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(54) WARP YARN TRANSFER PRINTING MACHINE

(57) A warp yarn transfer printing machine comprises a heating roller (2), a transfer printing unit (3) and a colored paper unit (4). A surface temperature of the heating roller (2) is controlled to be at a processing temperature. The transfer printing unit (3) includes a drive shaft (31), a separation shaft (32), a support shaft (33) and a conveyor belt (36). The drive shaft (31) is driven to rotate about its own axis and to drive the conveyor belt (36) to advance along a conveying path. The heating roller (2), the separation shaft (32) and the support shaft (33) abut against the conveyor belt (36) and are rotatable respectively about their own axes. The colored paper unit (4) includes a first colored paper set (41) disposed at one side of the transfer printing unit (3) and adapted for dyeing.

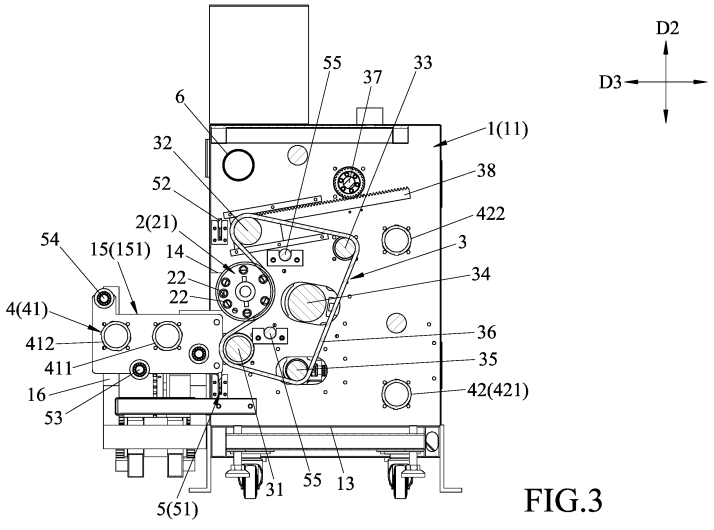


FIG.3

EP 3 888 916 A1

Description

[0001] The present invention relates to a dyeing apparatus, particularly to a warp yarn transfer printing machine.

[0002] Dyeing and finishing process is an important part of deep processing of products in textile industry chain and can increase the quality, function and value of the textile. Additionally, dyeing and finishing process is also the main part in resource consumption and pollutant emissions. Its energy consumption accounts for about 30% of that of the textile industry chain. The Chemical oxygen demand (COD) of waste water accounts for more than 80% of that of the textile industry. The dyeing and finishing process is to dye yarns with color so as to weave cloth materials with different colors. However, conventional dyeing and finishing process is to soak the yarns in a large amount of water containing dissolved dyes and to use a large amount of inorganic salt to facilitate dyeing. After that, a heating procedure and a rinsing procedure are required to complete dyeing. The abovementioned process not only has a low dye utilization rate (overall utilization rate is merely about 50% to 60%) but also produces a large amount of water vapor and waste materials after burning fuel, which consumes quite a lot of resources, and causes air pollution, and is therefore adverse to environment protection. In addition, waste material after fuel burning and the dyes need cleansing with water, which generates polluted water that requires to undergo sewage treatment before discharging. Construction of sewage treatment facilities consumes a lot of resources and land, which increases the cost of building factories. Therefore, the development of high-efficiency, short-flow, low-salt printing and dyeing technology would be quite beneficial.

[0003] From the technical perspective, yarns for weaving cloth material can be categorized into warp yarns and weft yarns, with warp yarns extending along a weaving direction while weft yarns interlacing warp yarns to be affixed to each other. Existing weaving machine generally supplies warp yarns by a warp yarn reel, with hundreds of kilograms of warp yarn being wound on the warp yarn reel thereby providing a large production scale. Weft yarns are wound on a plurality of weft yarn reels and weft yarns with different colors can be wound on a plurality of different weft yarn reels at the same time. In terms of practice, only two common materials of white yarn and black yarn are used as warp yarn. When the fabric is light-colored, white yarn is used as the warp yarn; on the contrary, when the fabric is dark-colored, black yarn is used as the warp yarn. When weaving, it is required for the fabric to have a large amount of weft yarns to cover the warp yarns so as to produce a fabric with the color of the weft yarns as the base color, and to conceal defects (white or black spots) caused by the warp yarns. The problem related to replacing warp yarns arises when warp yarns of another color is to be used to make up for the abovementioned defects. When replacing warp yarns, the number of warp yarns is usually a few thousand or up to ten thousand that are arranged in order. During the replacement, the warp yarns must be arranged in order neatly to corresponding positions, which is time-consuming and labor-intensive. Further, when warp yarns with another color are used, the cost increases significantly due to insufficient production scale. Existing weaving machines are thus categorized into black type and white type, and thus machines using white yarn cannot use black yarn, and on the other hand, machines using black yarn cannot use white yarn. Such restriction affects machine utilization and indirectly increases production costs.

[0004] For example, white warp yarns and light green weft yarns are used to produce cloth material having a base color of light green. Since the color of the warp yarns is white rather than light green, in order to ensure tightness of the cloth material, one can only increase the density of weft yarns. In this way, negative effects of increasing cost of time for weaving, hardening of the finished product and increase of defective products (e.g., floating yarn and broken yarn) are caused, thus leading to increase of manufacturing costs and decrease of customer comfort.

[0005] The object of the present invention is to provide a warp yarn transfer printing machine capable of performing waterless dyeing, accurately producing low amounts according to demand, and being convenient to replace warp yarns.

[0006] The warp yarn transfer printing machine of the present invention comprises a machine body unit, a heating roller detachably mounted to the machine body unit and extending along a left-right direction, a transfer printing unit mounted to the machine body unit and extending along the left-right direction, and a colored paper unit.

[0007] The heating roller is driven by the machine body unit to rotate about its own axis and has a surface temperature that is controlled to be at a processing temperature. The transfer printing unit includes a drive shaft, a separation shaft, a support shaft, and a conveyor belt surrounding the drive shaft, the separation shaft and the support shaft. An up-down direction perpendicular to the left-right direction, and a front-rear direction perpendicular to both the left-right direction and the up-down direction are defined. The drive shaft and the separation shaft are disposed respectively at a lower side and an upper side of the heating roller along the up-down direction. A position of the drive shaft is further more toward a front side relative to the heating roller along the front-rear direction. The support shaft is disposed at a rear side of the heating roller along the front-rear direction.

[0008] The drive shaft is driven by the machine body unit to rotate about its own axis and drives the conveyor belt to advance along a conveying path. The conveyor belt sequentially passes by the drive shaft, the heating roller, the separation shaft and the support shaft during the process of advancing along the conveying path, and circulates along the conveying path along with rotation

of the drive shaft. The conveyor belt is further in a tension state so that the conveyor belt itself presses against the drive shaft, the heating roller, the separation shaft and the support shaft. The heating roller abuts against the conveyor belt at an outer side of the conveyor belt, and the separation shaft and the support shaft abut against the conveyor belt at an inner side of the conveyor belt and are both driven by the conveyor belt to rotate about their own axes.

[0009] The colored paper unit includes a first colored paper set disposed at one of sides of the transfer printing unit along the front-rear direction.

[0010] The warp yarn transfer printing machine of the present invention further comprises a yarn arranging unit. The yarn arranging unit includes an input-yarn comb corresponding to the drive shaft, disposed at a front side relative to the transfer printing unit and extending along the left-right direction, and an output-yarn comb corresponding to the separation shaft, disposed at the front side relative to the transfer printing unit, and extending along the left-right direction. The input-yarn comb and the output-yarn comb are both detachably mounted to the machine body unit and are adapted for combing yarns.

