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(54) **APPARATUS FOR SIZING WARP YARNS**

EXPANDIERBARE POLYSTYROLPARTIKEL

APPAREIL D'ENCOLLAGE DES FILS DE CHAINE

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- **PATENT ABSTRACTS OF JAPAN vol. 15, no. 328 (C-0860), 21 August 1991 & JP 03 124869 A (KANEBO LTD.)**
- **PATENT ABSTRACTS OF JAPAN vol. 18, no. 58 (C-1159), 31 January 1994 & JP 05 272049 A (TSUDAKOMA CORP.)**

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Description

Field of the invention

[0001] The present invention is related to an apparatus for sizing warps made of textile yarns.

[0002] The term "sizing" means, as it is well known, a treatment for preparing warp to weaving, by means of smearing and coating the yarns with liquor chemical substances having a high binding capacity, to the aim of an enhancing resistance and smoothness of the yarn during weaving operations.

State of the prior art

[0003] Traditionally the sizing treatment provides that the warp yarns to be sized is wound onto a beam, generally delivered from the warping mill. The beam is coupled onto a rotary support generally equipped with a braking system which is manually or automatically adjustable so as to control the yarn tension during treatment. The process provides full dipping of the yarns into a liquor containing the sizing fluids, and a subsequent squeezing thereof so as to enable penetration of the sizing liquor (paste or starch) to penetrate into the yarns. The method further provides that the warp yarns pass through an elongated drying chamber generally including hot air blowers or heating cylinders.

[0004] The dryed sizing substance, besides strengthening the yarns, also keeps them all together side by side, whereby the warp must then be passed through lease bars which, alternatively crossing the yarns relatively to one another, break the thin film of the sizing substance thereon and their surface piles so as to separate each single yarn from the adjacent yarns.

[0005] Lastly the warp yarns are wound onto a beam which is rotated generally by an electrical motor.

[0006] Considering the large amount of wound yarns, their very slight diameter and the tension applied thereto, it must be avoided that the outer yarn layers progressively wound around the beam get stuck with the yarns of the inner layers: the yarns must therefore mutually intercross so as to afford proper overlapping. This result is generally achieved by horizontally reciprocating a yarn bearing and guiding cylinder placed in front of the winding beam. This operation is named as "z-offsetting".

[0007] The traditional system disclosed in the above leads to fairly good results, but is somehow disadvantageous due to the several reasons explained in the following:

- the machines employed are generally cumbersome and expensive,
- huge consumption of the sizing substances for the warp padding owing to the considerable volumes of the yarn dipping tanks;
- limited practicalness of use particularly in connection with small amounts of warp to be treated;
- critical problems of solidification of the sizing liquor in case of energy cutoff during the process.

[0008] In order to overcome the above drawbacks, warp yarn sizing apparatuses have been proposed which, instead of dipping the yarns, provide smearing application of the sizing liquor onto the outer surface of the yarn. Such apparatuses, known for instance from US-A-5,381,593 and IT-B-1.259.632 (according to which a "waxing" treatment substantially equivalent to sizing is performed), normally comprise an unwinding station of the warp from a supply beam, an application assembly of a sizing liquor onto the warp yarns including application cylinders and guide rollers, a drier station of the warp yarns, and a winding station of the warp onto an outlet beam. In the case of above-referenced US-A-5,381,593 and IT-B-1.259.632 documents, the drier station is constituted by a vertically arranged air blower. However known are in the art solutions in which the drier station is constituted by an horizontal drying oven.

[0009] An apparatus for sizing yarns according to the preamble of claim 1 is known from JP-A-03-124 869.

Statement of the invention

[0010] The present invention is directed to an apparatus for sizing warp yarns of the type set forth in the above, and its general object is to enhance and simplify an even sizing treatment of the warp yarns.

[0011] A particular object of the invention is to provide a sizing apparatus of the above-referenced type equipped with a drier system which is quick, efficient, adaptable and adjustable to any different need, and which is also particularly compact.

[0012] A further object of the invention is to make the drier system adjustable so as to obtain maximum efficiency thereof.

[0013] A further object of the invention is to reduce any risks of yarn breakage during the leasing step.

[0014] A further object of the invention is to enable mutual coupling even of a number of warp yarns subjected to different tension so as to cope with particular processing needs.

[0015] A further object of the invention is to ensure application of the sizing substance without rubbing and thus without superficial friction between the application rollers of the application assembly and the yarns under treatment.

[0016] These objects are achieved, according to the invention, essentially by virtue of the features set forth in the characterizing portion of claim 1, and additional features are recited in the subclaims.

Brief description of the drawings

[0017] The invention will now be disclosed in detail with reference to the accompanying drawings, purely provided by way of non limiting example, in which:

- Figure 1 is a diagrammatic lateral elevational and partially sectioned view of a sizing apparatus according to the invention,
- Figure 2 shows in an enlarged scale a detail of figure 1,
- Figure 3 shows in an enlarged scale a detail of figure 2,
- Figures 4 and 4 are views similar to figure 3, in a reduced scale, showing two different operative conditions,
- Figure 6 shows in an enlarged scale a detail of figures 1 through 5 to clarify one operating principle of the apparatus,
- Figure 7 is a variant of figure 1,
- Figure 8 shows in an enlarged scale a variant of a particular of the apparatus,and
- Figure 9 shows in an enlarged scale a further variant of another particular of the apparatus.

Detailed disclosure of the invention

[0018] Referring initially to figure 1, the apparatus according to the invention for sizing warp yarns 1 essentially comprises an unwinding station 2, an application assembly 13 of the fluid sizing substance including at least a pair of application cylinders 5 superimposed to each other and partially dipped within respective distributor tanks 11, guiding rollers 4, 12, and finally a drying station 6, an optional lease bar assembly 7, and a rewinding beam 8.

[0019] In more detail, the warp yarn 1 to be treated is normally wound onto a supply or inlet beam 3 placed at the unwinding station 2, where a mechanical support system keeps this beam 3 connected to an automatic braking system, not shown in detail since generally conventional.

[0020] The warp yarns 1 to be treated are passed by the guiding rollers 12 firstly to the lower application cylinder 5 and then, by the guiding rollers 4, to the upper application cylinder 5. As shown in better detail in figure 2, the guiding rollers 4 are jointly displaceable, through swinging of a motor-driven support not shown in the drawings, between a lowered operative position, shown in figure 1 and with full line in figure 2, in which they keep the warp yarns 2 in contact with the surfaces of the application cylinders 5, and a raised position shown with dotted lines in figure 2, in which during the starting stage or in case of stop of the apparatus, they keep the warp yarns 2 separated and spaced-apart from the surfaces of the application cylinders 5. It is to be pointed out in this connection that the invention contemplates, in order to achieve the same functional effect, the possibility of maintaining the guiding rollers 4 stationary and instead vertically displacing the application cylinders 5 and related distributor tanks 11, so as to perform separation of the warp yarns 1 relative to the surfaces of these application cylinders 5. This alternative embodiment is diagrammatically shown in figure 9, to which reference shall be made in the following.

[0021] The warp yarns 1 then run through the drier station 6 which, by virtue of the construction which shall be disclosed herebelow, is normally open when the apparatus is inoperative so as to make cleaning and starting operations easier, such as diagrammatically depicted in figure 5.

[0022] The warp yarns 1 are then passed through auxiliary components such as a height-adjusting comb, not shown, and the optional lease bars 7.

[0023] The yarns can thus be drawn by the re-winding beam 8 which, supported by a system generally similar to that of the unwinding station 2, is driven by a geared motor 9 for advantagement of the warp yarns 1 during the sizing process.

[0024] The peculiar features of the apparatus according to the invention will now be disclosed in more detail, with reference to the several aspects of the sizing process carried out by the apparatus.

Preparation of the sizing substance

[0025] Preparation of the chemical product to be applied for sizing is performed generally by introducing the product into an outer storage tank 10, having associated thereto one or more pumps with register valves and filters enabling the product to be stirred by means of recirculation thereof, to the aim of preventing formation of clots and keeping the product homogeneity high. Whenever the liquid substance has to be heated, so as to increase performances thereof, the storage tank 10 shall be equipped with a proper heating system having a temperature control device and a properly insulating structure so as to reduce evaporation of the product.

[0026] The liquid is then supplied to the distributor tanks 11 where it is kept in contact with the application cylinders 5 which, being partially dipped therein, are continuously rotated so as to prevent formation of solid films on its surface.

