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(54) Apparatus and method for foam dyeing traveling textile yarns

(57) Dyeing traveling textile yarns with a dye in foamed condition, and, more particularly, dyeing by separating a traveling sheet of yarn into separate spaced sheets and applying foamed dye to the inner facing and outer facing surfaces of the yarns in the separate sheets. Then recombining the separate sheets into a single sheet and further applying foamed dye to the yarn in the recombined sheet.

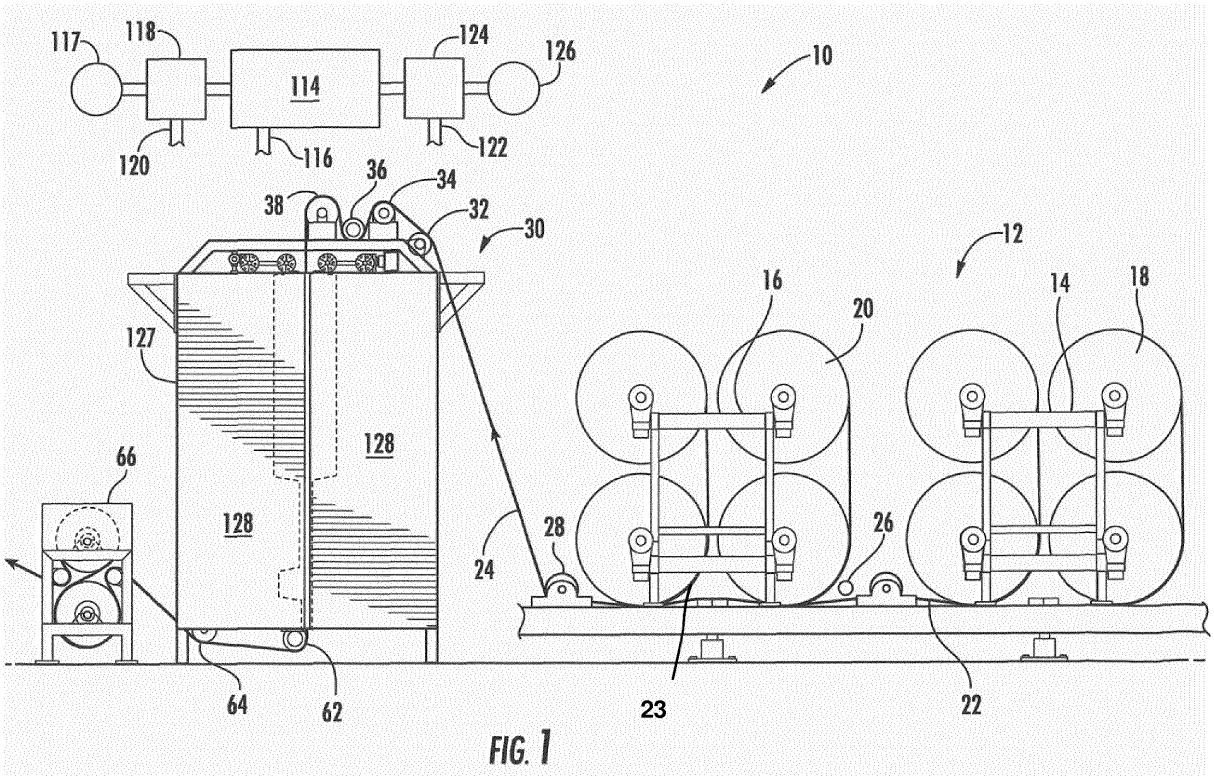

FIG. 1

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Description

FIELD OF THE INVENTION

[0001] Dyeing traveling textile yarns with dye in foam condition.

BACKGROUND OF THE INVENTION

[0002] It is known to use foamed dye to dye textile substrates by applying multiple coats of dye in a foamed state sequentially on traveling textile substrates using spaced foam applicators on opposite sides of the traveling substrates. One such prior art apparatus and method developed by the assignee of the present invention has a vertical series of spaced pairs of opposed foam applicators that apply foam to opposite sides of a traveling cotton textile substrate. In the specific embodiment of the prior art illustrated in the Fig. 6, the apparatus and method are used to dye undyed cotton yarn with reduced leuco-state indigo dye to produce a dye for use in making denim fabric. The applicators are mounted inside a sealed chamber containing an inert gas, such as nitrogen, and the dye is applied to the yarn in sheet form by a plurality of pairs of spaced foam applicators.

[0003] In the known prior art, undyed yarn is fed from a plurality of beams as a single sheet of yarn. The amount of waste liquid runoff is substantially less than in vat dyeing. Usually it involves a plurality of foamed dye applications to obtain a desired shade. In dyeing yarn for use in manufacturing denim cloth, it is usually desirable that the center of each yarn remains undyed, which can be accomplished by controlling the amount of moisture at which the dye is applied to the surface of the yarns in the first application, but it is also desirable that the entire surface of the yarns be dyed in the first application. A problem with the prior art apparatuses and methods is that the mass of yarns in the traveling sheet are crowded together and tend to overlap or otherwise become entangled with adjacent yarns, which makes it difficult, if not impossible, to coat the entire surface of each yarn without leaving undyed streaks as a result of the limited amount of dye applied during the first application.

[0004] The present invention provides a unique solution to the problem of applying a limited amount of dye with foam applicators to the surfaces of the yarn of a traveling sheet of yarn to accomplish full-surface application without penetrating the center of the yarn. The present invention provides this beneficial advantage by separating the sheet of yarn into separate spaced portions of the yarn sheet, thereby reducing the density of the yarns in each separate portion of the yarn sheet, and then applying foamed dye to the inwardly facing and outwardly facing surfaces of the yarns in each separated portion with applicators located between the separated portions for applying foamed dye to the inner facing surfaces of the yarns and foam applicators at the outer facing surfaces of the yarns to apply foamed dye to the outwardly facing surfaces of the yarns. The separate yarn sheet portions are then recombined and subjected to further foam dyeing with a plurality of applicators spaced downstream of the recombining.

[0005] An added advantage of the present invention is that the dye applied by the different applicators can be the same as or different in concentration or color or type of dye from the dye or shade of dye applied in the other applicators. Using the same dye in all the applicators results in a deepening of the shade of the color imparted by the dye. Using dyes of different colors in various applicators results in selected color variations in the yarns and in the resulting fabric woven or knitted from the yarns. Having the centers undyed while the surfaces are dyed allows color fashioning in a woven fabric made from those dyed yarns, which is particularly of interest in denim fabrics, such as used for manufacturing fashionable blue jeans.