[0011] In the warp yarn transfer printing machine of the present invention, the yarn arranging unit further includes a yarn input shaft disposed at a front side relative to the input-yarn comb and extending along the left-right direction, a yarn output shaft disposed at a front side relative to the output-yarn comb and extending along the left-right direction, and two yarn-pressing rods disposed at a rear side of the heating roller along the front-rear direction and extending along the left-right direction. The yarn input shaft and the yarn output shaft are both rotatable about their own axes. The yarn input shaft and the yarn output shaft are both adapted for a plurality of warp yarns to be arranged along the left-right direction and to abut against surfaces thereof. The yarn-pressing rods are further disposed respectively at a lower side and an upper side of the heating roller along the up-down direction and are detachably mounted to the machine body unit.

[0012] In the warp yarn transfer printing machine of the present invention, the first colored paper set of the colored paper unit has a first colored paper input reel located at a front side relative to the heating roller and a first colored paper output reel located at a front side relative to the first colored paper input reel. The first colored paper input reel and the first colored paper output reel are rotatable about their own axes.

[0013] In the warp yarn transfer printing machine of the present invention, the colored paper unit further includes a second colored paper set disposed at one side of the transfer printing unit opposite to the first colored paper set along the front-rear direction. The second colored paper set includes a second colored paper input reel located at a lower side relative to the heating roller, and a second colored paper output reel located at an upper side relative to the heating roller. The second colored paper input reel and the second colored paper output reel are rotatable about their own axes.

[0014] In the warp yarn transfer printing machine of the present invention, the machine body unit includes a first power box and a second power box that are respectively disposed at two opposite sides along the left-right direction, and a machine rack that is connected between the first power box and the second power box for supporting. The heating roller and the transfer printing unit are both disposed between the first power box and the second power box, causing the heating roller and the drive shaft to be driven.

[0015] In the warp yarn transfer printing machine of the present invention, the machine body unit further includes two sliding grooves respectively disposed at the first power box and the second power box, and corresponding in position to the heating roller. The sliding grooves extend along the front-rear direction and open toward a front side for mounting of the heating roller. The heating roller is mounted to the sliding grooves and, when unloaded, is movable along the sliding grooves so as to be detached from the machine body unit.

[0016] In the warp yarn transfer printing machine of the present invention, the machine body unit further includes a separation rack detachably mounted to a front side of the machine rack along the front-rear direction, and a slidable rack adjacent to the separation rack along the left-right direction. The first colored paper set, the yarn input shaft and the yarn output shaft are all mounted to the separation rack. When the separation rack is detached, the slidable rack is slidable along the left-right direction to be in front of the machine rack and to correspond in position to the sliding grooves such that the heating roller can be placed on the slidable rack when the heating roller is detached from the machine body unit.

[0017] The warp yarn transfer printing machine of the present invention further comprises a ventilation duct disposed on the machine body unit, located above the transfer printing unit, and adapted to permit exhaust gas to flow therethrough.

[0018] In the warp yarn transfer printing machine of the present invention, the heating roller includes a roller body extending along the left-right direction and a plurality of heating bars disposed inside the roller body and extending along the left-right direction. The heating bars surround an axis of the roller body, are equiangularly arranged, and are electrically connected to the machine body unit so as to have its temperature controlled in such a manner that a surface temperature of the heating roller reaches the processing temperature and is evenly distributed.

[0019] In the warp yarn transfer printing machine of the present invention, the transfer printing unit further includes a pressing shaft extending along the left-right direction and disposed between the support shaft and the drive shaft along the conveying path, and an offset shaft extending along the left-right direction and disposed between the pressing shaft and the drive shaft along the

conveying path. The pressing shaft abuts against an inner side of the conveyor belt such that a tension of the conveyor belt is increased, and is movable relative to the conveyor belt along a direction perpendicular to the left-right direction so as to adjust the tension of the conveyor belt. The offset shaft abuts against the inner side of the conveyor belt and has two ends that are each movable along the front-rear direction to generate offset thereby adjusting a position of the conveyor belt along the left-right direction during use.

[0020] In the warp yarn transfer printing machine of the present invention, the transfer printing unit further includes a gear shaft extending along the left-right direction and driven by the machine body unit to rotate about its own axis, and a gear rack meshing the gear shaft and connected to the separation shaft. The gear rack meshes the gear shaft in such a manner that the gear rack can be driven by the gear shaft to move. The gear rack further drives the separation shaft to move to thereby adjust relative positioning between the separation shaft and the heating roller.

[0021] The beneficial effects of the present invention reside in that: by the cooperation among the heating roller, the transfer printing unit and the colored paper unit, colored papers are utilized to perform waterless dyeing on warp yarns, and an accurate production in low amounts according to demand is enabled while replacement of the warp yarns is convenient, thereby yielding effects of environmental protection and cost reduction.

Fig. 1 is a perspective view of one embodiment of the warp yarn transfer printing machine of the present invention;

Fig. 2 is a front view of the embodiment;

Fig. 3 is a schematic sectional view taken along line III-III in Fig. 2;

Fig. 4 is a schematic diagram of the present embodiment used with a weaving machine, illustrating paths of a plurality of warp yarns and a plurality of colored papers during use;

Fig. 5 is a front view of the embodiment, illustrating a slidable rack being slidable along a left-right direction to a position in front of a machine rack when a separation rack is detached; and

Fig. 6 is a schematic diagram of the present embodiment used with a weaving machine, illustrating, during unloading, a separation shaft being moved rearwardly along a front-rear direction and a heating roller detached from the machine body unit and placed in the slidable rack.

[0022] The present invention is described in detail below with reference to the attached drawings and embodiments.

[0023] Referring to Fig. 1, Fig. 2 and Fig. 3, an embodiment of the warp yarn transfer printing machine of the present invention comprises a machine body unit 1 for supporting and driving components, a heating roller 2 mounted to the machine body unit 1 and extending along a left-right direction (D1), a transfer printing unit 3 mounted to the machine body unit 1 and extending along the left-right direction (D1), a colored paper unit 4, a yarn arranging unit 5, and a ventilation duct 6.

[0024] The machine body unit 1 includes a first power box 11 and a second power box 12 that are respectively disposed at two opposite sides along the left-right direction (D1), and a machine rack 13 that is connected between the first power box 11 and the second power box 12 for supporting.

[0025] The heating roller 2 is driven by the machine body unit 1 to rotate about its own axis and has a surface temperature that is controlled to be at a processing temperature. The heating roller 2 includes a roller body 21 extending along the left-right direction (D1) and a plurality of heating bars 22 disposed inside the roller body 21 and extending along the left-right direction (D1). The heating bars 22 surround an axis of the roller body 21, are equiangularly arranged, and are electrically connected to the machine body unit 1 so as to have its temperature controlled in such a manner that the surface temperature of the heating roller 2 reaches the processing temperature and is evenly distributed.

[0026] The transfer printing unit 3 includes a drive shaft 31, a separation shaft 32, a support shaft 33, a pressing shaft 34, an offset shaft 35, a conveyor belt 36 that surrounds the drive shaft 31, the separation shaft 32, the support shaft 33, the pressing shaft 34 and the offset shaft 35, a gear shaft 37 and a gear rack 38. An up-down direction (D2) perpendicular to the left-right direction (D1) is defined, and a front-rear direction (D3) perpendicular to both the left-right direction (D1) and the up-down direction (D2) is defined. The drive shaft 31 and the separation shaft 32 are respectively disposed at a lower side and an upper side of the heating roller 2 along the up-down direction (D2). Further, a position of the drive shaft 31 is more toward a front side relative to the heating roller 2 along the front-rear direction (D3). The support shaft 33 is disposed at a rear side of the heating roller 2 along the front-rear direction (D3). In this embodiment, a material of the conveyor belt 36 is woolen material, but can also be other materials such as plastic or rubber.