[0027] The liquid, once having reached a predetermined level, is collected and fed again to the storage tank 10 continuously, so as to obtain treatment evenness and avoid degradation or impoverishment of the product delivered to the distribution tanks 11.

Warp winding process

[0028] Upon start of the apparatus, the winding beam 8 driven by the geared motor 9 trails the warp yarns 2 through its successive paths, constantly controlling the peripheral speed thereof so as to keep it constant in spite of its diameter variation, by means of an electronic speed control system of the warp 1.

[0029] The warp 1, wound on the unwinding beam 2, is tensioned by the braking system 3 which, as mentioned, can be of any conventional type, such as for instance a pneumatic brake, a mechanical clutch or an electrical motor. The winding tension of the warp 1 on the winding beam 8 may be constant for the whole bobbin winding, or it may be variable from the beginning to the end according to the treatment need. The values of this braking action are controlled and made correspondent to predetermined values during the entire process, notwithstanding the diameters on the winding 8 and the unwinding beam 2 are continuously changing, by employing a load cell balance 15 operatively associated to one of the guiding rollers 12, which allows preventing all inconveniences of the re-winding beams of conventional sizing machines. The load cell balance 15 is not shown in detail, since its construction is well known to the experts of the art.

Differentiated tension winding

[0030] This operation can be performed by the variant of the apparatus according to the invention shown in figure 7. A plurality (two in the shown example) of unwinding stations 2 with respective unwinding beams 3 and automatic-correction electronic balances 15, in turn operatively associated to respective warp chains, are provided. Accordingly, if the composition of the warp to be weaved requires joining two or more chains of different yarns, with or without differentiated yarn tension (for instance in case the warp is made of two different materials, or in case of special patterns of the same material), the tension of the yarn wound onto the winding beam 8 can be selectively adjusted. Upon start of the winding beam 8, whose peripheral speed is continuously controlled in a known way by an automatic system carried by an idle cylinder, the yarns are coupled to and wound around the beam 8, which shall thereafter be ready to be delivered to the weaving loom possibly with differentiated tensions between the various warp yarns.

Sizing substance application

[0031] As already previously explained, the movable guiding rollers 4 (or the distributor tanks 11 with the respective application cylinders 5) are normally positioned so as to separate the warp yarn 1 from the surfaces of the application cylinders 5, to avoid formation of sizing product deposits on the yarn during stops. The application cylinders 5 are normally dipping into the liquid product contained within the tanks 11 and, as explained, are continuously rotated so as to prevent formation of solid films and clots on their surface.

[0032] Preferably a respective scraper member is operatively associated to each application cylinder 5, only one of which is shown as 16 in figure 2, to the aim of avoiding that treatment may be different between the starting stage of the apparatus, when the yarn has not yet collected any of the sizing product, and steady state operation, i.e. when the yarn regularly removes the sizing product.

[0033] Upon start of the re-winding beam 8, the drying oven 6, previously set in the open position shown in figure 5, is closed and the warp yarn 1 is then brought into contact with the application cylinder 5 due to either lowering of the movable guiding rollers 4 or raising of the distributor tanks 11 and related application cylinders 5. The advancement speed of the warp yarn 1 and the rotation speed of the application cylinders 5 become now synchronous, and smearing of the sizing substance begins.

[0034] An electronic control systems enables to selectively choose the amount of sizing product to be applied onto the warp yarns 1, by increasing or decreasing the ratio between the advancement speed of the yarn and the revolution speed of the application cylinders 5.

[0035] The smearing system of the sizing substance can be arranged, alternatively to that shown in figure 2, even according to the variant depicted in figure 9, in which parts which are identical or similar to those already previously disclosed in the above are indicated by the same reference numerals. In this variant the two fronts of the warp 1, indicated as h and k, are no longer touched, after having been smeared with the sizing substance, by any member of the apparatus until the end of the subsequent drying stage. The front h, which is the inner one with respect to the path between the guiding rollers 12, receives the sizing product firstly, i.e. by the first application cylinder 5, and then becomes the outer front k along the path between the guiding rollers 4. The front k instead, still dry, can be kept into contact with the guiding rollers 4 and receive then the sizing product by the second application cylinder 5 of the application assembly 13, just before the warp enters the drier station 6. As disclosed in more detail in the following, application of the size liquor is carried out in this case with the aid of two presser cylinders 45 each superimposed to a respective application cylinder 5, firstly over the front h and subsequntly over the front k, while mutual cooperation between cylinders 5 and 45 performs a pressing action onto the warp passing therethrough

Sizing substance penetration

[0036] The fluid sizing product, generally an aqueous solution, grasps at the warp yarn 1 superficially, and penetration thereof towards the innermost fibers is quite variable, depending upon the characteristics of the yarn

itself (for instance the amount of its twisting, the nature of its fibers and of any previous treatments, as well as the degree of natural humidity, may be different). A water vaporization or spraying at the warp inlet before smearing may improve the performances thereof, however acting and persisting only on the outer surface of the yarn.

[0037] The provision of a pair of superimposed squeezing cylinders 43, shown in the variant of figure 9 (one of which, i.e. the lower one, is in the shown example constantly dipped into water contained within a tank 44 therebelow) arranged upstream the application assembly 13 and downstream of the unwinding station 2 (and possibly of a further humidification station not shown in the drawing), provides a remarkable moisture to the warp 1 since these squeezing cylinders 43 are capable to penetrate the water particles otherwise stagnating superficially, thus decreasing the surface tension and enabling a quicker and dipper penetration of the sizing substance subsequently applied by the application cylinders 5 of the assembly 13.

[0038] The squeezing cylinders 43 may be either idle or driven: in the latter case the rotation speed thereof shall be synchronised with the advancement speed of the warp yarn 1 towards the application station 13.

[0039] The operative configuration provides that the upper cylinder 43 is normally bearing by gravity onto the warp yarn 1 in turn bearing upon the lower cylinder 43. In alternative, a pneumatic or mechanical system can be provided so as to both adjust the squeezing force, and to separate the cylinders 43 from each other during the preparation stage or stop of the apparatus.

[0040] To the aim of enhancing penetration of the sizing substance during application thereof to the warp yarn 1 and thus increasing resistance thereof, as well as for a better cohesion of the sizing substance with the warp itself, provision can even be made, as also depicted in figure 9, of the two idle or rotary driven pressure cylinders 45, each arranged above a respective application cylinder 5 so as to press the warp yarn 1 thereagainst. The pressing effect of the pressure cylinders 45 enables the sizing substance to still more deeply penetrate into the warp fibers.

[0041] In case of apparatus stops, the pressure cylinders 45 and the corresponding application cylinders 5 associated therewith are moved away from the warp yarn 1, which is held in position being supported by the guiding rollers 12 and 4 kept stationary.

Synchronized smearing

[0042] One important variant of the smearing system of the sizing substance such as disclosed in the above with reference to figure 2 or figure 9, is diagrammatically shown in figure 8. This variant enables to suppress rubbing generated between the warp yarns 1 and the surface of the application cylinders 5, whose peripheral speed may be generally lower than warp advancement speed.

[0043] As it is known to the practitioners, the quantity of sizing product to be applied can be adjusted by properly varying the rotation speed of each application cylinder 5 which, thus collecting more or less product from the tank 11 arranged therebelow, transports this product upwardly where the warp 1, moving at a higher speed than the peripheral speed of the application cylinders 5, rubs over the surface thereof wet by the sizing substance, thus removing the proper amount thereof which is required per unity of yarn length. If the same or even superior result is intended to be obtained, without however any rubbing between the warp yarn 1 and the surface of the application cylinders 5, the invention provides that, for each of these cylinders 5, an intermediate cylinder 34 is employed, which is vertically superimposed to the respective application cylinder 5 and is contacting on one side the latter and on the other side the warp yarn 1.

[0044] This intermediate cylinder 34, idle or generally motor-driven by an actuator system which is independent from that of the respective application cylinder 5, affords the advantage to be able of collecting the product from the application cylinder 5 and transferring it to the warp yarn 1 without the latter being subjected to any surface stress.

[0045] The feature of an independent driving system for the intermediate cylinder 34 is important to warrant a perfect identity between the peripheral speed of this intermediate cylinder 34 and the advancement speed of the warp yarn 1, whatever the contact angle therebetween (more or less open) be, whatever the warp tension be, and independently of the slippery degree of the sizing substance.

[0046] An intermediate cylinder 34 can also be provided between each application cylinder 5 and the respective presser cylinder 45 according to the above-disclosed alternative embodiment of figure 9.