[0006] Dividing of a traveling sheet of yarn into separate spaced sheet portions is known in the slashing art where the spaced separate yarns are fed into two different sizing boxes, but this has not involved foam dyeing and particularly foam applicators located between divided yarn sheets to apply foamed dye to the inner facing surfaces of the opposite divided yarn sheets.

SUMMARY OF THE INVENTION

[0007] Briefly described, in one form, the preferred embodiment of the present invention provides an apparatus and method for dyeing traveling textile yarns with dye applied in a foam condition.

[0008] According to a first aspect, a method of dyeing traveling textile yarns with a dye in foamed condition is provided, and, more particularly, dyeing by separating a traveling combined sheet of yarn into separate spaced sheets and applying foamed dye to the inner facing and outer facing surfaces of the yarns in the separate sheets. Then recombining the separate sheets into a single sheet and further applying foamed dye to the yarn in the recombined sheet.

[0009] According to one embodiment, a pair of driven infeed nip rollers feeds the yarn in a downstream direction, and a pair of outwardly spaced guide rollers downstream of the infeed rollers guide the sheet in separated spaced sheets. A pair of driven yarn sheet recombining nip rollers is located downstream of the outwardly spaced rollers for recombining the separated sheets into a single sheet. An exit guide roller, downstream of the recombining nip rollers guides the recombined yarn sheet from the apparatus.

[0010] A pair of outwardly facing, inner foam applicators and a pair of inwardly facing, outer foam applicators are disposed with the pair of outwardly facing, inner foam applicators being between the paths of separated yarn sheets or yarn sheet portions for applying foamed dye to the inner facing portions of the surface of the separated yarn sheet portions with their nozzles projecting oppo-

sitely into the paths of the separated yarn sheet portions to deflect the yarn sheet portions outwardly to maintain foam dispensing contact with the applicator nozzles. Similarly, the pair of inwardly facing outer foam applicators are disposed outwardly of the paths of the separated yarn portions for dispensing foamed dye to the outer facing surfaces of the yarns, and their nozzles project into the path of the yarn sheet portions to deflect the yarn sheet portions inwardly to maintain foam dispensing contact with the nozzles of the applicators.

[0011] Additional pairs of foam applicators are located downstream of the recombining rollers and have nozzles for applying foam dye to the opposite surfaces of the yarns in the recombined sheet of yarn.

[0012] In the preferred embodiment of the present invention the method and apparatus are adapted for dyeing undyed cotton yarn with reduced indigo dye in a leuco-state. In this embodiment the rollers feed the sheet of yarn through a sealed chamber containing an inert gas, such as nitrogen. In the chamber the yarn sheet is divided into separate spaced paths. The pairs of foam applicators are located within the chamber.

[0013] The concentration of dye being applied may be different with selected applicators in comparison with other applicators. For example, the concentration of dye in the applicators that apply dye to the yarns in the separated sheet portions may be less than the concentration applied in the other applicators to assure less than a full depth penetration of the dye into the yarn in the separated portions. In the preferred embodiment there are separate foam generators for the dye being applied to the separated yarn portions and the recombined yarn. For special effect yarns and fabric there can be several different foam generators for different pairs of applicators to provide different colors to the yarns.

BRIEF DESCRIPTION OF THE DRAWINGS

[0014]

Fig. 1 is a side elevation of a preferred embodiment of the apparatus of the present invention;

Fig. 2 is a side elevation of the dyeing frame of the apparatus of Fig. 1;

Fig. 3 is a vertical sectional view taken along line 3-3 of Fig. 2;

Fig. 4 is a horizontal sectional view taken along line 4-4 of Fig. 2;

Fig. 5 is a diagrammatic perspective view of the pairs of yarn applicators and traveling yarn in the apparatus of the foregoing paragraphs; and

Fig. 6 prior art apparatus.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0015] The dyeing apparatus 10 of the preferred embodiment of the present invention illustrated in the accompanying drawings, feeds originally undyed cotton yarns that are wound on warp beams 12 supported in two racks, 14 and 16, arranged in series with each rack supporting four warp beams 18 and 20 in a two over two stacking arrangement. One rack 14 is outboard of the other rack 16. Yarns from the four beams 18 of the outboard rack 14 are withdrawn and combined into a single yarn sheet 22 that passes under the beams 20 of the inboard rack 16 and combined with the yarn sheet 23 drawn from the beams 20 of the inner rack 16 to form a combined single sheet 24 drawn from the eight warp beams.

[0016] In threading up the apparatus 10, a cross yarn 26 is laid across the top of the sheet 22 of yarns from the outboard rack 14 prior to the sheet passing under the beams 20 of the inner rack 16. In this manner, the yarns from the inner rack 16 are laid on top of the cross yarn 26 in combining with the yarns from the outer rack 14. The combined single yarn sheet 24 is then threaded under a guide roller 28, upwardly to the top of the dyeing frame 30 over an intermediate guide roller 32 and then over a top guide roller 34, under a tensioning roller 36 and again upwardly over a driven roller 38 from which it is initially threaded downwardly into the dyeing frame 30.

[0017] As seen in figure 2 the yarn sheet is threaded downwardly through a top gas seal 40 into the top of a dyeing chamber 42 and into the chamber between a pair of driven nip rollers 44 near the top of the chamber. As the single yarn sheet is threaded past the nip rollers 44 the cross yarn 22 is pulled to one side to displace the yarn from one of the racks 14 in one direction from the yarns from the other rack 16, thereby separating the yarn sheet 24 into spaced separate yarn sheet path portions 46, 48, also referred to as separate sheets 46, 48 or spaced separate sheets 46, 48. The spaced separate yarn sheet portions 46, 48 are then threaded oppositely outwardly over a pair of spaced guide rollers 50, 52 downwardly to a pair of combining nip rollers 54 which recombine the spaced separate yarn sheet path portions into a combined single sheet 56. The combined sheet 56 is then threaded downwardly past a guide roller 58 through a lower gas seal 60 at the bottom of the chamber, around a tension roller 62 at the bottom of the dyeing frame 30 and outwardly under another guide roller 64 to a pair of stacked heating drums 66 around which the sheet is threaded and from which the dyed yarn sheet is fed to a conventional take-up apparatus or further processing apparatus.

