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(72) Inventor: **Fuse' Gianlugi**
20010 Marcallo con Casone (IT)

(74) Representative: **Petruzzello, Aldo et al**
Racheli & C. S.p.A
Viale San Michele del Carso, 4
20144 Milano (IT)

(71) Applicant: **VINCENZO ZUCCHI S.P.A.**
I-20145 Milano (IT)

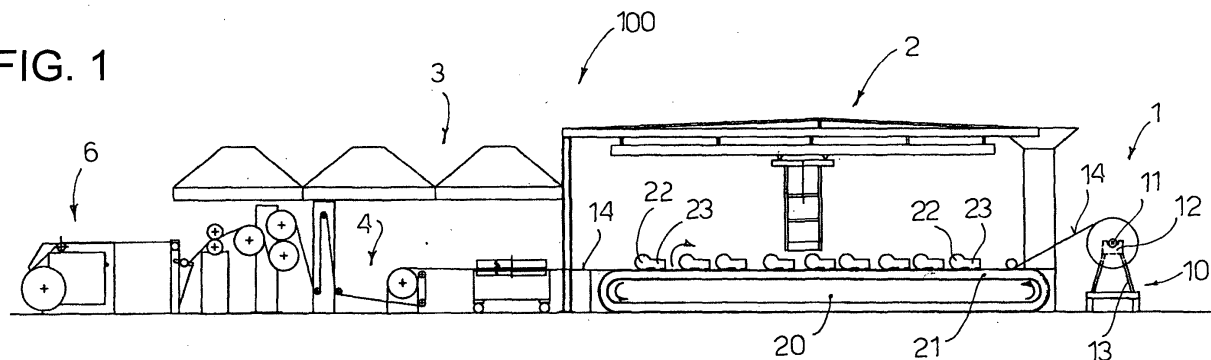
(54) **Apparatus and method for printing on yarns and fabric obtained from the printed yarns**

(57) A apparatus (100) for printing on yarns (14) is described, comprising a feeding station (1) comprising a beam (10) in which a plurality of yarns (14) are wound, a printing station (2) comprising a plurality of print rollers (22) able to print dyes onto yarns (14) unwound from said beam (10), a drying station (3, 4) able to perform

drying and fixing of the printed dye on said yarns (14) leaving the printing station (2) and a beaming station (6) able to collect said printed and dried yarns leaving the drying station (3, 4) on a warp beam (61).

Also described are a yarn printing method and a fabric obtained with said printed yarns.

FIG. 1



Description

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

[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 yams 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 yams 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 yams, as the dyes fix only to the polyester part contained in the yam. As a result, this procedure is very limiting and cannot be carried on cotton yams.

[0010] An object of the present invention is to eliminate the drawbacks of the prior art, providing an apparatus and a method for printing on yams that are highly versatile and suitable to be applied to various types of yams and particularly to cotton yams.

[0011] Another object of the present invention is to provide an apparatus for printing on yams that is cheap and simple to make.

[0012] Another object of the present invention is to provide a method for printing on yams of industrial type that allows a high production speed in automatic mode and at a low cost.

[0013] 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.

[0014] Another object of the present invention is to provide a fabric made from printed yams that is not excessively expensive, does not have strict size and colours limitations and makes it possible to obtain a multitude of chromatic variables.

[0015] This object is achieved according to the invention with the fabric according to independent claim 14.

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

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

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

[0018] Thus, the warp beam with the printed yams is ready to be disposed in a loom for weaving so as to obtain a fabric with printed warp yams and neutral or dyed weft yams. 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 yams, 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 yams 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 yams.

[0021] An apparatus for printing yams 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 yams, 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 yams 14 is wound on the mandrel 11. The yams 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 yams 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 anticlockwise rotation and defines a horizontal feed surface in the direction of the arrow F (figure 2).

[0026] The yams 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 yams 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 yams 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 yams 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 yams 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 yams 14 impregnated with dye would contaminate any other contact member also altering the design printed on the yams, 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 yams 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 yams 14 and for a perfect fixation of the dyes the yams 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 yams 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 yams 14 towards a synchronising movable roll 48 which adjusts drawing of the yams 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 yams 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 yams 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 yams 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 yams 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 yams to the exact size of the fabric that is to be obtained.