Coated warp yarn path

[0047] The warp yarn 1 coated with the sizing product remain wet and cohesion of the product to the surface of the yarns will become permanent only following drying.

[0048] According to one fundamental feature of the invention, the path of the warp yarns 1 from the exit of the application assembly 13 up to the exit of the drier station 6, i.e. between the last application cylinder 5 and a guiding roller 14 placed downstream of the drier station 6, is straight (normally horizontal) and without any bearing or contact with any parts of the apparatus. This unique characteristic was conceived in consideration of the fact that any contact of the wet warp 1 with guiding members or any other element intended to deviate the path thereof may originate several problems, particularly during servicing stops of the apparatus: any increased amount of the sizing chemical product due to rubbing, or solidi-

fication thereof, may actually cause treatment evenness imperfections or breakages upon re-starting of the apparatus, in addition to huge waste of time for cleaning operations.

[0049] By virtue of the peculiar position of the application assembly 13 of the sizing substance and of the horizontal arrangement of the drying oven 6, any contact of the wet warp 1 is prevented with members which might somehow decrease or make the amount of the applied sizing product uneven, thus creating heap up areas. Also cleaning operations are accordingly simplified.

Drying process

[0050] The warp yarn 1 having received the sizing chemical product onto its surface must be dryed so as to obtain the required result: crystallization or mere surface drying, thus forming a film capable of increasing the yarn resistance and its smoothness, and eliminating unnecessary surface piles which might originate hindrances during weaving.

[0051] According to another fundamental feature of the invention, the drying process is quickly performed within a movable modular horizontal oven 6 provided with a combined infrared ray and hot air blower drying system.

[0052] Referring particularly to figure 3, the oven 6 comprises a pair of respectively upper and lower platforms or support plates 40, 41, each of which carries one or more infrared ray radiators X and one or more air heating assemblies Y of the finned tube nest type.

[0053] The two systems are normally jointly activated in a combined way, and may also be adjusted independently from each other in accordance with the operation need.

[0054] The normally employed energy source is electrical power, but, particularly as far as the tube nest assemblies Y are concerned, other alternative systems such as steam or oil might be employed.

[0055] The platforms 40, 41 are arranged so as to enable inlet of the yarn from one side 20 and outlet thereof from the opposite side 21 of the oven 6, and barriers may be provided on the lateral and upper and lower surfaces thereof so as to prevent the heated air to excape ouwardly.

[0056] One or more blowers 22 draw the hot and humid air from one end 23 of the oven 6 and perform conditioning thereof running it along venting ducts 42 through the drying assemblies Y to then supply the air into the oven 6 at the opposite end 24 thereof.

[0057] Air humidity and temperature can be detected so as to provide automatic control of the process, by means of sensors 25 fitted within the venting ducts 42 or directly within the oven 6.

[0058] The horizontal positioning of the oven 6 enables employing the energy of the heating assemblies at the best, since it prevents natural convection upwardly motion of the hot air, and thus enhancing energetic efficiently, under the same amount of consumed energy, as compared with the case of a vertical positioning.

[0059] As shown in better detail in figures 4 and 5, the mobility feature of the oven 6 derives from the tiltable mounting of the two support plates 40, 41 between the fully closed position of figure 4 and the fully open position of figure 5. Accordingly, the distance and thus the action degree of the drying assemblies relative to the warp yarn 1 can be adjusted between the above two extreme positions, and in practice also the length (shown by references 30 and 30A) of the warp 1 directly subjected to this action. Moreover this drastically reduces any risks of burning of the warp 1 in case the apparatus is stopped during operation, since the hot parts of the oven 6 can be quickly moved away from the yarn, and further makes the oven cleaning operations easier.

[0060] The infrared ray radiators X are arranged along to juxtaposed formations, on the one and on the other support plates 40, 41, the radiating units of each formation X normally facing towards the radiating unit of the other formation; in alternative, they might be arranged in an alternatively offset fashion.

[0061] In both cases, and as shown in better detail in figure 6, each radiating unit of each formation is conveniently associated to a respective parabolic reflector 27 and is facing towards a same opposite parabolic reflector 27 of the other formation. The feature consisting of facing two or more radiating reflectors 27 to one another experimentally showed that the result in terms of efficiency on the warp 1 can be highly enhanced, since the infrared rays emitted by radiators X are alternatively reflected between the parabolic reflectors 27 with the best exploitation of the energy and thus a quicker drying effect of the warp 1. The paths of the reflected rays are diagrammatically indicated as 26, 28 and 29 in figure 6.

[0062] The feature consisting of employing the two different heating sources simultaneously, with the possibility of varying selectively and in a combined way the action of these sources (at least in a range between 20% and 85%) also demonstrated, following experimental texts, that, as compared with the presently employed systems in this kind of treatment, yarns of any type i.e. both of vegetal and synthetic nature, even topped, or carded or differently prepared, both coloured or row, can be efficiently dryed without the need of high electrical power, and thus with an optimum energetic efficiency.

Leasing process

[0063] The warp yarn 1 thus dryed (completely or, as it will pointed out in the following, partially) runs into crossing paths along the lease bars 7 which, breaking the thin layer of size formed between the single threads, again separate them for subsequent delivery to the loom.

[0064] Breakage of this thin layer normally takes place when the yarns are perfectly dry and anyhow at

the end of the drying process, such as in the case depicted in figure 1. However if the yarn structure is particularly weak, or if the size layer is particularly thick, or in case clots and/or other imperfections are present, running through the lease bars might involve breaking of the yarn itself.

[0065] With the modular oven 6 system the risks of yarn breaking can be reduced, in the case of yarns requiring this, by providing the lease bar assembly between two identical ovens, same as the one previously disclosed, respectively indicated as 31 and 32 in the variant of figure 7. In this case the lease bar assembly, designated as 33 in figure 7, is interposed between the two ovens 31 and 32. Accordingly, separation between the yarns is performed at a stage in which consistency of the applied sizing product is not yet so stiffened as to involve yarn breakage. Drying is completed upon the yarn passing through the second oven 32, which may generally have a lower power than the first oven 31.

[0066] It is to be pointed out that this application, apparently in contrast with the above disclosed feature consisting of the straight path without any contact of the warp 1 from the exit of the application assembly 13 up to the end of the drying process, is instead based upon the same principle, with the natural exception of this particular treatment, since the second oven 32 placed downstream of the lease part station 33 is as stated of a limited power, whereby as pointed out the major part of the drying process is carried out by the first oven 31.

Re-winding process with axial z-offsetting

[0067] Warp z-offsetting upon re-winding is performed by directly reciprocating the winding beam 8 along a longitudinal direction parallel to the axis thereof, i.e. perpendicularly to the advancement direction of the warp yarns 1, during rotation thereof to wind up the warp yarns.

[0068] This system enables having an absolute certainty of displacement of the beam 8 with respect to the path of the arriving yarn 1, and thus a repetitive and continuos overlapping independently of the yarn tension, of the general maintainance conditions of the apparatus and of the friction between yarns and cylinder.

[0069] Moreover, since mechanical actions on the yarn are reduced, its characteristics are kept enchanged and any risks of undesired removal of part of the previously applied sizing substance are prevented.

[0070] It will be apparent from the above that the apparatus according to the invention allows to appreciably enhance evenness of the warp yarn sizing treatment, as well as permanent adhesion of the sizing substance to the yarns. This effect is mainly achieved due to the straight path of the warp yarn without any bearing between the last application point of the sizing substance and the exit of the drier station, as well as to the configuration of the modular movable horizontal oven provided in the drier station. In particular, the horizontal arrangement enables to take advantage in the most convenient way of the natural upwardly convection motion of the heated air, while mobility enables easy and quick adjustment of the distance between the drying assemblies and the yarn, as well as immediate moving away of the hot parts relative to the yarn in case of need, as well as a remarkable cleaning ease, and modularity permits extending the apparatus capability practically without limits, even at a later time with respect to original installation of the apparatus, and possibly application of the oven even to already existing apparatuses. On the other hand, the control system of the warp winding tension ensures proper operation avoiding any possibility of errors not contemplated in the design stage, and further enables supplying the warp to the re-winding beam under differentiated tensions, thus obtaining for example a warp formed by yarns having different winding tensions which are particularly useful for obtaining special effects or fabrics with inserts made of different materials. Moreover the envisaged provision of the intermediate cylinders superimposed to the application cylinders of the sizing substance avoids any inconveniences deriving from rubbing friction of the yarn during application of the sizing substance.

