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(54) Machine for providing suitability for weaving a thin yarn and/or warp made by animal and/or vegetal and/or artificial and/or synthetic fibers at a pure state or in a mixture of the same

(57) The machine (1) for providing suitability for weaving a thin yarn and/or warp (3) of fibers comprises impregnating cylinders (11, 12) of the yarn and/or warp (3) with a reinforcing product (13) able to provide to the yarn and/or warp (3) mechanical properties which make it suitable for weaving, squeezing cylinders (12, 14) of the yarn and/or warp (3) impregnated for eliminating the quantity in excess of the reinforcing product (13), drying and/or sizing means of the reinforcing product (13) applied to the yarn and/or warp (3), and regulating means of the position of the axis of at least one impregnating cylinders (11, 12).

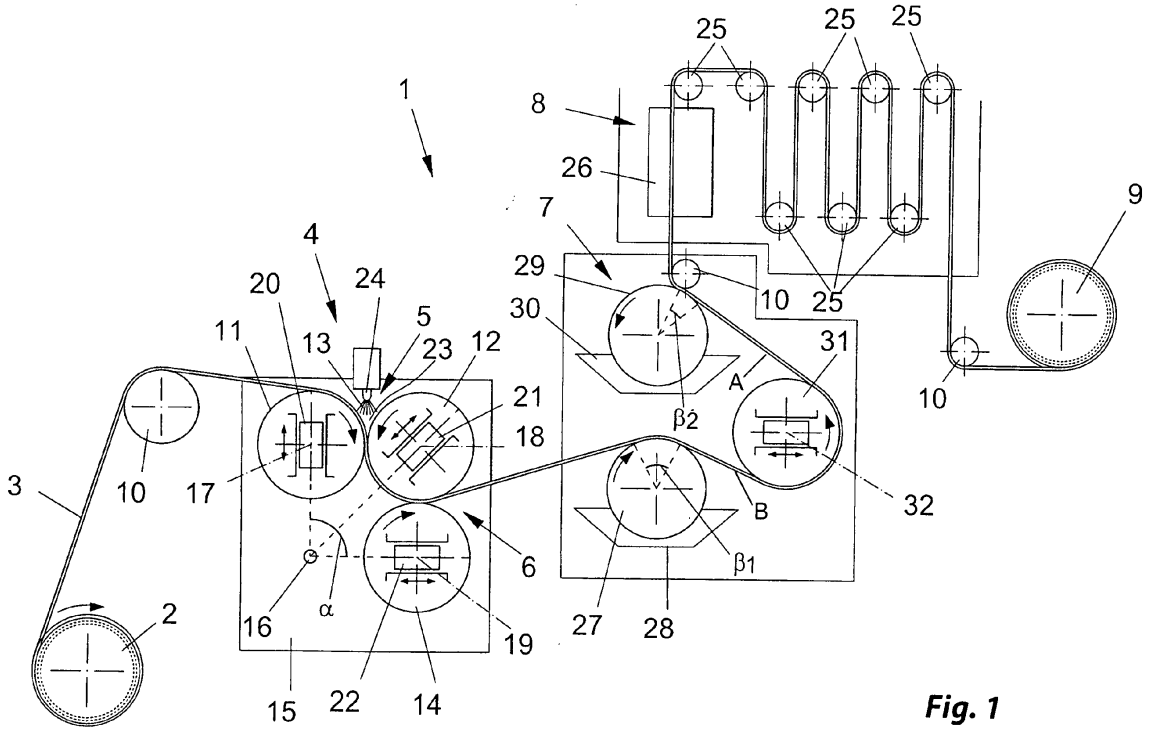

Fig. 1

EP 2 554 733 A1

Description

[0001] The present invention refers to a machine for providing suitability for weaving a thin yarn and/or warp made by animal and/or vegetal and/or artificial and/or synthetic fibers at a pure state or in a mixture of the same.

[0002] With the term thin yarn or warp it is meant the one having a title not less than 60 Nm. With the term animal fibers are meant fibers obtained from insects (for example silkworms) or from fleece (for example wool, alpaca, vicunia, cashmere, etc.)

[0003] With the term vegetal fibers are meant all the fibers obtained from plants, shrubs, fluorescence, roots, leaves (for example ramie fiber, bamboo, cotton, linen, etc.)

[0004] It is known the difficult to weave thin natural fibers, which just because of their high thinness tend to break during the weaving.

[0005] For this reason, nowadays a weaving technique is available, providing first of all the doubling and the twisting of the yarn in natural fibers, with a hydro-soluble reinforcing wire, then the weaving of the doubled and twisted yarn, and finally the dissolution of the hydro-soluble reinforcing wire at a high temperature, in a slightly acid aqueous solution.

[0006] The spinning plant is provided with a first machine, which confers a spinning twist S or Z to the wick of natural fibers, for creating a natural yarn, a second doubling machine of the natural yarn with the hydro-soluble wire and a third machine, in which the doubled natural yarn with the hydro-soluble wire is subjected to a new twist in the same or opposed direction to that of the preceding twist in the spinning of the yarn.

[0007] The spinning technique used to confer to the thin yarn a suitability for spinning necessarily introduces an additional twist to the thin yarn, which can modify its physical final characteristics with respect to those actually required.

[0008] Such a spinning technique laments first of all the drawback of an excessive complexity of the spinning where various operations must be realized, among which as already said the first twist of the wick, the doubling of the natural yarn and the second twist of the doubled natural yarn.

[0009] A further disadvantageous aspect provides the fact that the natural yarn has protected areas for the presence of the hydro-soluble reinforcing yarn and areas that are more or less directly exposed to parts of the weaving frame, for example to the comb dividing the warp wires, and they can be subjected to wearing caused by friction or even a breaking during the weaving.