[0041] As a result a beam 61 of printed warp yams is obtained, ready to be woven with the insertion of raw or printed weft yams 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 yams 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 yams with different dyeing colours, countless chromatic motifs can be obtained on the fabric made with the warp yams 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 yams (14) comprising:
 - a feeding station (1) comprising a beam (10) wherein a plurality of yams (14) to be printed are wound,
 - a printing station (2) comprising a plurality of print rollers (22) able to print dyes onto the yams (14) unwound from said beam (10),
 - a drying station (3, 4) able to carry out drying and fixing of the dye printed on said yams (14)

- leaving the printing station (2), and
- a beaming station (6) able to collect on a warp beam (61) said printed and dried yams leaving the drying station (3, 4).

2. An apparatus (100) according to claim 1, **characterised in that** said drying station comprises:

- a pre-drying station (3) able to perform a first drying of the dye printed on said yams (14), without contact of the yams with contact organs, and
- a post-drying station (4) disposed downstream of said pre-drying station to perform complete drying of the dye printed on said yams (14), by means of contact of the yams with organs of contact.

3. An apparatus (100) according to claim 2, **characterised in that** said pre-drying station (3) comprises:

- infrared panels (30) provided with a radian source in the infrared range, and/or
- microwave panels provided with a radiation source in the microwave range, and/or
- air dryers (31) provided with air blowers.

4. A apparatus (100) according to claim 2 or 3, **characterised in that** said post-drying station (4) comprises steam-heated cylinders (41, 42, 43, 44) around which said yams (14) coming from the pre-drying station (3) are made to pass.

5. A plant (100) according to any one of claims 2 to 4, **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 yams (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 yams (14) to synchronise their speed of travel in the post-drying station (4) with their speed of travel in the beaming station (6).

6. A apparatus (100) according to any one of claims 2 to 4, **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. A 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. A 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 yams (14) in the beam (61), and
 - a comb with V-shaped sectors to bring the yams to the exact measurement of the fabric to be woven.
10. A method for printing on yams (14), particularly on cotton or cotton mixtures, comprising the following stages:
 - feeding of yams (14) from a warp beam (10),
 - printing of dye on said yams (14) by means of a printing machine for fabrics,
 - drying of the printed dye; and
 - beaming of the printed and dried yams in a warp beam (61).
11. A method according to claim 10, **characterised in that** said drying stage comprises the following steps:
 - a pre-drying step, in which the dye printed on the yams is dried without contact of the yams with contact elements, and
 - a post-drying step, in which the dye printed on the yams is dried completely by means of contact with contact organs.
12. A method according to claim 11, **characterised in that** said pre-drying step comprises drying by means of infrared and/or microwaves and/or air blowers.
13. A method according to claim 11 or 12, **characterised in that** said post-drying step comprises drying by means of contact with steam-heated cylinders.
14. A fabric obtained by weaving on a loom, **characterised in that** the warp yams are printed with the

method according to any one of claims 10 to 13.

15. A fabric according to claim 14, **characterised in that** the warp yams are yams which have undergone a dying treatment.
16. A fabric according to claim 14 or 15, **characterised in that** it is of a width ranging from 150 cm to 320 cm.
17. A fabric according to any one of claims 14 or 16, **characterised in that** it is a terry cloth.