[0071] Naturally the details of construction and the embodiments may be widely varied with respect to what has been disclosed and illustrated, without thereby departing from the scope of the present invention, such as defined in the appended claims.

Claims

1. Apparatus for sizing warp yarns (1), comprising a warp unwinding station (2) from a supply beam (3), an application assembly (13) of a sizing liquor onto the warp yarns consisting of application cylinders (5) and guiding rollers (4, 12), a drier station including a horizontal drying oven (6), and a winding station (8) of the warps onto an outlet beam (9), **characterized in that** said warp yarns (1) are advanced through said drying oven (6) along a straight path without any bearing or contacting means between the last application cylinder (5) of the application assembly (13) and the exit (14) of the drying oven (6), and **in that** said drying oven (6) is equipped with a combined heating system including infrared ray radiator sources (X) and hot air blower sources (Y) operated simultaneously and in a combined fashion.

2. Apparatus according to claim 1, **characterized in that** said infrared ray radiator sources (6) are arranged in juxtaposed formations of radiating unit, wherein each radiating unit of each formation is facing towards a corresponding radiating unit of another formation.

3. Apparatus according to claim 1 or claim 2, **characterized in that** parabolic reflector members (27) are operatively associated to said infrared ray radiator sources (X) of the drying oven (6).

4. Apparatus according to claim 2, **characterized in that** the distance between said juxtaposed radiator formations with respect to the warp yarns (1) is adjustable.

5. Apparatus according to claim 4, **characterized in that** said juxtaposed radiator formations are carried by respective movable supports (40, 41) tiltable between a fully closed position and a full open position of the drying oven (6).

6. Apparatus according to claim 5, **characterized in that** said tiltable supports (40, 41) further carry said hot air blower sources (Y).

7. Apparatus according to claim 1, **characterized in that** an intermediate lease bar station (33) is provided at the exit of said drying oven (31) and **in that** a second drying oven (32) is arranged downstream of said intermediate lease bar station (33).

8. Apparatus according to claim 1, **characterized in that** a load cell balance control system of the warp yarn tension is associated to at least one of said guiding roller (15) of the application assembly (13).

9. Apparatus according to claim 1, **characterized in that** it comprises a plurality of winding stations (2) and related supply beams (3) to each of which a respective guiding roller (15) with load cell balance control system of warp yarn tension is associated.

10. Apparatus according to claim 1, **characterized in that** said application cylinders (5) of the application assembly (13) are partially dipped and rotated within respective distributor tanks (11) of the sizing substance, and **in that** driving means are provided to operate a relative displacement between said application cylinders (5) and said guiding rollers (4) to separate the warp yarns (1) and said application cylinders (5) relative to each other.

11. Apparatus according to claim 10, **characterized in that** scraper members (16) are associated to said application cylinders (5).

12. Apparatus according to claim 1, **characterized in that** a respective intermediate cylinder (34) is associated to each application cylinder (5) of the application assembly (13) and is vertically superimposed to said application cylinder (5) so as to transfer the sizing substance therefrom to the warp yarns (1).

13. Apparatus according to claim 12, **characterized in that** said intermediate cylinder (34) is driven in rotation independently of the related application cylinder (5) and at a peripheral speed corresponding to the advancement speed of the wrap yarns (1).

14. Apparatus according to claim 1, **characterized in that** the combined action of said infrared ray radiator sources (X) and said hot air blower sources (Y) is variable within a range substantially comprised between 20 and 85%.

15. Apparatus according to claim 1, **characterized in that** a respective idle or motor-driver presser cylinder (45) is associated to each application cylinder (5) of the application assembly (13), to press the warp yarns (1) towards said application cylinder (5).

16. Apparatus according to claim 15, **characterized in that** said presser cylinders (45) and said application cylinders (5) are mutually movable towards and away from each other.

17. Apparatus according to claim 15, **characterized in that** an intermediate cylinder (34) is provided between each application cylinder (5) and the respective presser cylinder (45).

18. Apparatus according to claim 1, **characterized in that** a humidification station including idle or motor-driven juxtaposed squeezing rollers (43) is provided between said unwinding station (2) of the warp yarns and said application assembly (13) of the sizing substance, to transfer water to said warp yarns (1).

19. Apparatus according to claim 1, **characterized in that** a pair of idle or motor-driven juxtaposed squeezing rollers (43) is further provided in close proximity to the exit of said application assembly (13).

20. Apparatus according to claim 1, **characterized in that** the hot air drying flow provided by said blower sources (Y) within said oven (6) is directed obliquely relative to said straight path of the warp yarns (1) and with a flow direction which is opposite to the travel direction of the warp yarns.

Patentansprüche

1. Vorrichtung zum Schlichten von Kettgarnen (1), enthaltend eine Kettgarnabwickelstation (2) aus einem Zuführbalken (3), einer Zuführungseinheit (13) aus einer Schlichteflotte auf den Kettgarnen, bestehend aus Zuführungszylindern (5) und Führungsrollen (4, 12), einer Trockenstation, die einen hori-

zontalen Trockenofen (6) und eine Kettgamaufwikkelstation (8) auf einem Auslaßbalken (9) enthält, **dadurch gekennzeichnet, daß** die Kettgarne (1) durch den Trockenofen (6) entlang eines geraden Weges ohne irgendwelche Trage- oder Kontaktmittel zwischen dem letzten Zuführungszylinder (5) der Zuführungseinheit (13) und dem Ausgang (14) des Trockenofens (6) gefördert werden, und daß der Trockenofen (6) mit einem kombinierten Heizsystem, das Infrarotstrahlerquellen (X) und Heißluftgebläsequellen (Y) umfaßt, die gleichzeitig und in einer kombinierten Weise betrieben werden.

2. Vorrichtung gemäß Anspruch 1, **dadurch gekennzeichnet, daß** die Infrarotstrahlerquellen (6) in nebeneinander liegenden Strahlereinheitenzusammensetzungen angeordnet werden, bei denen jede Strahlereinheit von jeder Zusammensetzung zu einer entsprechenden Strahlereinheit einer anderen Zusammensetzung gegenüberliegt.

3. Vorrichtung gemäß Anspruch 1 oder Anspruch 2, **dadurch gekennzeichnet, daß** Parabokeflektorteile (27) wirksam an die Infrarotstrahlerquellen (X) des Trockenofens (6) gekoppelt sind.

4. Vorrichtung gemäß Anspruch 2, **dadurch gekennzeichnet, daß** die Entfernung zwischen den nebeneinander liegenden Strahlerzusammensetzungen in Bezug auf die Kettgarne (1) regulierbar ist.

5. Vorrichtung gemäß Anspruch 4, **dadurch gekennzeichnet, daß** die nebeneinander liegenden Strahlerzusammensetzungen durch entsprechende, bewegliche, zwischen einer vollständig geschlossenen Stellung und einer vollständig offenen Stellung des Trockenofens (6) schwenkbaren Stützen (40, 41) getragen werden.

6. Vorrichtung gemäß Anspruch 5, **dadurch gekennzeichnet, daß** die schwenkbaren Stützen (40, 41) ferner die Heißluftgebläsequellen (Y) tragen.

7. Vorrichtung gemäß Anspruch 1, **dadurch gekennzeichnet, daß** eine dazwischenliegende Kreuzschienenstation (33) an dem Ausgang des Trockenofens (31) angebracht wird und daß ein zweiter Trockenofen (32) stromabwärts von der Kreuzschienenstation (33) angebracht ist.

8. Vorrichtung gemäß Anspruch 1, **dadurch gekennzeichnet, daß** ein Lastenausgleichsmeßkontrollsystem der Kettgarnspannung an mindestens eine der Führungsrollen (15) der Zuführungseinheit (13) angeschlossen ist.

9. Vorrichtung gemäß Anspruch 1, **dadurch gekennzeichnet, daß** sie eine Vielzahl von Wickelstationen (2) und verbundenen Zuführbalken (3) enthält, wobei zu jedem von ihnen eine entsprechende Führungsrolle (15) mit dem Lastenausgleichsmeßkontrollsystem der Kettgarnspannung verbunden ist.

10. Vorrichtung gemäß Anspruch 1, **dadurch gekennzeichnet, daß** die Zuführungszylinder (5) der Zuführungseinheit (13) teilweise in entsprechende Schlichteverteilerbehälter (11) eingetaucht und gedreht werden, und daß Antriebsmittel angebracht sind, um eine relative Verschiebung zwischen den Zuführungszylindern (5) und den Führungswalzen (4) durchzuführen, um die Kettgarne (1) und die Zuführungszylinder (5) relativ voneinander zu trennen.

