FIG. 1A