[0027] The drive shaft 31 is driven by the machine body unit 1 to rotate about its own axis and drives the conveyor belt 36 to advance along a conveying path. The conveyor belt 36 sequentially passes by the drive shaft 31, the heating roller 2, the separation shaft 32 and the support shaft 33, the pressing shaft 34 and the offset shaft 35 during the process of advancing along the conveying path, and circulates along the conveying path as the drive shaft 31 rotates. Further, the conveyor belt 36 is in a tension state so that the conveyor belt 36 presses against the drive shaft 31, the heating roller 2, the separation shaft 32 and the support shaft 33. The heating roller 2 abuts against the conveyor belt 36 at an outer side of the conveyor belt 36, and the separation shaft 32 and the support shaft 33 abut against the conveyor belt 36 at an

inner side of the conveyor belt 36 and are driven by the conveyor belt 36 to rotate about their own axes. The pressing shaft 34 abuts against the inner side of the conveyor belt 36 such that the tension of the conveyor belt 36 is increased. The pressing shaft 34 is further movable relative to the conveyor belt 36 along a direction perpendicular to the left-right direction (D1) so as to adjust the tension of the conveyor belt 36. The offset shaft 35 abuts against the inner side of the conveyor belt 36 and has two ends that are each movable along the front-rear direction to generate offset, thereby adjusting a position of the conveyor belt 36 along the left-right direction (D1) during use.

[0028] The gear shaft 37 extends along the left-right direction (D1) and is driven by the machine body unit 1 to rotate about its own axis. The gear rack 38 meshes the gear shaft 37 and is connected to the separation shaft 32. Since the gear rack 38 meshes the gear shaft 37, the gear rack 38 can be driven by the gear shaft 37 to move. The gear rack 38 further brings the separation shaft 32 to move to thereby adjust relative positioning between the separation shaft 32 and the heating roller 2.

[0029] The heating roller 2 and the transfer printing unit 3 are both disposed between the first power box 11 and the second power box 12, causing the heating roller 2 and the drive shaft 31 to be driven. The machine body unit 1 further includes two sliding grooves 14 respectively disposed at the first power box 11 and the second power box 12, and corresponding in position to the heating roller 2, a separation rack 15 detachably mounted to a front side of the machine rack 13 along the front-rear direction (D3), and a slidable rack 16 adjacent to the separation rack 15 along the left-right direction (D1). The sliding grooves 14 extend along the front-rear direction (D3) and are for mounting of the heating roller 2. The heating roller 2 is mounted to the sliding grooves 14 and is movable along the sliding grooves 14 so as to be separated from the machine body unit 1 when being detached. In the present embodiment, the separation rack 15 consists of two positioning tabs 151 respectively and correspondingly fixed to the first power box 11 and the second power box 12, but t is just an example and the separation rack 15 is not limited to this. When the separation rack 15 is detached, the slidable rack 16 is slidable along the left-right direction (D1) to be in front of the machine rack 13 and to correspond in position to the sliding grooves 14 such that the heating roller 2 can be placed on the slidable rack 16 when the heating roller 2 is detached from the machine body unit 1.

[0030] The colored paper unit 4 includes a first colored paper set 41 disposed at a front side of the transfer printing unit 3 along the front-rear direction (D3) and a second colored paper set 42 disposed at a rear side of the transfer printing unit 3. The first colored paper set 41 has a first colored paper input reel 411 located at a front side relative to the heating roller 2, and a first colored paper output reel 412 located at a front side relative to the first colored paper input reel 411. The first colored paper input reel 411 and the first colored paper output reel 412 are rotatable about their own axes. The second colored paper set 42 includes a second colored paper input reel 421 located at a lower side relative to the heating roller 2 and a second colored paper output reel 422 located at an upper side relative to the heating roller 2. The second colored paper input reel 421 and the second colored paper output reel 422 are rotatable about their own axes. The first colored paper set 41, the yarn input shaft 53 and the yarn output shaft 54 are all mounted to the separation rack 15.

[0031] The yarn arranging unit 5 includes an input-yarn comb 51 corresponding to the drive shaft 31, disposed at a front side relative to the transfer printing unit 3 and extending along the left-right direction (D1), and an output-yarn comb 52 corresponding to the separation shaft 32, disposed at a front side relative to the transfer printing unit 3, and extending along the left-right direction (D1), a yarn input shaft 53 disposed at a front side relative to the input-yarn comb 51 and extending along the left-right direction (D1), a yarn output shaft 54 disposed at a front side relative to the output-yarn comb 52 and extending along the left-right direction (D1), and two yarn-pressing rods 55 disposed at a rear side of the heating roller 2 along the front-rear direction (D3) and extending along the left-right direction (D1).

[0032] The input-yarn comb 51 and the output-yarn comb 52 are both detachably mounted to the machine body unit 1 and are adapted for combing yarns. The yarn input shaft 53 and the yarn output shaft 54 are rotatable about their own axes. The yarn input shaft 53 and the yarn output shaft 54 are both adapted for a plurality of warp yarns 91 to be arranged along the left-right direction (D1) and abutting against their surfaces.

[0033] The yarn-pressing rods 55 are further disposed respectively at a lower side and an upper side of the heating roller 2 along the up-down direction (D2) and are detachably mounted to the machine body unit 1. It should be stated that it is not required to mount the yarn-pressing rods 55 on the machine body unit 11 during use. However, when the warp yarns 91 are to be replaced, the yarn-pressing rods 55 can be mounted to the machine body unit 1 to affix the warp yarns 91 in position so as to prevent the warp yarns 91 from messing up, which is beneficial in improving convenience.

[0034] The ventilation duct 6 is disposed on the machine body unit 1, is located at an upper side of the transfer printing unit 3, and is adapted to permit exhaust gas to flow therethrough. The ventilation duct 6 has many through holes permitting the exhaust gas to enter the ventilation duct 6 so as to be discharged. It should be stated that the pressure inside the ventilation duct 6 is generally lower than the pressure around the transfer printing unit 3 to thereby discharge the exhaust gas. However, in another usage of the ventilation duct 6, the pressure inside the duct is increased to be higher than the pressure around the transfer printing unit 3; at this time, the function of the ventilation duct 6 is no longer to discharge the exhaust gas, but is rather to blow air flow

toward the transfer printing unit 3 to generate a cooling effect so as to prevent dyed warp yarns 91 from being heated for too long and thereby deteriorate in color.

[0035] Referring to Fig. 1, Fig. 2 and Fig. 4, a plurality of warp yarn 91 are moved along a warp yarn path. First, the warp yarns 91 are arranged along the left-right direction (D1), abut against a surface of the yarn input shaft 53, and then advance from a front side in a direction toward the transfer printing unit 3. The warp yarns 91 are inputted into the transfer printing unit 3 and are driven by the conveyor belt 36 to sequentially pass by the drive shaft 31, the heating roller 2 and the separation shaft 32. That is to say, the warp yarn path between the drive shaft 31 and the separation shaft 32 is adjacent to a front side of the conveying path. The warp yarns 91 advance in a direction toward the yarn output shaft 54 after being outputted from the transfer printing unit 3, are arranged along the left-right direction (D1), and abut against a surface of the yarn output shaft 54. In this way, the warp yarns 91 are inputted orderly into the transfer printing unit 3, and then are outputted orderly from the transfer printing unit 3 and can be processed in order.

[0036] A plurality of first colored papers 92 can be wound on the first colored paper input reel 411 and movable along a first colored paper path. A plurality of second colored papers 93 can be wound on the second colored paper input reel 421 and movable along a second colored paper path. It should be stated that first colored papers 92 of multiple different colors can be wound on the first colored paper input reel 411, with the first colored papers 92 of each color corresponding to an appropriate number of the warp yarns 91 according to demand. Similarly, second colored papers 93 of multiple different colors can also be wound on the second colored paper input reel 421, with the second colored papers 93 of each color corresponding to an appropriate number of the warp yarns 91 according to demand. The width of each of the first colored papers 92 and the second colored papers 93 in the left-right direction (D1) can be adjusted by cutting, so as to accurately cover the corresponding warp yarns 91 according to demand and produce small amounts of warp yarns 91 with different colors.