11. Vorrichtung gemäß Anspruch 10, **dadurch gekennzeichnet, daß** Abstreichelemente (16) mit den Zuführungszylindern (5) verbunden sind.

12. Vorrichtung gemäß Anspruch 1, **dadurch gekennzeichnet, daß** ein entsprechender Mittel-Zylinder (34) mit jedem Zuführungszylinder (5) der Zuführungseinheit (13) verbunden und senkrecht zu den Zuführungszylindern (5) darübergelegt wird, um die Schlichte daraus zu den Kettgarnen (1) zu transferieren.

13. Vorrichtung gemäß Anspruch 12, **dadurch gekennzeichnet, daß** der Mittel-Zylinder (34) in eine von den verbundenen Zuführungszylindern (5) unabhängige Drehung und mit einer peripheren Geschwindigkeit, entsprechend zu der Vorwärtsbewegungsgeschwindigkeit der Kettgarne (1), versetzt wird.

14. Vorrichtung gemäß Anspruch 1, **dadurch gekennzeichnet, daß** die kombinierte Wirkung der Infrarotstrahlerquellen (X) und der Heißluftgebläsequellen (Y) variabel im Bereich im wesentlichen zwischen 20 und 85 % liegt.

15. Vorrichtung gemäß Anspruch 1, **dadurch gekennzeichnet, daß** ein entsprechender stromloser oder motor-betriebener Preßzylinder (45) mit jedem Zuführungszylinder (5) der Zuführungseinheit (13) verbunden ist, um die Kettgarne (1) gegen die Zuführungszylinder (5) zu drücken.

16. Vorrichtung gemäß Anspruch 15, **dadurch gekennzeichnet, daß** die Preßzylinder (45) und die Zuführungszylinder (5) gegeneinander aufeinander zu und voneinander weg beweglich sind.

17. Vorrichtung gemäß Anspruch 15, **dadurch gekennzeichnet, daß** ein Mittel-Zylinder (34) zwischen jedem Zuführungszylinder (5) und dem entsprechendem Preßzylinder (45) angebracht ist.

18. Vorrichtung gemäß Anspruch 1, **dadurch gekennzeichnet, daß** eine Befeuchtungsstation, die stromlose oder motor-betriebene nebeneinander liegende Preßrollen (43) umfasst, zwischen der Kettgarnabwickelstation (2) und der Schlichtezuführungseinheit (13) angebracht wird, um Wasser zu den Kettgarnen (1) zu bringen.

19. Vorrichtung gemäß Anspruch 1, **dadurch gekennzeichnet, daß** ein Paar stromlose oder motor-betriebene nebeneinander liegende Preßrollen (43) ferner in unmittelbarer Nähe des Ausgangs der Zuführungseinheit (13) angebracht werden.

20. Vorrichtung gemäß Anspruch 1, **dadurch gekennzeichnet, daß** der durch die Gebläsequellen (Y) in dem Ofen (6) erzeugte Heißlufttrockenstrom schräg relativ zu dem geraden Weg der Kettgarne (1) und mit einer Strömungsrichtung, die entgegengesetzt zu der Bewegungsrichtung der Kettgarne (1) ist, gelenkt wird.

Revendications

1. Appareil d'encollage de fils de chaîne (1), comprenant un poste (2) de déroulement de chaîne d'une ensouple (3) d'alimentation, un ensemble d'application (13) d'une liqueur d'encollage sur les fils de chaîne, constitués de cylindres applicateurs (5) et de rouleaux de guidage (4, 12), un poste sécheur comprenant un four horizontal de séchage (6) et un poste d'enroulement (8) des chaînes sur une ensouple de sortie (9), **caractérisé en ce que** les fils de chaîne (1) avancent dans le four de séchage (6) suivant un trajet rectiligne sans aucun dispositif d'appui ou de contact entre le dernier cylindre applicateur (5) de l'ensemble d'application (13) et la sortie (14) du four de séchage (6), et **en ce que** le four de séchage (6) est équipé d'un système combiné de chauffage comprenant des sources à radiateur infrarouge (X) et des sources à ventilateur d'air chaud (Y) fonctionnant simultanément et de manière combinée.

2. Appareil selon la revendication 1, **caractérisé en ce que** les sources à radiateur infrarouge (6) sont disposées par formation juxtaposée d'une unité rayonnante, dans lequel chaque unité rayonnante de chaque formation est tournée vers une unité rayonnante correspondante d'une autre formation.

3. Appareil selon la revendication 1 ou 2, **caractérisé en ce que** des organes réflecteurs paraboliques (27) sont associés pendant le fonctionnement aux sources à radiateur infrarouge (X) du four de séchage (6).

4. Appareil selon la revendication 2, **caractérisé en ce que** la distance comprise entre les formations juxtaposées de radiateur par rapport aux fils de chaîne (1) est réglable.

5. Appareil selon la revendication 4, **caractérisé en ce que** les formations juxtaposées de radiateur sont portées par des supports mobiles respectifs (40, 41) qui peuvent pivoter entre une position totalement fermée et une position totalement ouverte du four de séchage (6).

6. Appareil selon la revendication 5, **caractérisé en ce que** les supports pivotants (40, 41) portent en outre les sources à ventilateur d'air chaud (Y).

7. Appareil selon la revendication 1, **caractérisé en ce qu'**un poste intermédiaire à barre d'enverjure (33) est placé à la sortie du four de séchage (31), et **en ce qu'**un second four de séchage (32) est disposé en aval du poste intermédiaire à barre d'enverjure (33).

8. Appareil selon la revendication 1, **caractérisé en ce qu'**un système de commande d'équilibre à jauge dynamométrique de tension de fils de chaîne est associé à l'un au moins des rouleaux de guidage (15) de l'ensemble d'application (13).

9. Appareil selon la revendication 1, **caractérisé en ce qu'**il comprend plusieurs postes d'enroulement (2) des ensouples associées d'alimentation (3) à chacune desquelles est associé un rouleau respectif de guidage (15) avec un système de commande d'équilibrage dynamométrique de tension des fils de chaîne.

10. Appareil selon la revendication 1, **caractérisé en ce que** les cylindres applicateurs (5) de l'ensemble d'application (13) sont plongés partiellement et entraînés en rotation dans les cuves distributrices respectives (11) de la substance d'encollage, et **en ce qu'**un dispositif d'entraînement est destiné à assurer un déplacement relatif des cylindres applicateurs (5) et des rouleaux de guidage (4) afin que les fils de chaîne (1) et les cylindres applicateurs (5) soient séparés mutuellement.

11. Appareil selon la revendication 10, **caractérisé en ce que** des organes de raclage (16) sont associés aux cylindres applicateurs (5).

12. Appareil selon la revendication 1, **caractérisé en ce qu'**un cylindre intermédiaire respectif (34) est associé à chaque cylindre applicateur (5) de l'ensemble d'application (13) et est superposé verticalement au cylindre applicateur (5) afin que la substance d'encollage soit transférée de celui-ci aux fils

de chaîne (1).

13. Appareil selon la revendication 12, **caractérisé en ce que** le cylindre intermédiaire (34) est entraîné en rotation indépendamment du cylindre applicateur associé (5) et a une vitesse périphérique correspondant à la vitesse d'avance des fils de chaîne (1).

14. Appareil selon la revendication 1, **caractérisé en ce que** l'action combinée des sources à radiateur infrarouge (X) et des sources à ventilateur d'air chaud (Y) est variable dans une plage pratiquement comprise entre 20 et 85 %.

15. Appareil selon la revendication 1, **caractérisé en ce qu'**un cylindre fou ou presseur entraîné par un moteur (45) respectif est associé à chaque cylindre applicateur (5) de l'ensemble d'application (13) afin que les fils de chaîne (1) soient poussés vers le cylindre applicateur (5).

16. Appareil selon la revendication 15, **caractérisé en ce que** les cylindres presseurs (45) et les cylindres applicateurs (5) sont mobiles afin qu'ils s'écartent et se rapprochent mutuellement.

17. Appareil selon la revendication 15, **caractérisé en ce qu'**un cylindre intermédiaire (34) est placé entre chaque cylindre applicateur (5) et le cylindre presseur respectif (45).

18. Appareil selon la revendication 1, **caractérisé en ce qu'**un poste d'humidification comprenant des rouleaux juxtaposés de serrage (43) fous ou entraînés par un moteur est disposé entre le poste de déroulement (2) des fils de chaîne et l'ensemble d'application (13) de la substance d'encollage afin que de l'eau soit transférée aux fils de chaîne (1).