[0018] In the dyeing chamber 42, in the space between the separate yarn sheet path portions 46, 48 a pair of inner foam dye applicators 68 and 70 having nozzles 72, 74 positioned in contact with and extending across the inner facing surfaces 76, 78 of the spaced separate yarn

sheet path portions 46, 48. Each of these inner applicators 68, 70 has an inlet 80, 82 through which foamed dye is fed into parabolic foam distribution chambers 84, 86 of the type described in U.S. Patent No. 4, 655, 056. These foam distribution chambers 84, 86 are arranged vertically so as to fit within the space between the separate yarn sheet path portions 46, 48. The foamed dye in the chambers 84, 86 exits through the nozzles 72, 74, to apply foamed dye to the inwardly facing surfaces of the yarns.

[0019] A pair of outer foam applicators 88, 90 are disposed outwardly of the space between separate yarn sheet path portions 46, 48 upstream of the nozzles 72, 74 of the inner foamed dye applicators 68, 70 and have nozzles 92, 94 and horizontal parabolic distribution chambers 96, 98. The nozzles 92, 94 of these outer applicators 88, 90 extended horizontally across and in contact with the inner facing surfaces of the yarns in the separate yarn sheet path portions to apply foamed dye thereto.

[0020] Below the combining nip rollers 54 there are two pairs 100, 102 of applicators mounted in sequence. Each pair has an upper applicator 104 with the nozzle 106 projecting into the dyeing chamber 42 in contact with the surface of the recombined sheet 56, and projects inwardly sufficiently to displace the yarn sheet slightly out of its normal path to assure foam dispensing contact with the yarn surface. The lower applicator 108 of each pair has its nozzle 110 projecting into the chamber 42 in contact with and displacing the yarn sheet 56 in a direction opposite to the displacement by the upper applicator, thereby maintaining full contact of the nozzle with the yarn sheet 56. Each of the nozzles 106, 110 of both of these pairs have infeeds 112 and parabolic distribution chambers 113 outside the dyeing chamber 42.

[0021] The dyeing chamber 42 is shaped around the interior components in close proximity thereto for a minimum interior volume, thereby efficiently utilizing a limited quantity of inert gas to provide an inert atmosphere.

[0022] Nitrogen or other suitable inert gas is fed from a gas supply tank 114 through a supply line 116 to the chamber 42 to maintain the interior of the chamber substantially inert, and under a pressure slightly above atmospheric to avoid bleeding of oxygen containing atmosphere into the chamber 42.

[0023] The inert gas is also fed to a main foam generator 118 that also receives reduced indigo dye in a leuco state from a main dye supply tank 117. This main foam generator 118 generates foam that is then fed through the foam supply line 120 to distributors 119 and valves 121 on the dyeing frame 30 for measured distribution to the various foam applicators. To provide a different concentration, shade or color to the foamed dye applied by different applicators, a secondary supply of foamed reduced indigo dye is fed through a conduit 122 from a secondary foam generator 124 that receives inert gas from the main supply tank 114 and dye from a secondary dye supply tank 126.

[0024] When the sheet of yarns has been threaded through the apparatus and the operation begins, the sheet passes over the top of the dyeing frame 30 and then downwardly into the dyeing chamber 42 where it separates into spaced separate yarn sheet path portions for application of foamed dye to the inner and outer facing surfaces of the separate yarn sheet portions, and then downwardly through the combining nip rollers past the pairs of applicators that apply foamed dye to deepen the shade of the dye on the yarn.

[0025] The amount of foamed dye applied by each pair of applicators can be limited so that there is no significant runoff and no need for pressure rolling after each pair of applicators to be sure that the foam penetrates the yarn. When the yarn leaves the chamber 42 with the foamed dye imparted thereto, it enters the ambient atmosphere and the oxygen in the atmosphere fixes the originally leuco-state dye on the surface.

[0026] The vertical sectional view of Fig. 3 is taken down through the center of the dye frame 30 and illustrates the yarn travel in a separated yarn sheet path 46 past an inner applicator 68 with its parabolic foam distributor chamber 84 and then past the nozzles 100, 110 of the applicator pairs 88, 90 that apply foamed dye to the recombined yarn sheet 56.

[0027] Fig. 4 is a horizontal sectional view of the pairs of applicators 68, 70, 88, 90 that apply foamed dye to the spaced separate yarn sheet portions.

[0028] Fig. 5 diagrammatically illustrates the separate spaced yarn sheet portions 46, 48 progressing past the pairs of applicators 68, 70 that apply foam to the separate spaced yarn sheet portions 46, 48 and illustrates the combining of the separate spaced yarn portions back into a single yarn sheet 56 and the passage past the pairs of applicators 88, 90 that apply foamed dye to the recombined sheet 56.

[0029] As seen in Fig. 1, the dyeing frame 30 is enclosed with panels 127. The panels laterally outward of the dyeing chamber 42 are in two separable portions 128 meeting in alignment with the center line of the interior components. Opening of these panel portions 128 allows access into the interior of the dyeing frame 30 for threading of yarn through the apparatus and for maintenance and correction of any malfunction. For this purpose, the dyeing chamber is formed in separable halves for separating with the supported opposing rollers and applicators. This is accomplished with opposing gears 130 driven by a motor 132.

[0030] In a typical operation the yarn sheet entering the dyeing frame is 63 inches wide with a yarn density of 74 ends per inch. This results in a total number of yarns in the sheet of 4662 ends. When the sheet is divided into separate spaced sheet portions, this results in 2331 ends across the width of each spaced separate sheet portion. This reduces substantially the likelihood of any white spots remaining on any of the yarns due to overlapping or entangling during travel past the applicators. This advantage is particularly significant when dyeing cotton

yarn for use in weaving denim fabric as the initial dye application can be light to retain an undyed center while fully tinting the outside surface of each yarn. The subsequent dyeing of the recombined yarn sheet then deepens the shade or, if desired, applies a different color to the yarn. Having an undyed center is an advantage in the manufacture of current day denim fabric where spots of undyed yarn can be generated during stone washing or other treatment to provide desired fashion effects. While use of the present invention allows for retaining undyed centers in the yarn, it importantly avoids the generation of noticeable undyed streaks that are undesirable in the ultimate denim fabric.