[0037] When moving along the first colored paper path, upon departure from the first colored input reel 411, the first colored papers 92 advance with a front side toward the transfer printing unit 3 and are inputted into the transfer printing unit 3. After being inputted into the transfer printing unit 3, the first colored papers 92 are adjacent to a front side of the warp yarns 91 and are driven by the conveyor belt 36 to pass sequentially by the drive shaft 31, the heating roller 2 and the separation shaft 32. That is to say, the first colored paper path between the drive shaft 31 and the separation shaft 32 is adjacent to a front side of the warp yarn path. After being outputted from the transfer printing unit 3, the first colored papers 92 advance toward a direction of the first colored output reel 412 and are finally wound on the first colored paper output reel 412.

[0038] When moving along the second colored paper path, upon departure from the second colored input reel 421, the second colored papers 93 advance with a rear side toward the transfer printing unit 3 and are inputted into the transfer printing unit 3. After being inputted into the transfer printing unit 3, the second colored papers 93 are adjacent to a rear side of the warp yarns 91 and are driven by the conveyor belt 36 to pass sequentially by the drive shaft 31, the heating roller 2 and the separation shaft 32. That is to say, the second colored paper path between the drive shaft 31 and the separation shaft 32 is adjacent to a rear side of the warp yarn path and is at a front side of the conveying path. After being outputted from the transfer printing unit 3, the second colored papers 93 advance toward a direction of the second colored output reel 422 and are finally wound on the second colored paper output reel 422.

[0039] It can be discovered from the above description related to the conveying path, the warp yarn path, the first colored paper path and the second colored paper path that there is a neighboring portion among these four paths between the drive shaft 31 and the separation shaft 32. For ease of illustration, this portion is referred to as a processing region in the following description. The first colored papers 92, the warp yarns 91, the second colored papers 93 and the conveyor belt 36 are sequentially next to one another from the front to the rear in the processing region. As the warp yarns 91 pass through the processing region, since the first colored paper set 41 and the second colored paper set 42 are respectively located at a front side and a rear side of the transfer printing unit 3, the first colored papers 92 and the second colored papers 93 are respectively adjacent to two opposite sides of the warp yarn 91 respectively along the first colored paper path and the second colored paper path, and the first colored papers 92, the warp yarns 91 and the second colored papers 93 are driven by the conveyor belt 36 due to the frictional forces thereamong. Since the conveyor belt 36 is in a tension state, the first colored papers 92, the warp yarns 91 and the second colored papers 93 are pressed thereby and thus are sandwiched evenly and flatly between the conveyor belt 36 and the heating roller 2.

[0040] In the processing region, the warp yarns 91, the first colored papers 92 and the second colored papers 93 would pass by the heating roller 2. A surface temperature of the heating roller 2 is controlled to be at the processing temperature such that the dyes of the first colored papers 92 and the second colored papers 93 sublimate and then adhere to the warp yarns 91. In the present embodiment, the colored papers 92, 93 are respectively adjacent to two opposite sides of the warp yarns 91 to generate an effect of even dyeing. Nevertheless, the dyeing effect can be achieved by using either the first colored paper set 41 or the second colored paper set 42 which is adjacent to only one side of the warp yarns 91.

[0041] In addition, the dyes that do not adhere to the warp yarns 91 after sublimation are exhaust gas which

is sucked into the ventilation duct 6 and then discharge outwardly. The first colored papers 92 and the second colored papers 93 are wound correspondingly on the first colored paper output reel 412 and the second colored paper output reel 422 after use, to facilitate unloading.

[0042] In this way, the warp yarns 91 depart from the yarn input shaft 53 and then are inputted into the transfer printing unit 3, are dyed in the processing region, followed by being outputted by the transfer printing unit 3 to the yarn output shaft 54 to finally obtain dyed warp yarns 91, which are the finished products processed by the present embodiment.

[0043] Referring to Fig. 4, Fig. 5 and Fig. 6, the warp yarns 91 can be replaced by performing the following steps according to this embodiment, but this is merely an example and is not limiting. In the first step, the gear rack 38 and the gear shaft 37 drive the separation shaft 32 to move rearwardly along the front-rear direction (D3) so that the heating roller 2 is revealed and the conveyor belt 36 is loosened. In the second step, the separation rack 15 is detached so that the slidable rack 16 is slidable along the left right direction (D1) to be in front of the machine rack 13 and corresponding in position to the sliding grooves 14. In the third step, the heating roller 2 is detached so that the heating roller 2 is able to move along the sliding grooves 14 to thereby place the heating roller 2 in the slidable rack 16. In the fourth step, the slidable rack 16 is pushed away from the front of the machine rack 13 along the left-right direction (D1). In the fifth step, using the input-yarn comb 51 and the output-yarn comb 52, the warp yarns 91 to be replaced are combed and pulled from a weaving machine 94, and then the warp yarns 91 are secured to be adjacent to the transfer printing unit 3 by the yarn-pressing rods 55. In the sixth step, the slidable rack 16 is pushed to be in front of the machine rack 13 again and moving the heating roller 2 along the sliding grooves 14 back to the original position for mounting, and then the slidable rack 16 is pushed away the front of the machine rack 13 along the left-right direction (D1) again. In the seventh step, the separation rack 15 is(?) mounted and the first colored paper 92 is wound around the heating roller 2 in advance. In the eighth step, the yarn-pressing rods 55 are detached and removed such that the warp yarns 91 press tightly against the heating roller 2, and the input-yarn comb 51 and the output-yarn comb 52 comb the warp yarns 91 toward the yarn input shaft 53 and the yarn output shaft 54. In the ninth step, the gear rack 38 and the gear shaft 37 drive the separation shaft 32 to move along the front-rear direction (D3) forwardly so as to tighten the conveyor belt 36. In this way, the warp yarns 91 are replaced and sandwiched between the conveyor belt 36 and the heating roller 2 to thereby perform dyeing.

[0044] By applying the abovementioned yarn replacing process, it is not required to cut off the warp yarns 91 and rearrange the warp yarns 91 in the present embodiment, so the difficulty in replacing the warp yarns 91 is decreased drastically, the warp yarns 91 are thus neatly arranged to corresponding positions. There is saving in terms of cost of time and cost of labor.

[0045] Referring to Fig. 1, Fig. 2 and Fig.4, according to the abovementioned structure and processing procedure, the present embodiment possesses the following effects:

First, during the processing procedure, principle of dye sublimation is used and no large amount of water resource is used, thereby yielding effects of environmental protection and cost reduction.

Second, since the first colored papers 92 wound on the first colored paper input reel 411 may be first colored papers 92 with multiple different colors, a width of the first colored papers 92 along the left-right direction (D1) can be adjusted to enable accurate production of differently colored warp yarns 91 in low amounts according to demand. (Similarly, the second colored papers 93 wound on the second colored paper input reel 412 may also be second colored papers 93 with multiple different colors.)

Third, the pressing shaft 34 is able to adjust the tension of the conveyor belt 36 such that the first colored papers 92, the warp yarns 91 and the second colored papers 93 experience suitable pressure during processing.

Fourth, relative positioning between the separation shaft 32 and the heating roller 2 can be adjusted by the gear shaft 37 and the gear rack 38 in the present embodiment.

Fifth, since the heating roller 2 is mounted to the sliding groove 14 and is thus movable along the sliding groove 14, when mounting or adjusting the yarns 91 or the conveyor belt 36, the heating roller 2 would not obstruct mounting or adjusting thereof, so convenience is provided.

Sixth, since the conveyor belt 36 is in a tension state, the first colored papers 92, the warp yarns 91 and the second colored papers 93 are pressed and can be evenly and flatly sandwiched between the conveyor belt 36 and the heating roller 20.

Seventh, the first colored paper set 41 and the second colored paper set 42 are located respectively at the front side and the rear side, such that the first colored papers 92 and the second colored papers 93 are respectively adjacent to two opposite sides of the warp yarns 91 along the first colored paper path and the second colored paper path to yield the effect of even dyeing.

Eighth, since the warp yarns 91 are arranged along the left-right direction (D1) and abut against surfaces of the yarn input shaft 53 and the yarn output shaft 54, the warp yarns 91 can be inputted and outputted orderly.