19. Appareil selon la revendication 1, **caractérisé en ce qu'**une paire de rouleaux juxtaposés de serrage (43) fous ou entraînés par des moteurs est en outre placée très près de la sortie de l'ensemble d'application (13).

20. Appareil selon la revendication 1, **caractérisé en ce que** le courant de séchage d'air chaud formé par les sources à ventilateur (Y) dans le four (6) est dirigé obliquement par rapport au trajet rectiligne des fils de chaîne (1) et avec une direction d'écoulement opposée à la direction de déplacement des fils de chaîne.

FIG. 1

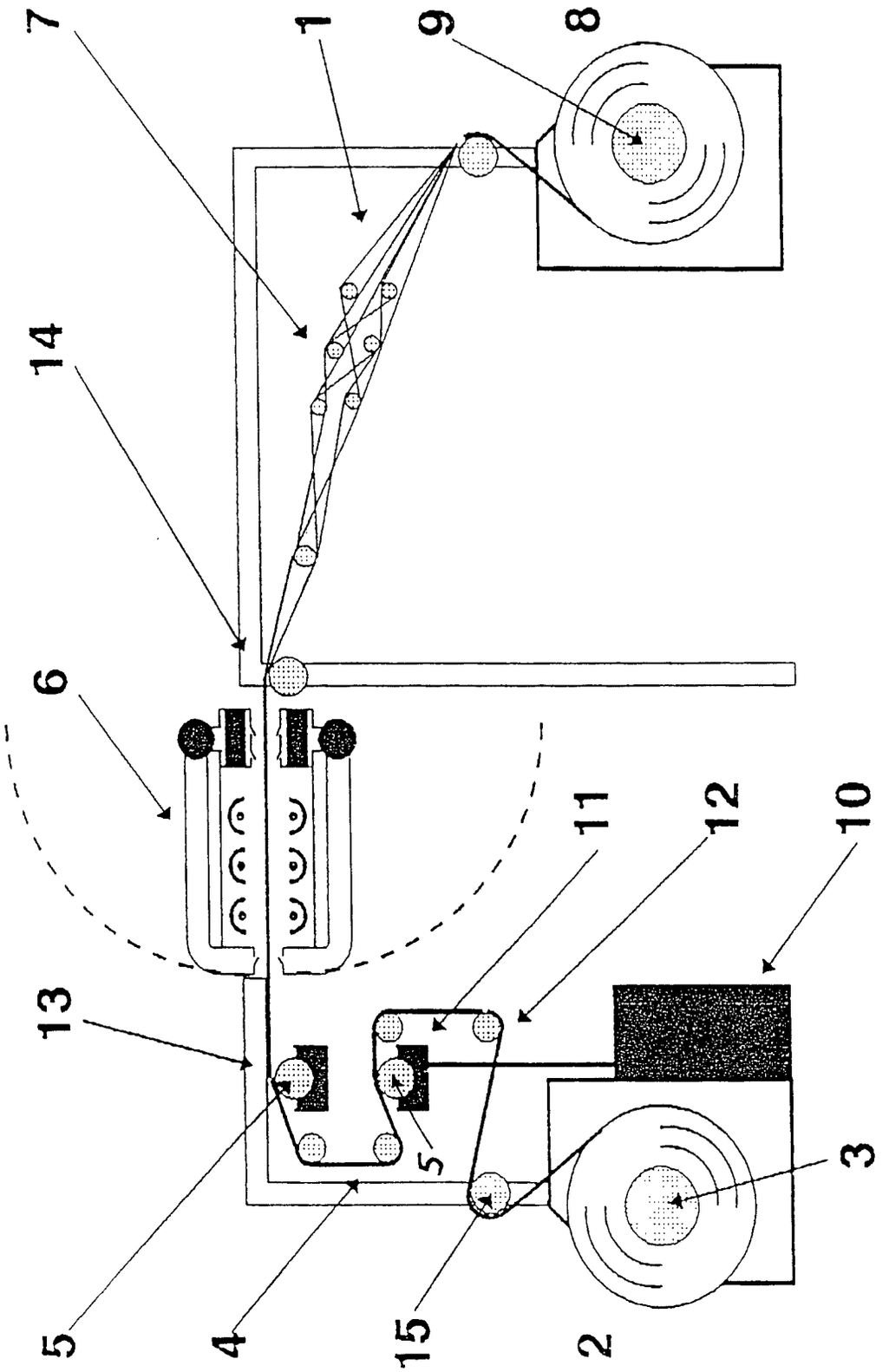


FIG. 2

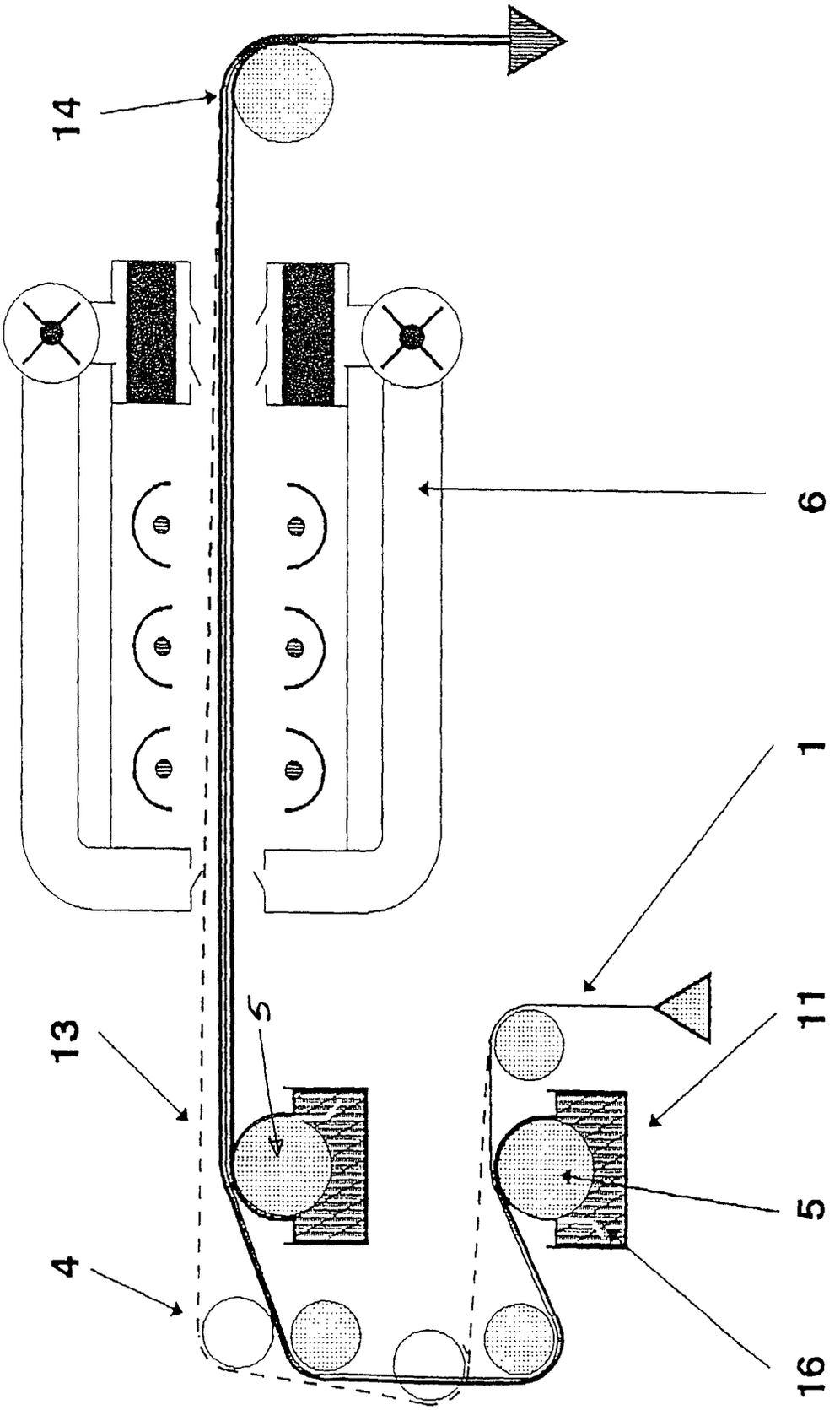