[0031] An advantage of the apparatus of the present invention is that the tension in the traveling yarn sheet can be maintained uniform because of the driven nip rollers and take up rollers that can be synchronously driven to maintain uniform travel as well as assuring desirable full contact of the tensioned yarns with the nozzles of the applicators.

[0032] While the foregoing description of the preferred embodiment of the present invention describes the use of a chamber containing inert gas and the application of reduced indigo dye in leuco-state, the invention is applicable as well to applying other dyes, such as sulfur, vat dye and other dyes, or a combination of applying one dye from some of the applicators and other dyes from other applicators for different fashion effects.

[0033] Also, the invention is applicable for other types of foam dyeing in a non-inert atmosphere without a dyeing chamber.

[0034] When a leuco-state dye, such as reduced indigo, passes from an inert atmosphere within a dyeing chamber, and enters the ambient atmosphere, the oxygen in the atmosphere oxidizes and sets the dye.

[0035] In a typical operation the dye concentration in the liquid phase of the foam applied by the applicators to the spaced separated yarn sheet portions is about 6% and is applied at a wet pick-up rate of about 25% to a yarn sheet traveling at 25 yards per minute. The concentration of the dye in the foam that is applied by the applicators that apply foamed dye to the recombined sheet is the same wet pick-up. The flow rate of the liquid varies, however, because for equal wet pick-up, the liquid flow rate will by necessity be one-half for half the yarn sheet in comparison to a full sheet.

[0036] It should be noted that while the described preferred embodiment has eight warp beams of yarn, any number of warp beams can be used, depending on the desired production requirements, and the number of applications can be more or less than described herein.

[0037] In view of the aforesaid written description of the present invention, it will be readily understood by those skilled in the art that the present invention is susceptible of broad utility and application. Many embodiments and adaptations of the present invention other than those herein described, as well as many variations, modifications, and equivalent arrangements, will be apparent from or reasonably suggested by the present invention and the foregoing description thereof, without departing from the substance or scope of the present invention. Accordingly, while the present invention has been described herein in detail in relation to preferred embodiments, it is to be understood that this disclosure is only illustrative of examples of the present invention and is made merely for purposes of providing a full and enabling disclosure of the invention. The foregoing disclosure is not intended nor is it to be construed to limit the present invention or otherwise exclude any other embodiment, adaptations, variations, modifications and equivalent arrangements, the present invention being limited only by the claims appended hereto and the equivalents thereof.

Claims

1. A method of dyeing traveling textile yarns with foamed dye, comprising

   providing two separate sheets (22, 23) of textile yarn;
   combining said two separate sheets (22, 23) into a single combined sheet (24) of yarn;
   continuously feeding the combined sheet (24) of yarn in a single path;
   separating said traveling combined sheet (24) into two separate spaced sheets (46, 48) for continuing travel in separate spaced path paths, with the yarns in each separate spaced sheets (46, 48) having inner surfaces facing the other sheet and outer surfaces facing away from the other sheet, and having interior portions;
   said separating resulting in less yarns in each separate spaced sheet (46, 48) than in said combined sheet (24), thereby providing less density and less yarn overlap and entanglement in each separate spaced sheet (46, 48) than in said combined sheet (24);
   applying foamed dye to the inner surfaces and to the outer surfaces of the yarns in said separate sheets (46, 48);
   recombining said separate sheet (46, 48) for continued travel as a single recombined sheet (56).

2. The method of dyeing traveling textile yarns according to claim 1, characterized further by applying foamed dye to the yarns in the traveling recombined sheet (56) of yarns.

3. The method of dyeing traveling textile yarns according to claims 1 or 2, wherein at least one of said applying foamed dye applies dye from a different source than the source of dye applied by other dye applying.

4. The method of dyeing traveling textile yarns according to any of claims 1, 2 or 3, characterized further in that the applying foamed dye to the yarns in said separate sheets (46, 48) applies dye to tint the surfaces of the yarns, leaving the interior portions of the yarns undyed, and said dyeing of the yarns in the recombined sheet (56) applies dye to deepen the shade of the dye applied to the yarn in the separate sheets (46, 48).

5. The method of dyeing traveling textile yarns according to any of claims 1 to 4, wherein the yarn is undyed cotton yarn and the yarn is fed through a sealed chamber (42) containing an inert gas and said yarn sheet separating and recombining are within the chamber (42) and the foamed dye is indigo dye in a leuco-state and is applied to said yarns in said chamber.

6. An apparatus for dyeing traveling textile yarns with dye applied in a foam condition, and arranged for carrying out a method according to claim 1, comprising:

a pair of driven infeed nip rollers (44) for feeding a combined sheet (24) of two separate yarn sheets (22, 23) in a downstream direction;
a pair of outwardly spaced guide rollers (50, 52) downstream of said infeed nip rollers (44) for guiding two separate sheets (46, 48) of said combined sheet (24) in separated spaced paths to provide less density an less yarn overlapping an entangling in each separate sheet (46, 48) than in said combined sheet (24);
a pair of driven yarn sheet recombining nip rollers (54) downstream of said outwardly spaced rollers (50, 52) for recombining said separated yarn sheets (46, 48) into a single recombined sheet (56); an exit guide roller (62) downstream of said recombining nip rollers (54) for guiding said recombined sheet (56) from said apparatus;
a pair of outwardly facing, inner foam applicators (68, 70) and a pair of inwardly facing, outer foam applicators (88, 90), said pairs spaced from each other in the downstream direction of travel of said yarns;
said pair of outwardly facing, inner foam applicators (68, 70) disposed between the paths of said separated sheets (46, 48) and having foam dispensing nozzles (72, 74) extending transversely of and in contact with the inner facing surfaces of the yarns of said separated sheets (46, 48) for surface dyeing of the inward facing surfaces of said separated sheets (46, 48);
said pair of inwardly facing, outer foam applicators (88, 90) disposed outwardly of the path of yarn travel and having foam dispensing nozzles (92, 94) extending transversely of and in contact with the outer facing surfaces of the yarns for surface dyeing of the outward facing surfaces of said yarn.

7. The apparatus for dyeing traveling textile yarns according to claim 6, characterized further by a plurality of foam applicators (104, 108) downstream of said recombining rollers (54) and having nozzles (106, 110) for applying foamed dye to the yarns in said recombined sheet (56) of yarns.