Ninth, the exhaust gas generated by the processing can be discharged through the ventilation duct 6. The first colored papers 92 and the second colored papers 93 after use are wound correspondingly on the

first colored paper output reel 412 and the second colored paper output reel 422 to be conveniently unloaded.

Tenth, through the input-yarn comb 51 and the output-yarn comb 52 that comb the yarns and the yarn-pressing rods 55 that affix the warp yarns 91 during replacement of the warp yarns 91 (referring to Fig. 6) in the present embodiment, the warp yarns 91 are arranged neatly to corresponding positions.

[0046] To sum up, in the warp yarn transfer printing machine of the present invention, through the cooperation among the heating roller 2, the transfer printing unit 3 and the colored paper unit 4, the first colored papers 92 and the second colored papers 93 are utilized to perform waterless dyeing on the warp yarns 91, and an accurate production in low amounts according to demand is enabled while replacing the warp yarns is convenient, thereby yielding effects of environmental protection and cost reduction and achieving the objects of the present invention.

Claims

1. A warp yarn transfer printing machine comprising a machine body unit, a heating roller, a transfer printing unit and a colored paper unit, said warp yarn transfer printing machine **characterized by**:

   said machine body unit for supporting and driving components;

   said heating roller detachably mounted to said machine body unit and extending along a left-right direction, said heating roller being driven by said machine body unit to rotate about its own axis and having a surface temperature that is controlled to be at a processing temperature;

   said transfer printing unit mounted to said machine body unit and extending along the left-right direction, including a drive shaft, a separation shaft, a support shaft and a conveyor belt surrounding said drive shaft, said separation shaft and said support shaft, an up-down direction perpendicular to the left-right direction, and a front-rear direction perpendicular to both the left-right direction and the up-down direction being defined, said drive shaft and said separation shaft being disposed respectively at a lower side and an upper side of said heating roller along the up-down direction, a position of said drive shaft further being more toward a front side relative to said heating roller along the front-rear direction, said support shaft disposed at a rear side of said heating roller along the front-rear direction, said drive shaft being driven by said machine body unit to rotate about its own axis and to drive said conveyor belt to advance along a conveying path, said conveyor belt sequentially passing by said drive shaft, said heating roller, said separation shaft and said support shaft during the process of advancing along the conveying path, and circulating along the conveying path along with rotation of said drive shaft, said conveyor belt further being in a tension state so that said conveyor belt itself presses against said drive shaft, said heating roller, said separation shaft and said support shaft, said heating roller abutting against said conveyor belt at an outer side of said conveyor belt, said separation shaft and said support shaft abutting against said conveyor belt at an inner side of said conveyor belt and being both driven by said conveyor belt to rotate respectively about their own axes; and

   said colored paper unit including a first colored paper set disposed at one of sides of said transfer printing unit along the front-rear direction.

2. The warp yarn transfer printing machine according to claim 1, **characterized by**: further comprising a yarn arranging unit, said yarn arranging unit including an input-yarn comb corresponding to said drive shaft, disposed at a front side relative to said transfer printing unit, and extending along the left-right direction, and an output-yarn comb corresponding to said separation shaft, disposed at the front side relative to said transfer printing unit, and extending along the left-right direction, said input-yarn comb and said output-yarn comb being both detachably mounted to said machine body unit and adapted for combing yarns.

3. The warp yarn transfer printing machine according to claim 2, **characterized in that**: said yarn arranging unit further includes a yarn input shaft disposed at a front side relative to said input-yarn comb and extending along the left-right direction, a yarn output shaft disposed at a front side relative to said output-yarn comb and extending along the left-right direction, and two yarn-pressing rods disposed at a rear side of said heating roller along the front-rear direction and extending along the left-right direction, said yarn input shaft and said yarn output shaft being rotatable about their own axes, said yarn input shaft and said yarn output shaft both adapted for a plurality of warp yarns to be arranged along the left-right direction and to abut against surfaces thereof, said yarn-pressing rods further disposed respectively at a lower side and an upper side of said heating roller along the up-down direction and detachably mounted to said machine body unit.

4. The warp yarn transfer printing machine according to claim 3, **characterized in that**: said first colored paper set of said colored paper unit has a first colored

paper input reel located at a front side relative to said heating roller, and a first colored paper output reel located at a front side relative to said first colored paper input reel, said first colored paper input reel and said first colored paper output reel being rotatable about their own axes.

5. The warp yarn transfer printing machine according to claim 4, **characterized in that**: said colored paper unit further includes a second colored paper set disposed at one side of said transfer printing unit opposite to said first colored paper set along the front-rear direction, said second colored paper set including a second colored paper input reel located at a lower side relative to said heating roller, and a second colored paper output reel located at an upper side relative to said heating roller, said second colored paper input reel and said second colored paper output reel being rotatable about their own axes.

6. The warp yarn transfer printing machine according to claim 5, **characterized in that**: said machine body unit includes a first power box and a second power box that are respectively disposed at two opposite sides along the left-right direction, and a machine rack that is connected between said first power box and said second power box for supporting, said heating roller and said transfer printing unit both being disposed between the said first power box and said second power box, causing said heating roller and said drive shaft to be driven.

7. The warp yarn transfer printing machine according to claim 6, **characterized in that**: said machine body unit further includes two sliding grooves respectively disposed at said first power box and said second power box, and corresponding in position to said heating roller, said sliding grooves extending along the front-rear direction and opening toward a front side for mounting of said heating roller, said heating roller being mounted to said sliding grooves and, when unloaded, being movable along said sliding grooves so as to be detached from said machine body unit.

8. The warp yarn transfer printing machine according to claim 7, **characterized in that**: the machine body unit further includes a separation rack detachably mounted to a front side of said machine rack along the front-rear direction, and a slidable rack adjacent to said separation rack along the left-right direction, said first colored paper set, said yarn input shaft and said yarn output shaft being all mounted to said separation rack,
when said separation rack is detached, said slidable rack being slidable along the left-right direction to be in front of said machine rack and to correspond in position to said sliding grooves such that said heating roller can be placed on said slidable rack when said heating roller is detached from said machine body unit.

9. The warp yarn transfer printing machine according to claim 1, **characterized by**: further comprising a ventilation duct disposed on said machine body unit, located at an upper side of the transfer printing unit, and adapted to permit exhaust gas to flow therethrough.

10. The warp yarn transfer printing machine according to claim 1, **characterized in that**: said heating roller includes a roller body extending along the left-right direction and a plurality of heating bars disposed inside said roller body and extending along the left-right direction, said heating bars surrounding an axis of said roller body, being equiangularly arranged, and being electrically connected to said machine body unit so as to have its temperature controlled in such a manner that a surface temperature of said heating roller reaches the processing temperature and is evenly distributed.

11. The warp yarn transfer printing machine according to claim 1, **characterized in that**: said transfer printing unit further includes a pressing shaft extending along the left-right direction and disposed between said support shaft and said drive shaft along the conveying path, and an offset shaft extending along the left-right direction and disposed between said pressing shaft and said drive shaft along the conveying path, said pressing shaft abutting against an inner side of said conveyor belt such that a tension of said conveyor belt is increased, and being movable relative to said conveyor belt along a direction perpendicular to the left-right direction so as to adjust the tension of said conveyor belt, said offset shaft abutting against the inner side of said conveyor belt and having two ends that are each movable along the front-rear direction to generate offset thereby adjusting a position of said conveyor belt along the left-right direction during use.

12. The warp yarn transfer printing machine according to claim 1, **characterized in that**: said transfer printing unit further includes a gear shaft extending along the left-right direction and driven by said machine body unit to rotate about its own axis, and a gear rack meshing said gear shaft and connected to said separation shaft, said gear rack meshing said gear shaft such that said gear rack can be driven by said gear shaft to move, said gear rack further driving said separation shaft to move to thereby adjust relative positioning between said separation shaft and said heating roller.