FIG. 3

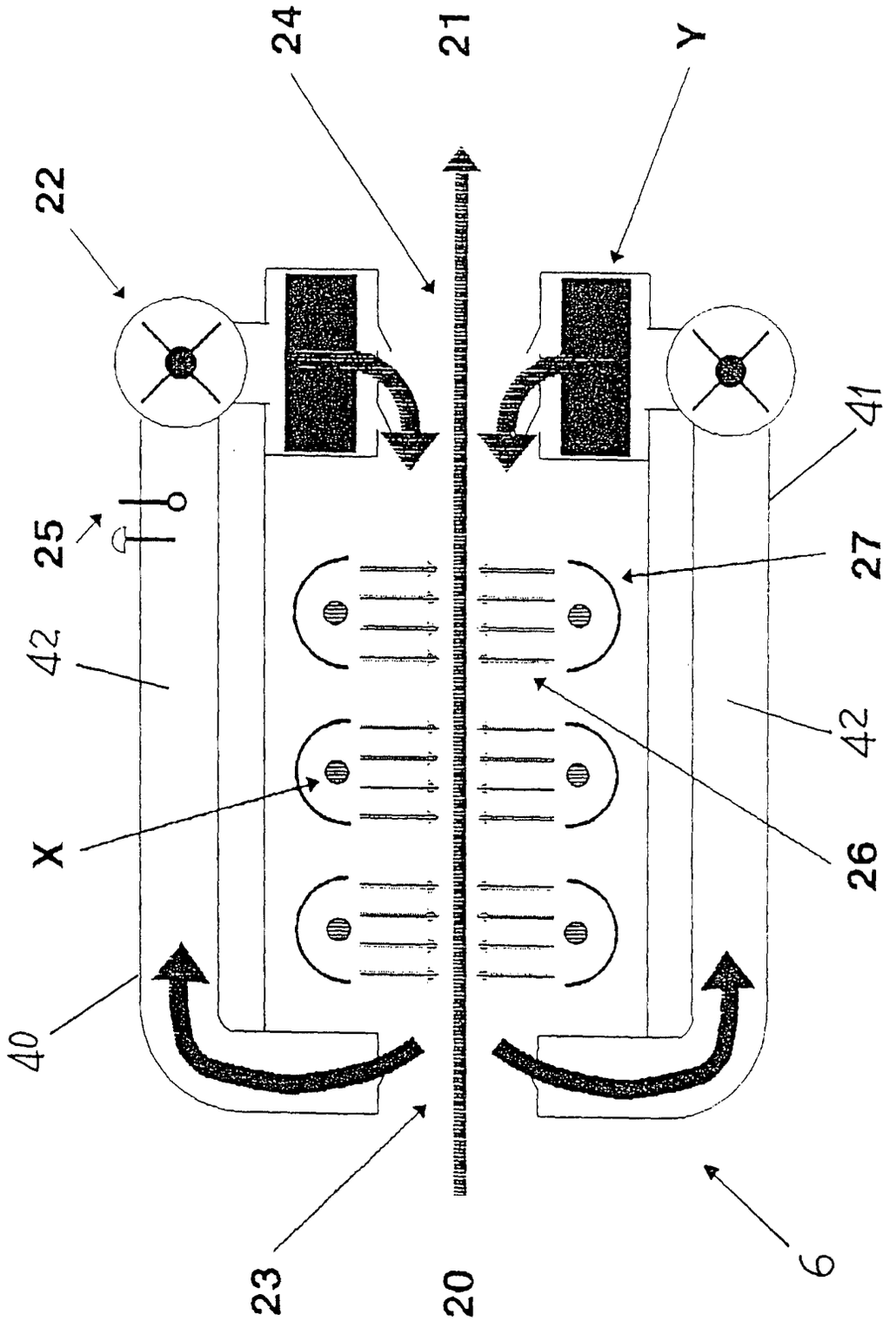


FIG. 5

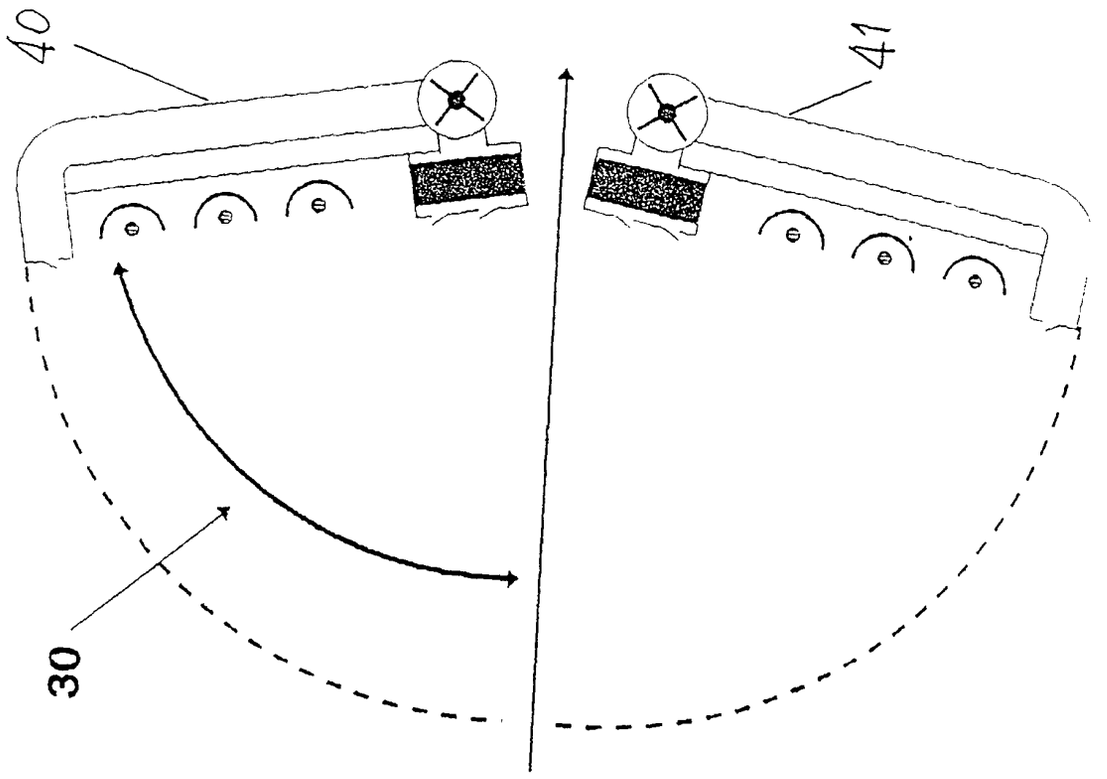


FIG. 4

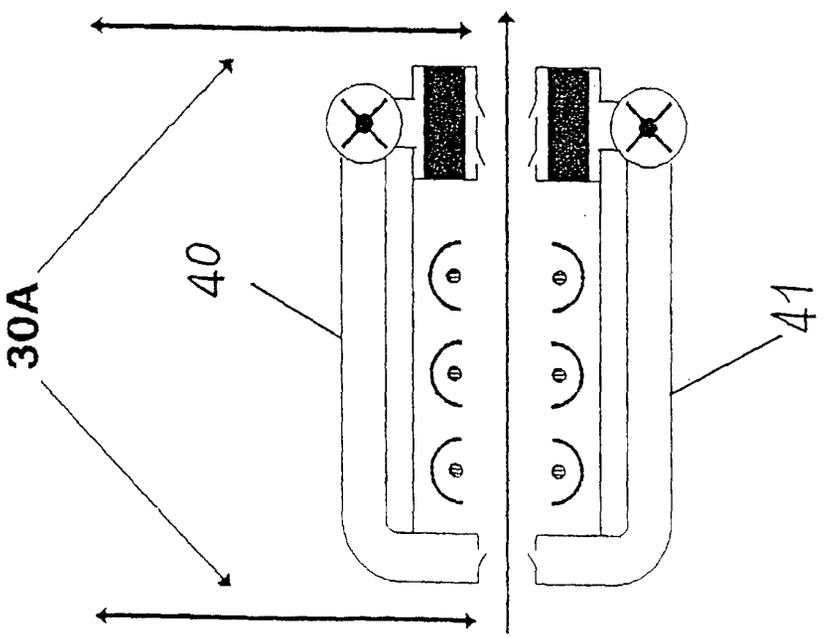


FIG. 6

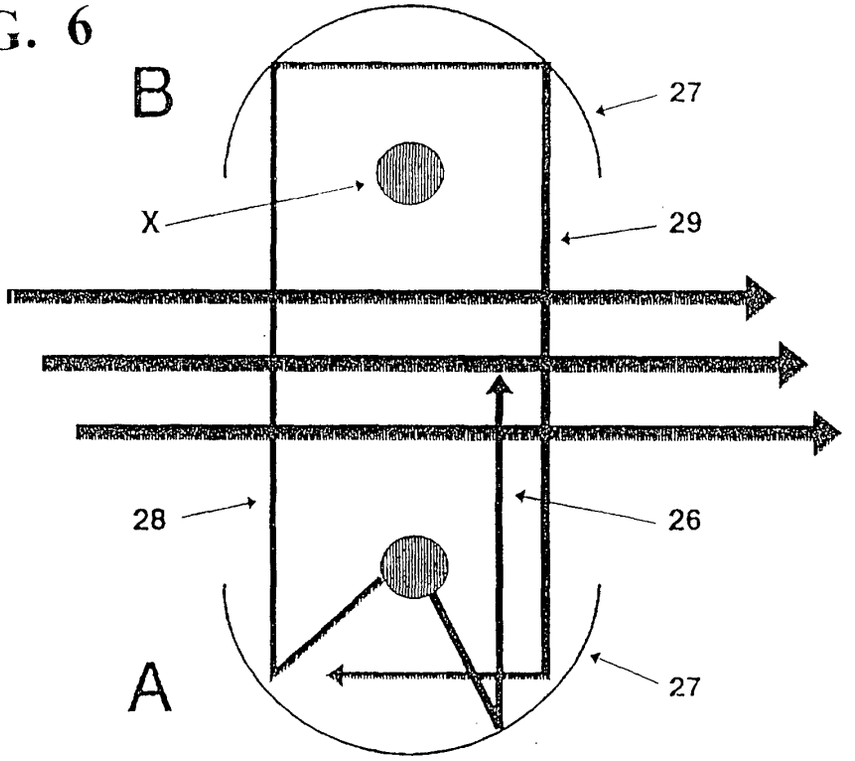


FIG. 8

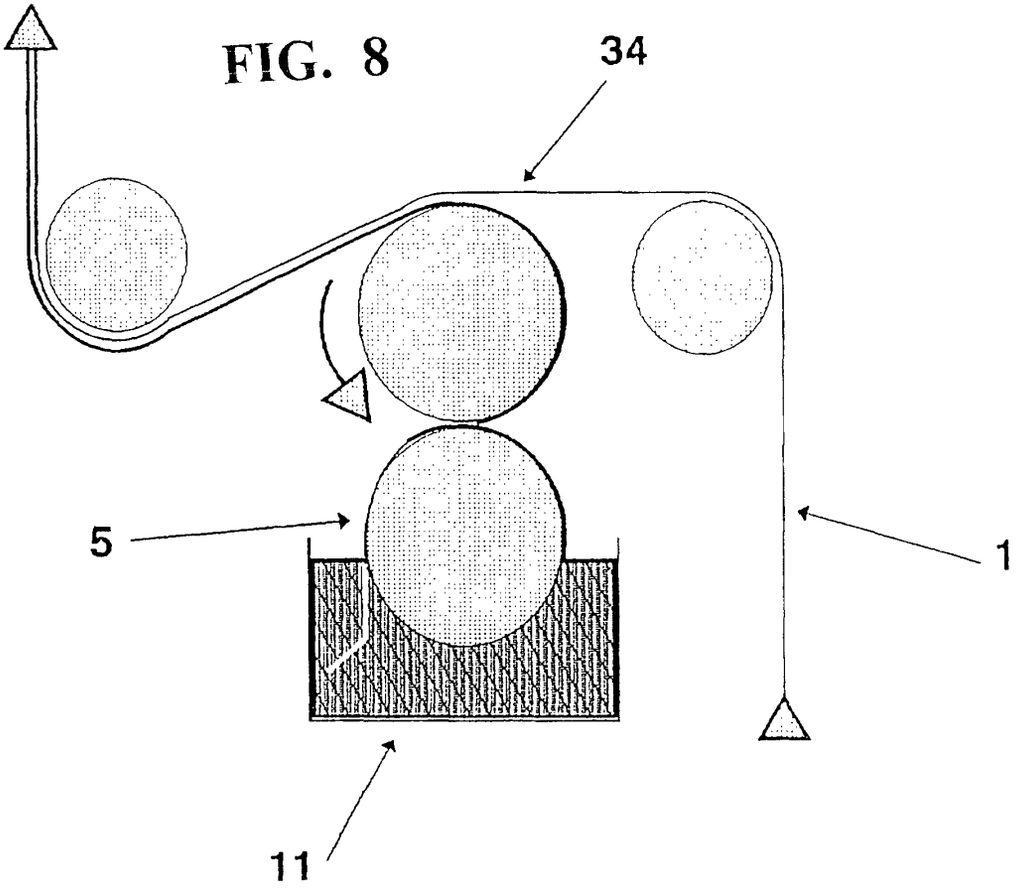


FIG. 7

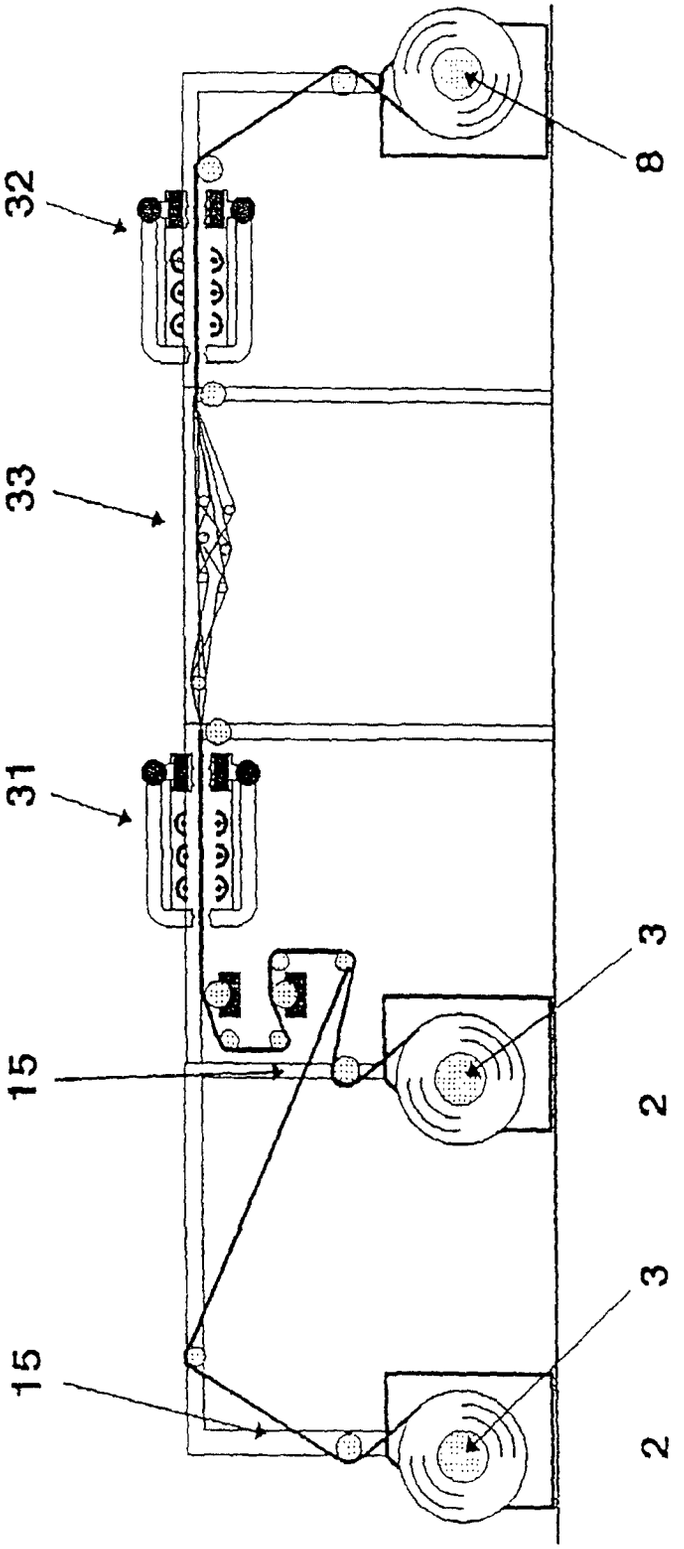


FIG. 9