8. The apparatus for dyeing traveling textile yarns according to claim 6 or 7, characterized further in that said outwardly facing, inner applicators (68, 70) are located between said outwardly spaced guide rollers (50, 52) and said recombining rollers (54), and said inwardly facing, outer applicators (88, 90) are located between said outwardly spaced rollers (50, 52) and said outwardly facing, inner applicators (68, 70).

9. The apparatus for dyeing traveling textile yarns according to claim 6, 7 or 8, characterized further in that said outwardly facing nozzles (72, 74) of said inner foam applicators (68, 70) project into the paths of said separated sheets (46, 48) to deflect the separated sheets (46, 48) outwardly to maintain foam dispensing contact therewith; and said inwardly facing nozzles(92, 94) of said outer applicators (88, 90) project into the path of said yarn to deflect the yarn inwardly to maintain foam dispensing contact therewith.

10. The apparatus for dyeing traveling textile yarns according to any of claims 6 to 9, wherein said textile yarns are undyed cotton yarns and the dye applied by said applicators is indigo leuco-state dye.

11. The apparatus for dyeing traveling textile yarns according claim 10, characterized further by

a dyeing chamber (42) sealed from atmospheric air and having entry and exit seals through which said traveling textile yarns enter and exit said chamber (42);
a supply of inert gas communicating with said chamber (42) to maintain a substantially inert atmosphere therein;
said pair of infeed nip rollers (44) are disposed in said chamber (42) for feeding said combined sheet (24) of yarn in said chamber (42) in a downstream direction;
said pair of outwardly spaced guide rollers (50, 52) are in said chamber (42) downstream of said infeed nip rollers (44) ;
said pair of yarn sheet recombining nip rollers (54) are in said chamber (42) downstream of said outwardly spaced guide rollers (50, 52);

said exit guide roller (62) is outside said chamber (42), downstream of said recombining nip rollers (54) for guiding said recombined sheet (56) through said exit seal and from said chamber (42); and

said pairs of foam applicators (68, 70; 88, 90) are in said chamber (42).

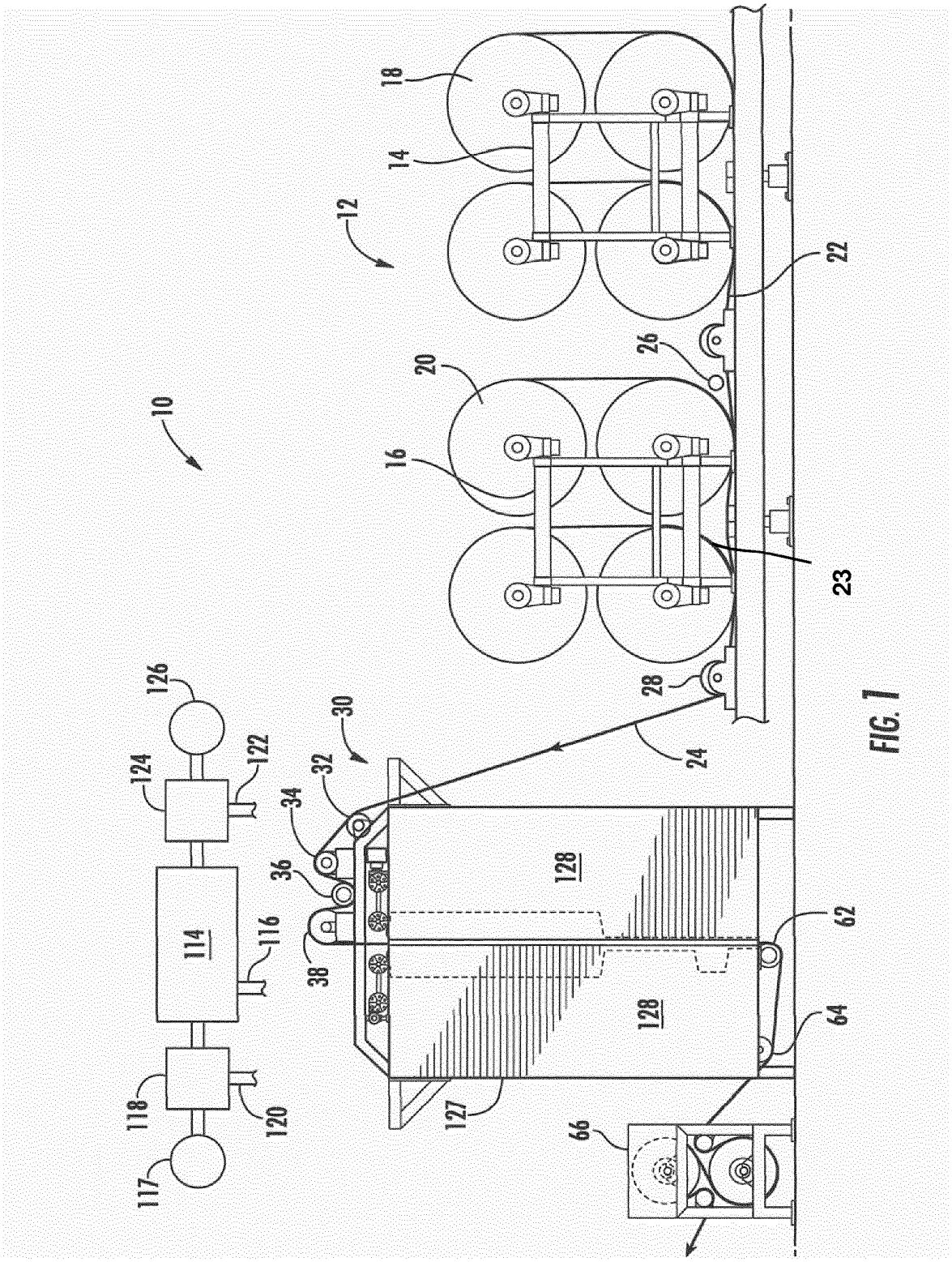
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FIG. 1