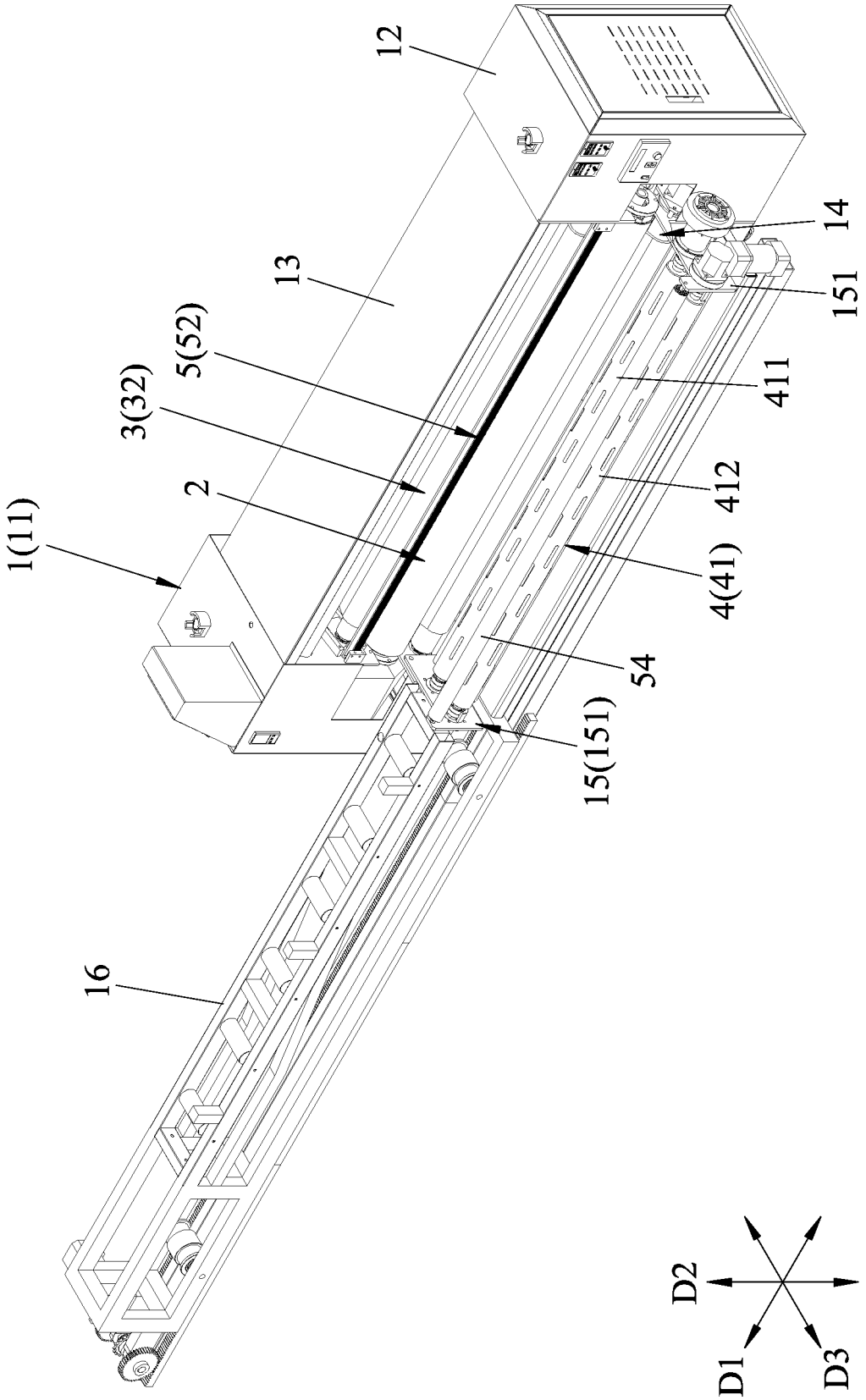


FIG.1

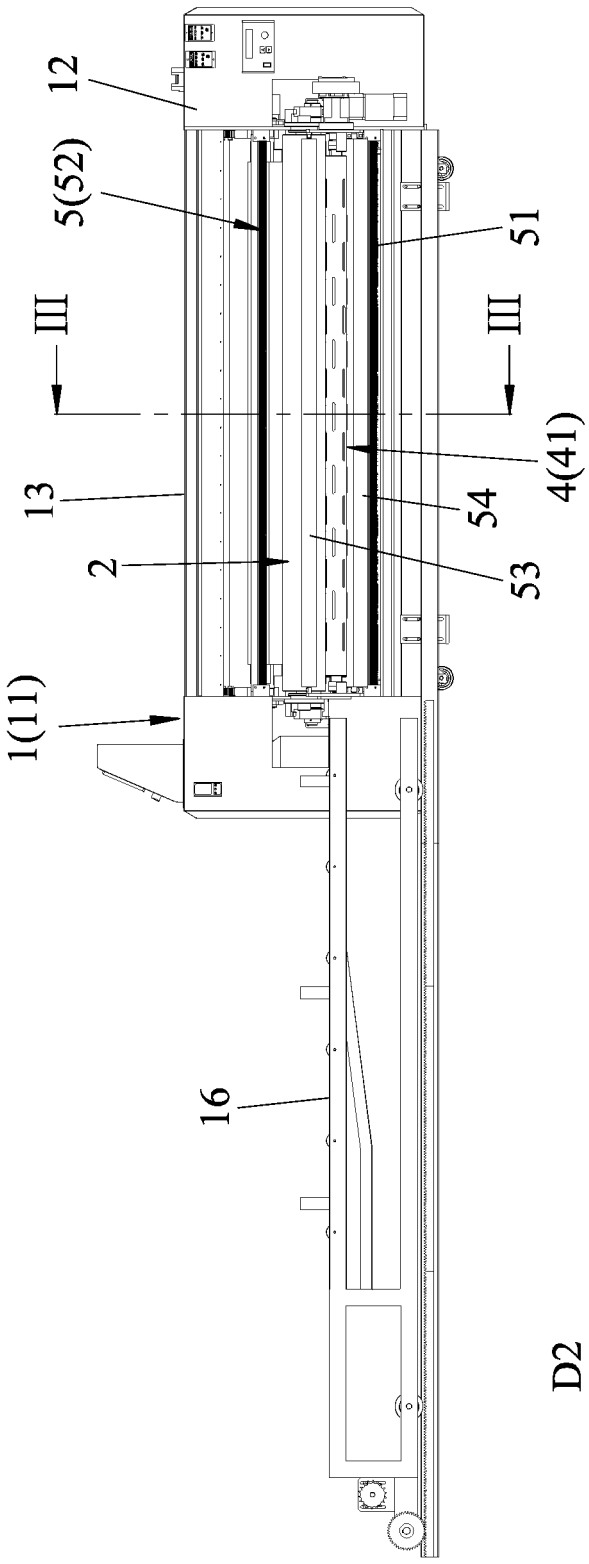
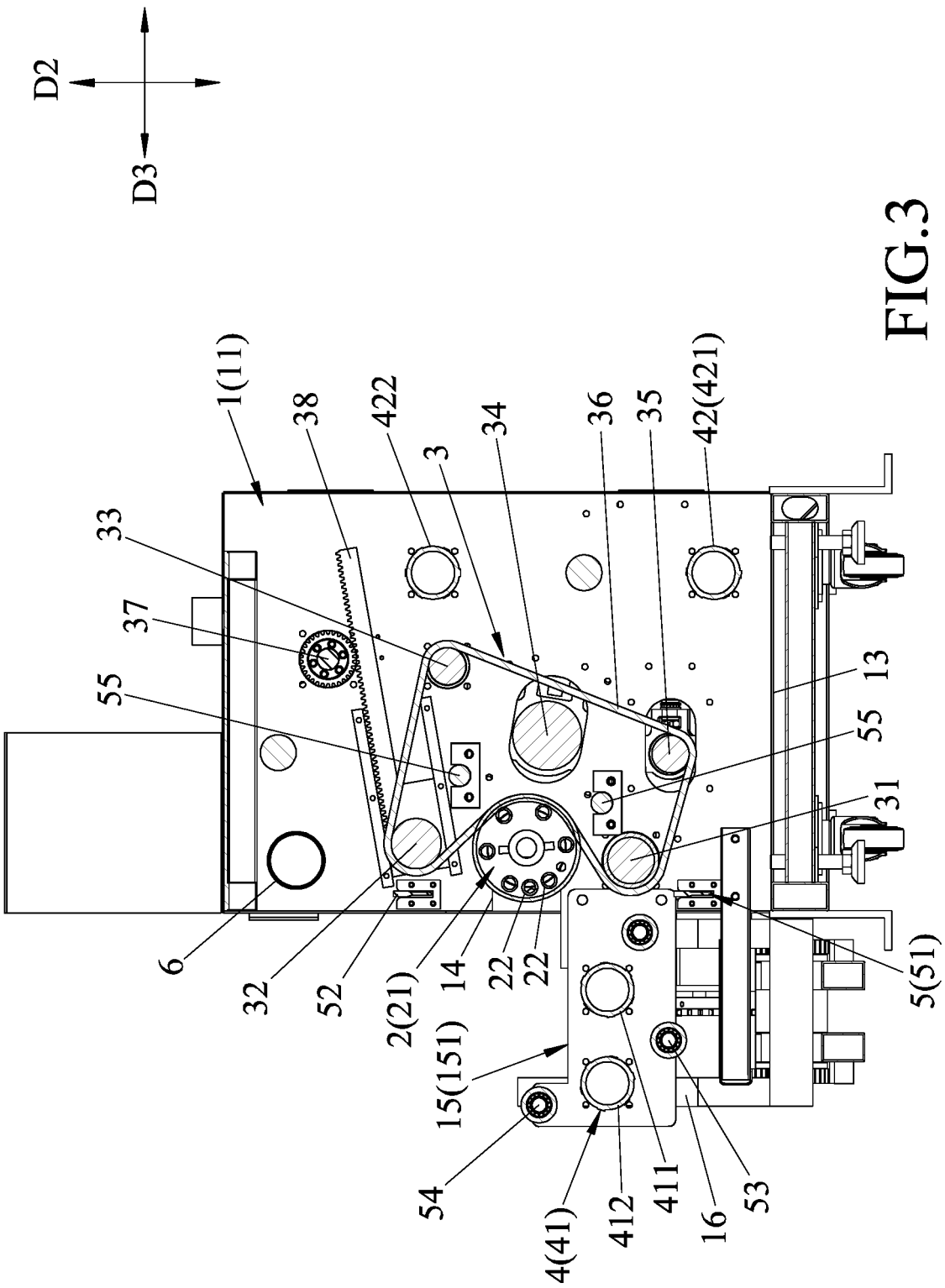