FIG. 1

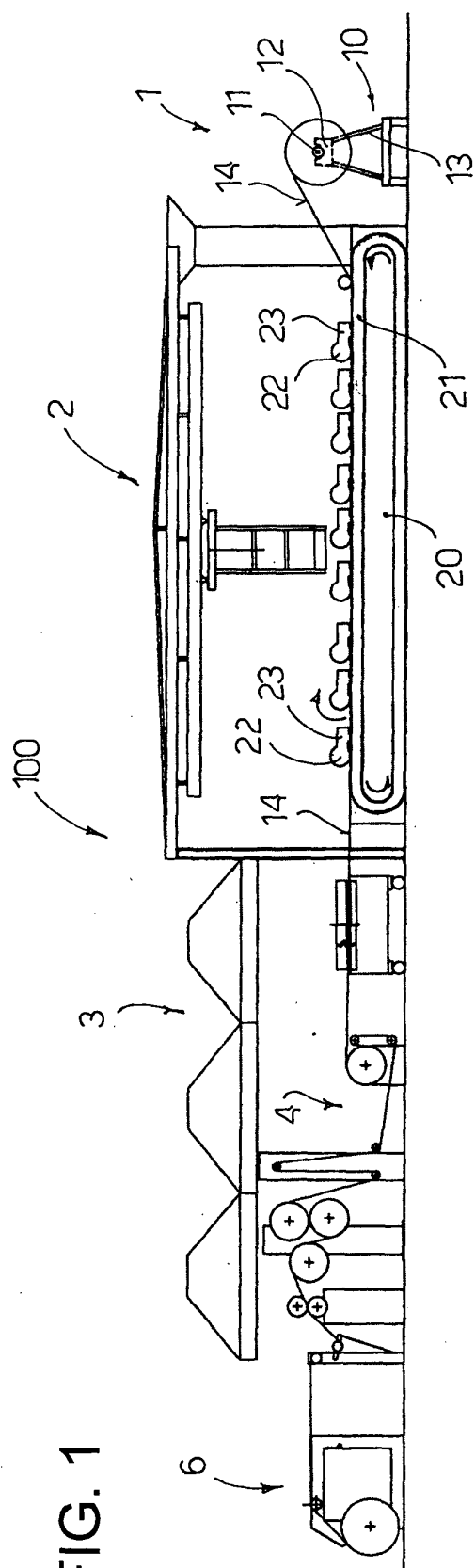


FIG. 2

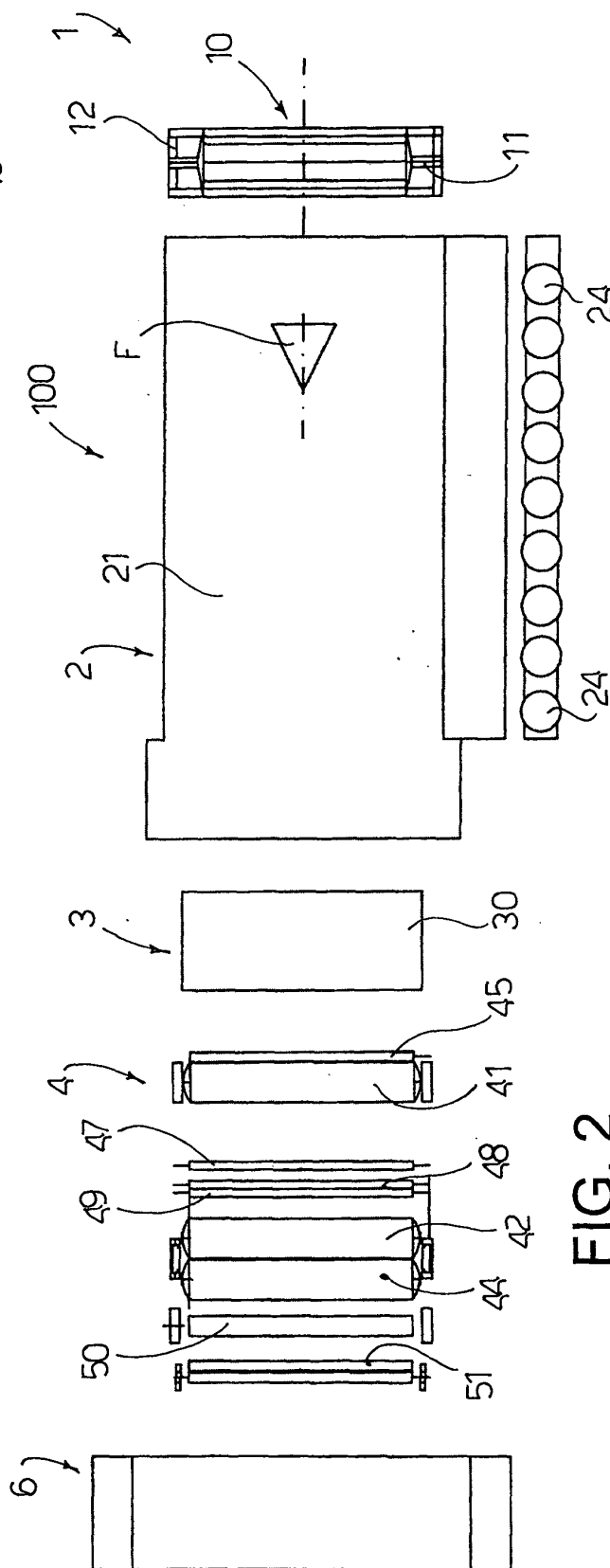
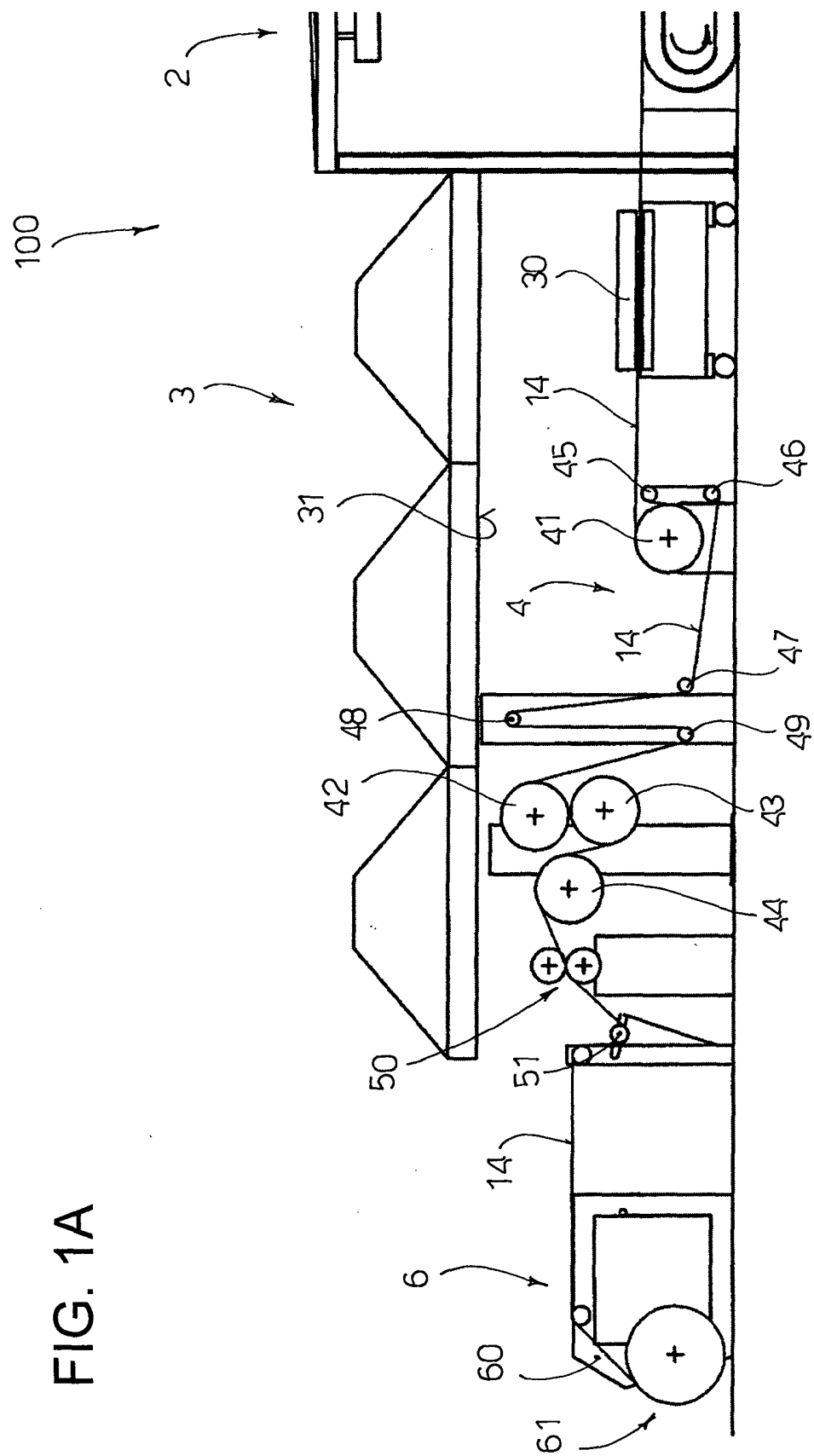


FIG. 1A





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Office

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Application Number
EP 03 42 5645

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Place of search THE HAGUE		Date of completion of the search 5 April 2004	Examiner D'Souza, J
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 03 42 5645

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
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