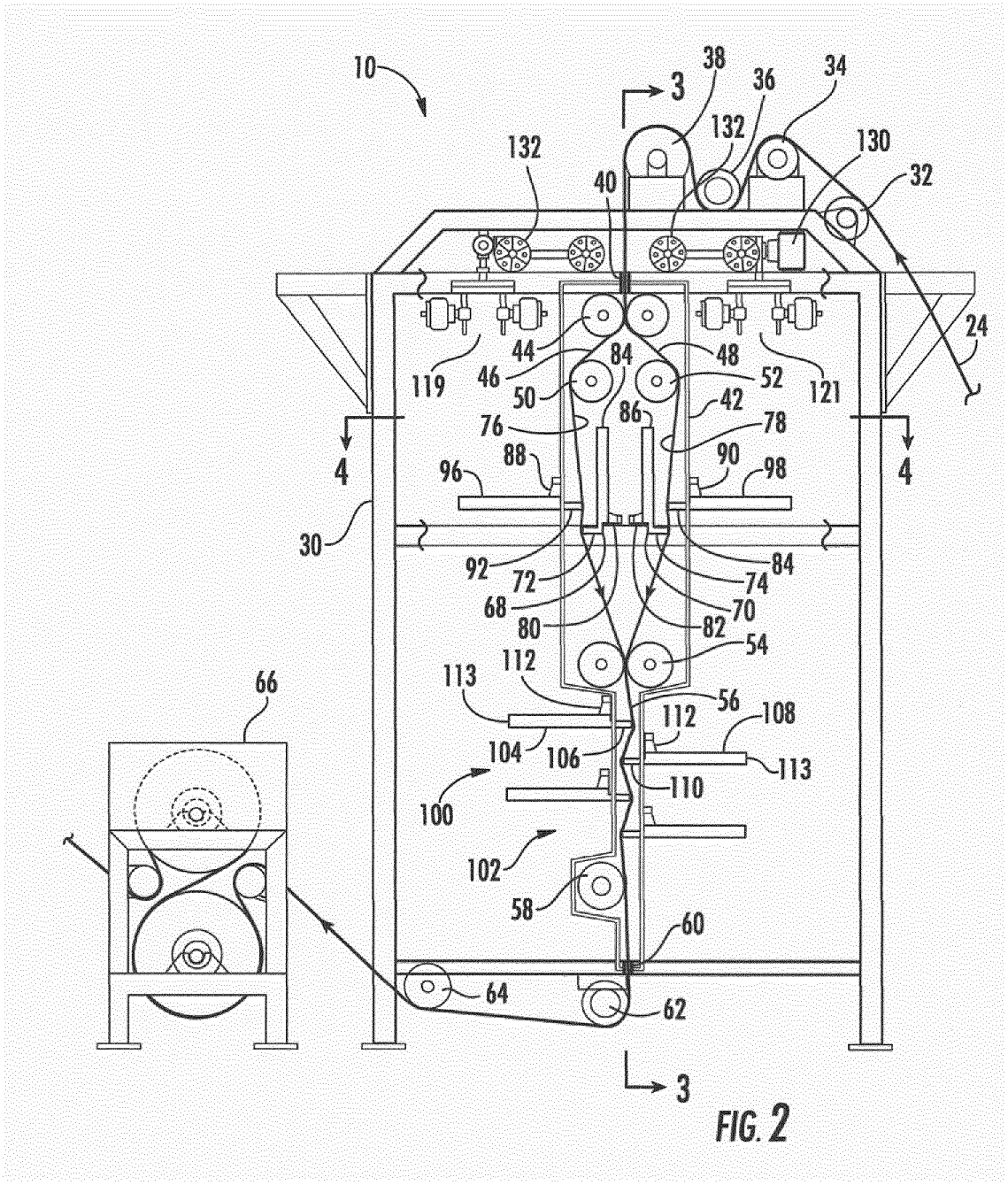
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FIG. 2