FIG.2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4(41)
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53

FIG.3

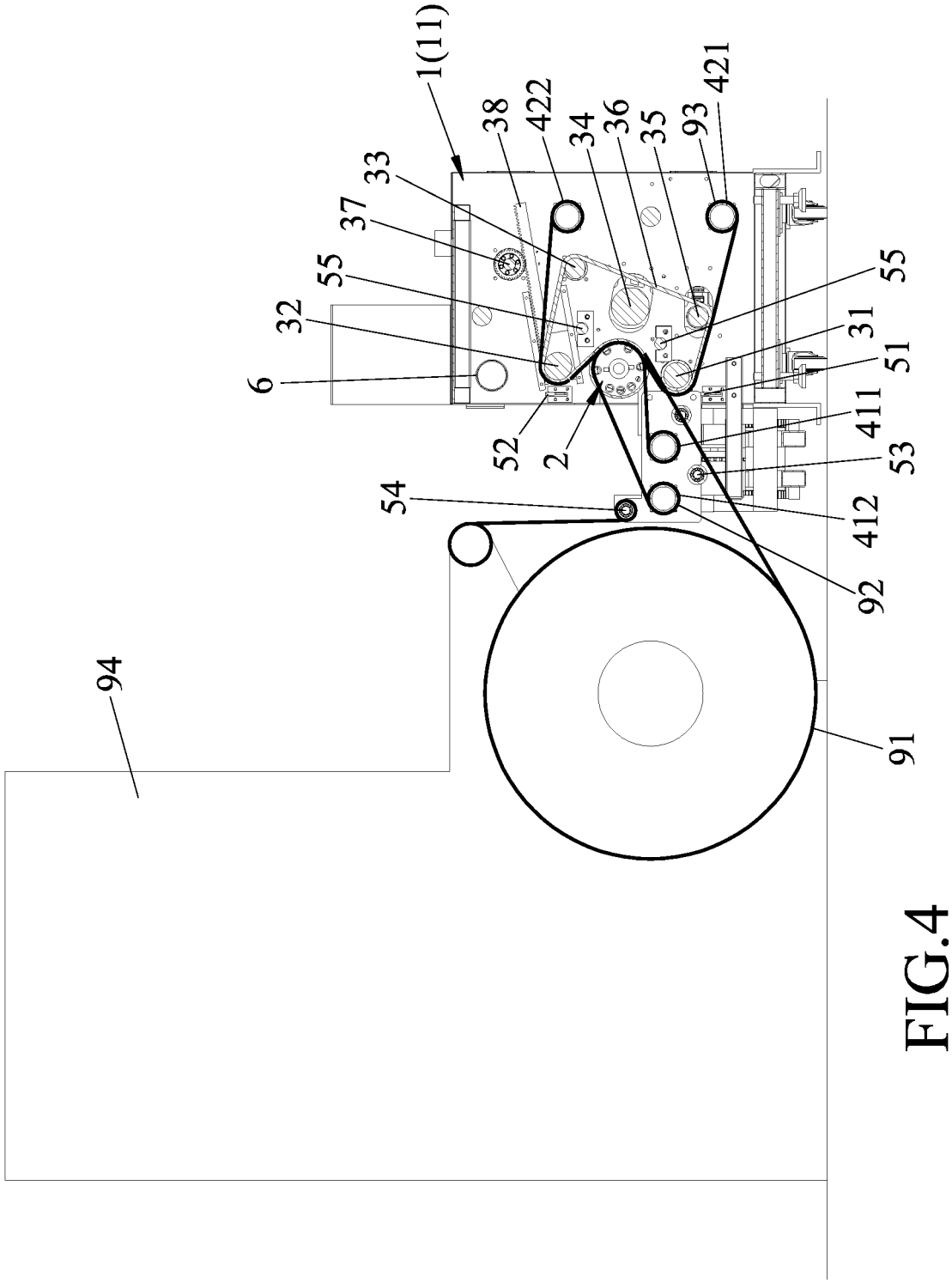
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FIG.4