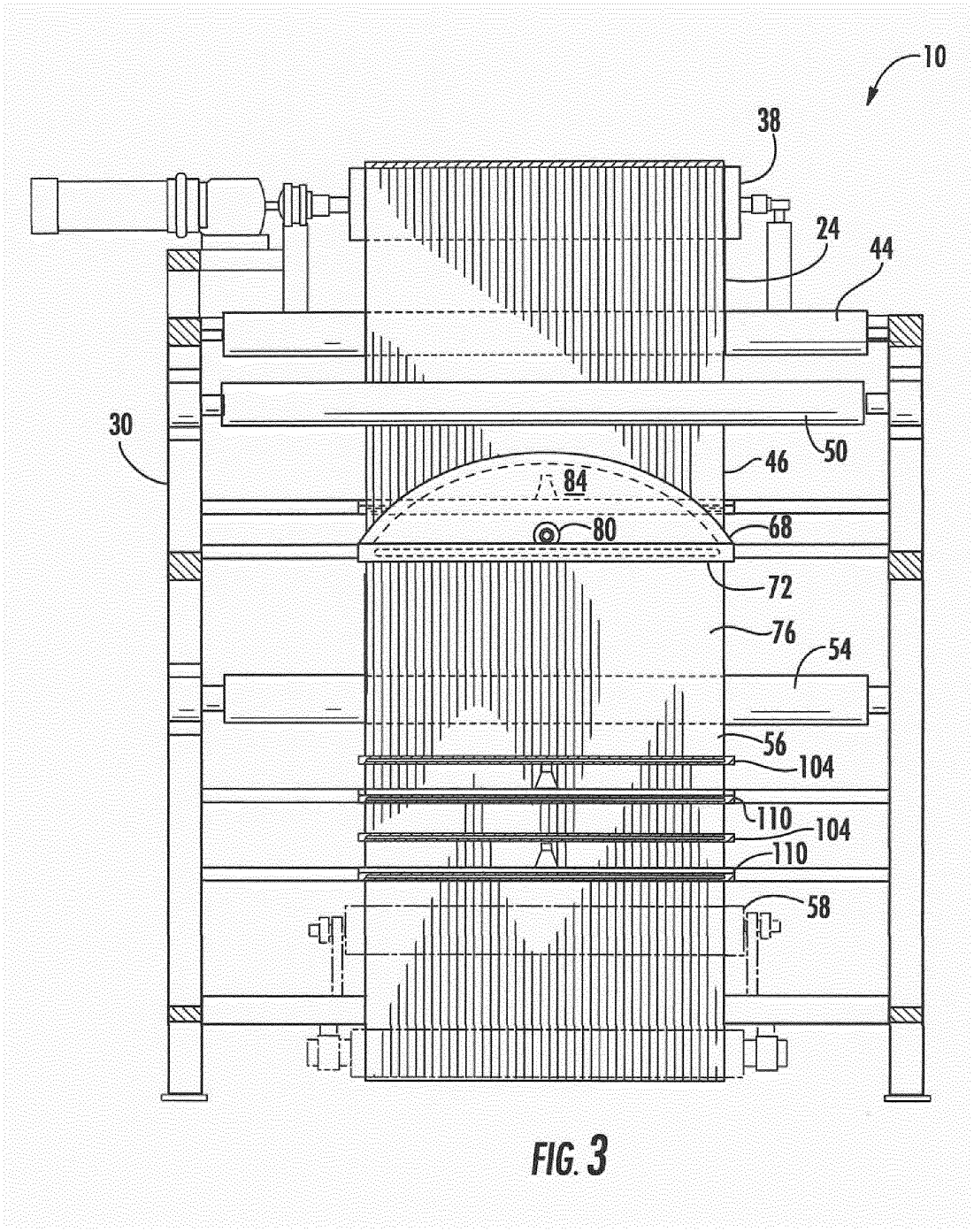

FIG. 3

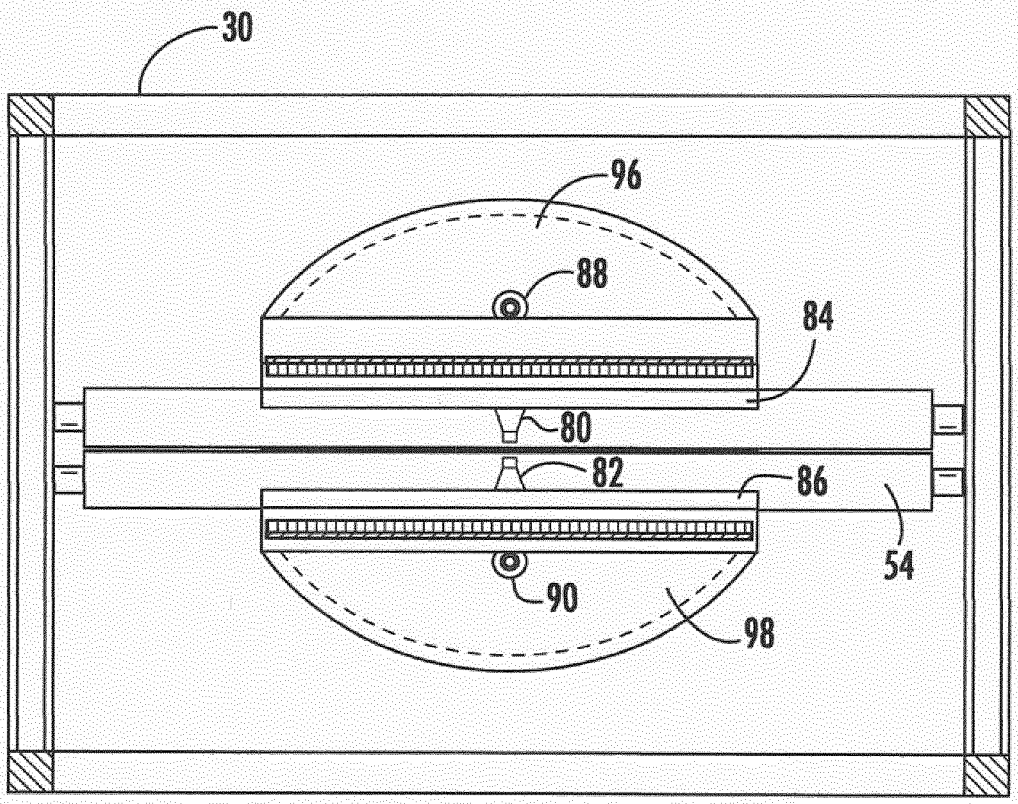

FIG. 4

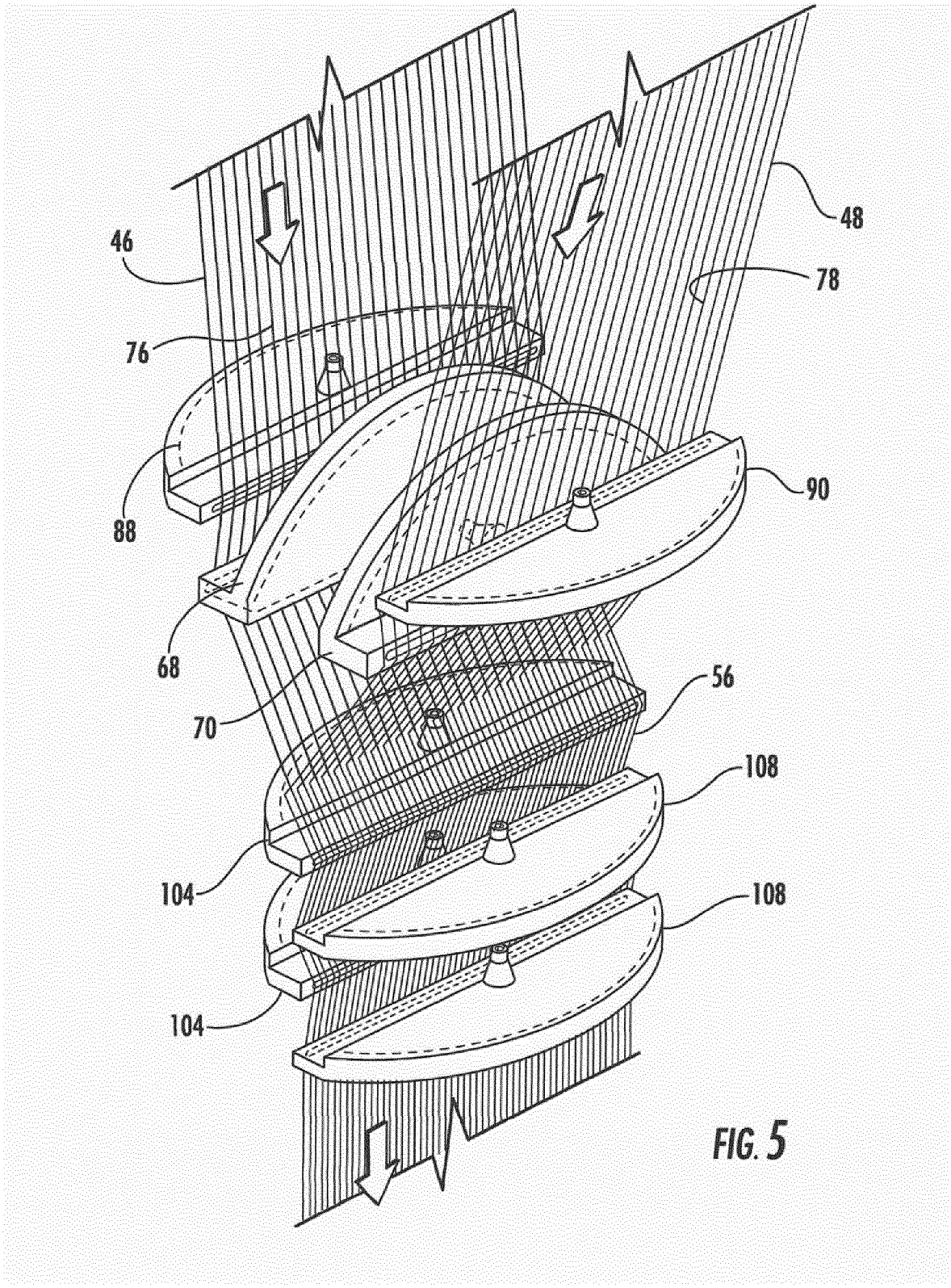

FIG. 5

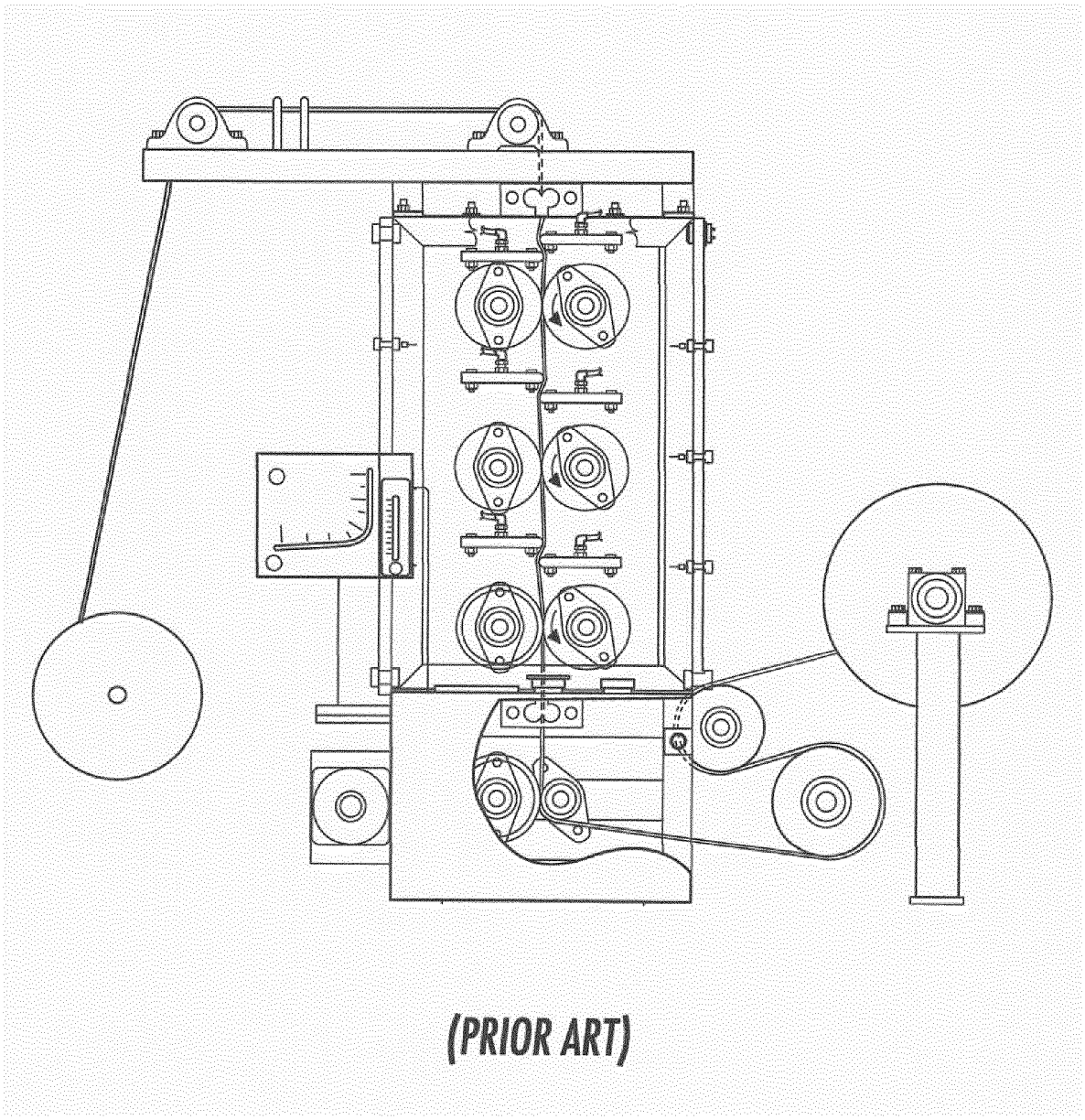

FIG. 6

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European Patent Office
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EUROPEAN SEARCH REPORT

Application Number
EP 13 16 5120

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
Y A	WO 2008/147515 A1 (GASTON SYSTEMS INC [US]; AURICH CHRISTOPH WALTER [US]; ZEIFFER DIETER) 4 December 2008 (2008-12-04) * paragraphs [0059] - [0060]; claim 1; figures 1,9 *	1,5,6,8, 10,11 2-4,7,9	INV. D06B19/00 D06B1/08 D06B11/00
Y A	DE 34 12 039 A1 (ZELL J KRUECKELS GMBH & CO KG [DE]) 3 October 1985 (1985-10-03) * page 12, paragraph 3; claim 1; figures 6-9 * * page 1, paragraph 1 *	1,5,6,8, 10,11 2-4,7,9	
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A	WO 2008/056256 A1 (MASTER SRL [IT]; RONCHI FRANCESCO [IT]) 15 May 2008 (2008-05-15) * the whole document *	1-11	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	16 August 2013	Bichi, Marco

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
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