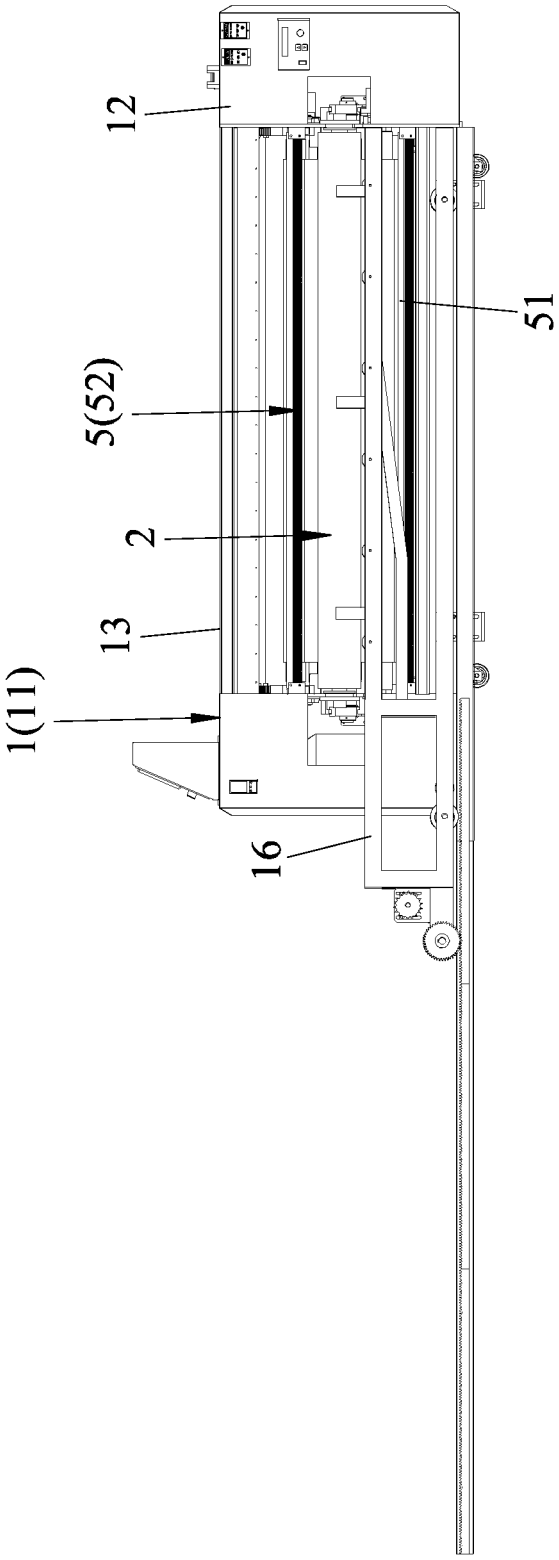

FIG.5

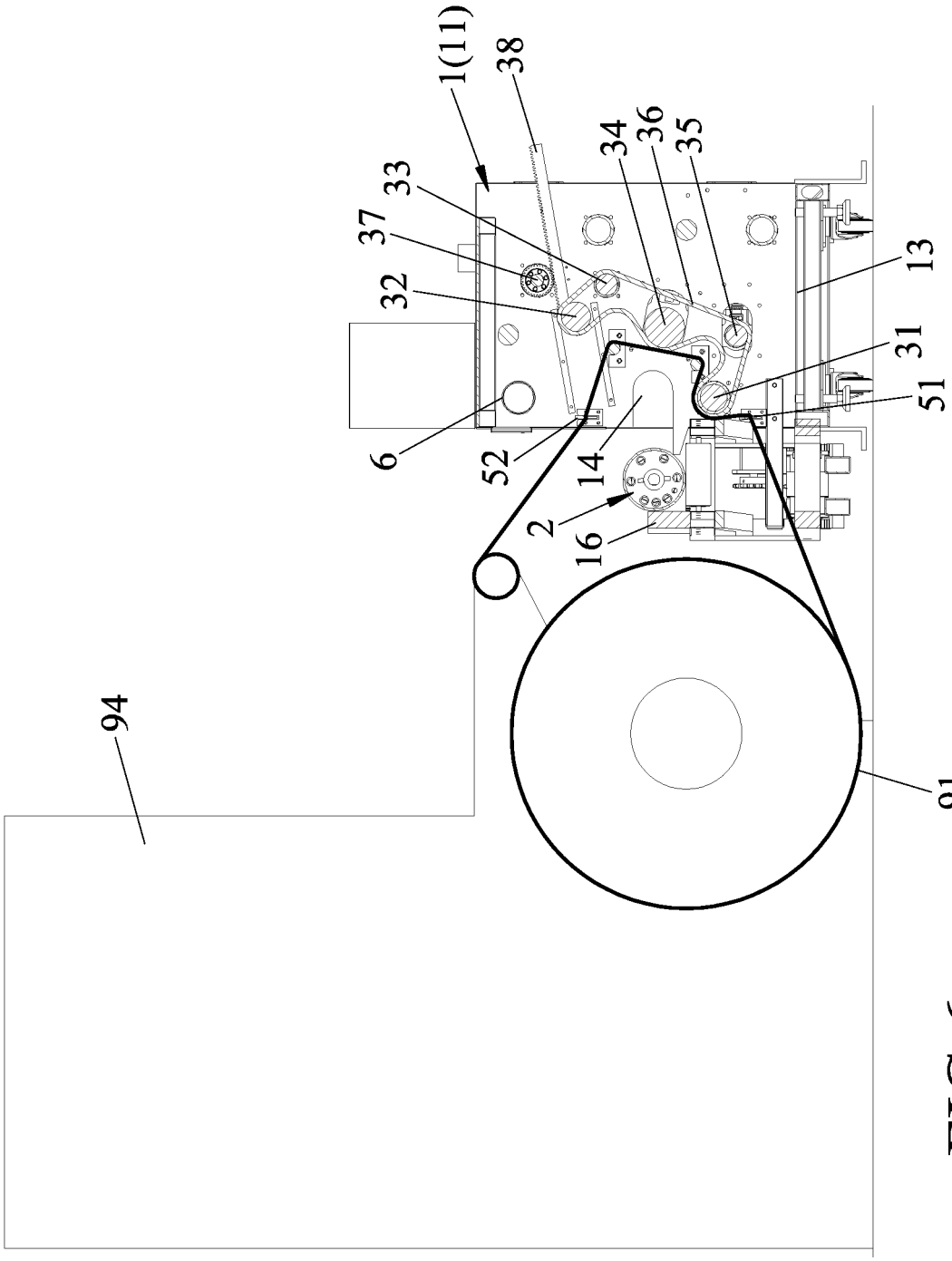

FIG.6

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2018/118403

A. CLASSIFICATION OF SUBJECT MATTER

B41F 16/00(2006.01)i; B41F 16/02(2006.01)i; D06P 5/24(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

B41F D06P

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

CNABS; CNTXT; TWABS; TWTXT; VEN; USTXT; WOTXT; EPTXT; CNKI: 转印, 转移, 印刷, 印染, 印花, 加热, 滚筒, 辊筒, 滚轮, 辊轮, 带, 整线, 整理, 纱线, 梳理, 压线, 加压, 调偏, print+, transfer, heat+, roller?, wheel?, belt, strap, strip, press +, deviation

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CN 108790385 A (GUANGZHOU FUYUAN CLOTHES ACCESSORIES CO., LTD.) 13 November 2018 (2018-11-13) description, paragraphs [0003]-[0014], and figure 1	1-12
X	US 2017144431 A1 (KYUNGIL-TECH CO., LTD.) 25 May 2017 (2017-05-25) description, paragraphs [0027]-[0093], and figure 3	1-12
A	EP 0993963 B1 (ENDUCTION ET DE FLOCKAGE SOC D) 26 March 2003 (2003-03-26) entire document	1-12
A	CN 106978745 A (GUANGZHOU FUYUAN CLOTHES ACCESSORIES CO., LTD.) 25 July 2017 (2017-07-25) entire document	1-12
A	CN 204736548 U (SHANGHAI QUANXI TEXTILE CO., LTD.) 04 November 2015 (2015-11-04) entire document	1-12

☐ Further documents are listed in the continuation of Box C. ☑ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
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"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
24 January 2019	**08 April 2019**
Name and mailing address of the ISA/CN **State Intellectual Property Office of the P. R. China** **No. 6, Xitucheng Road, Jimenqiao Haidian District, Beijing 100088** **China** Facsimile No. **(86-10)62019451**	Authorized officer Telephone No.

Form PCT/ISA/210 (second sheet) (January 2015)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2018/118403

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				RU	2624899	C2	07 July 2017
				GB	201522092	D0	27 January 2016
				US	9776390	B2	03 October 2017
				KR	101809264	B1	14 December 2017
				KR	20170059619	A	31 May 2017
				RU	2015153573	A	21 June 2017
				GB	2544564	B	22 November 2017
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				DE	69906212	T2	05 February 2004
				FR	2784618	B1	24 November 2000
				PT	993963	T	30 June 2003
				EP	0993963	A1	19 April 2000
				ES	2194424	T3	16 November 2003
				PT	993963	E	30 June 2003
				AT	235377	T	15 April 2003
CN	106978745	A	25 July 2017	None			
CN	204736548	U	04 November 2015	None			

Form PCT/ISA/210 (patent family annex) (January 2015)