[0010] The technical aim of the present invention is therefore to realize a machine which confers suitability to the weaving of a thin yarn and/or warp of natural, animal and/or vegetal and/or artificial and/or synthetic fibers which are pure or in a mixture of the same, by eliminating the technical drawbacks lamented in the known technique. Within this technical scope, an aim of the invention is that to realize a machine which provides suitability for weaving a thin yarn and/or warp of natural, animal and/or vegetal and/or artificial and/or synthetic fibers at the pure state or in a mixture of the same, without changing its initial physical characteristics.

[0011] Another aim of the invention is that to realize a machine which provides suitability for weaving a a thin yarn and/or warp of natural, animal and/or vegetal and/or artificial and/or synthetic fibers at the pure state or in a mixture of the same, by reinforcing in a uniform way the yarn and/or the warp.

[0012] Another aim of the invention is that to realize a machine which provides suitability for weaving a thin yarn and/or warp of natural, animal and/or vegetal and/or artificial and/or synthetic fibers at the pure state or in a mixture of the same, by adapting itself in a versatile way to yarns and/or warps and reinforcing products of a different type, in order to always guarantee optimal performances.

[0013] Not ultimate aim of the invention is that to realize a machine which provides suitability for weaving a thin yarn and/or warp of natural, animal and/or vegetal and/or artificial and/or synthetic fibers at the pure state or in a mixture of the same, which also results to be adaptable in a versatile way, according to the result to be obtained. The technical scope, and also these and other aims, according to the present invention, are reached by realizing a machine for providing suitability for weaving a thin yarn and/or warp of natural, animal and/or vegetal and/or artificial and/or synthetic fibers at the pure state or in a mixture of the same, characterized in that it comprises impregnating cylinders of the yarn and/or warp with a reinforcing product able to provide the yarn and/or warp the mechanical properties which make it suitable for weaving, twisting cylinders of the impregnated yarn and/or warp for eliminating the excess quantity of said reinforcing product, drying means of the twisted yarn and/or warp and regulating means of the position of the axis, at least of the impregnating cylinders.

[0014] The machine makes a process for the yarn and/or warp in such a way to reinforce it, to increase its cohesion among the fibers, by rendering its external surface smoother and by avoiding tangles and by lubricating it in order to reduce its friction during the weaving.

[0015] The regulation of the position at least of the impregnating cylinders can advantageously be both individual and collective.

[0016] Preferably at least the impregnating cylinders are supported with a possible oscillation around a common oscillating center and they are individually supported with a possible translation in the radial direction, with respect to the oscillating center. Preferably also the rotation speed of at least each impregnating cylinder can be individually regulated.

[0017] This flexibility in the regulation of the machine permits to adapt in an easy way the process performed by the machine itself, in function of the application and of the result to be obtained.

[0018] Further characteristics and advantages of the invention will be clearer from the following description of a preferred but not exclusive embodiment of the machine for providing suitability for weaving a thin yarn and/or warp of natural, animal and/or vegetal and/or artificial and/or synthetic fibers at the pure state or in a mixture of the same, schematically illustrated in figure 1.

[0019] With reference to figure 1, the machine 1 comprises in sequence a beam 2 for discharging the warp 3, a sizing station 4 comprising an impregnating section 5 and a following twisting section 6 of the warp 3, a waxing station 7 of the warp 3, a drying and/or reticulation station 8 of the reinforcing product applied to the warp 3 in the sizing station 4, and a beam 9 for charging the warp 3 that is ready for weaving.

[0020] The machine can obviously in a conceptive way process a yarn instead of a warp, and in such a case it will be necessary to adapt the size of the organs.

[0021] The machine 1 provides return rolls 10 among adjacent stations, between the discharging beam 2 and the sizing station 4, between the drying station 8 and the charging beam 9.

[0022] In the sizing station 4, the impregnating section 5 comprises cylinders 11, 12 for impregnating the warp with a reinforcing product 13, able to provide to the warp the mechanical properties which make it suitable for weaving, and the squeezing section 6 comprises squeezing cylinders 12, 14 of the impregnated warp 3, for eliminating the excess quantity of the reinforcing product 13.

[0023] In particular, as it will be clear also in the following, the cylinder 12 is shared with the impregnating section 5 and the squeezing section 6 and it acts both as impregnating cylinder in cooperation with the impregnating cylinder 11, and as squeezing cylinder in cooperation with the twisting cylinder 14.

[0024] The sizing station 4 therefore comprises at the end in the preferred solution three single cylinders 11, 12, 14 of which the first cylinder 11 for impregnating the warp 3, the second cylinder 12 both for impregnating and squeezing the warp 3 and the third cylinder 14 for squeezing the warp 3.

[0025] With this configuration of the sizing station 4, a very short warp length can be obtained between the impregnating section 5 and the squeezing section 6, with a consequent optimization of the working times and of limitation of the scraps, and this is an aspect to consider in case the warp 3 is made of an expensive material.

[0026] The sizing station 4 also has regulating means of the position of the axis at least of the impregnating cylinders 11, 12 and preferably also of the squeezing cylinders 12, 14.

[0027] The regulating means comprise a support frame 15, which is common to at least the impregnating cylinders 11, 12 and in particular also for the squeezing cylinders 12, 14. The frame 15 has an oscillating axis 16, parallel and distanced from the axis 17 of the impregnating cylinder 11, from the axis 18 of the impregnating and squeezing cylinder 12 and from the axis 19 of the squeezing cylinder 14, such that the impregnating cylinders 11, 12 and the squeezing cylinders 12, 14 by means of the oscillation of the frame 15 around the axis 16 can be subjected to a flushing movement along an arched trajectory.

[0028] The regulating means also comprise at least for each impregnating cylinder 11, 12 and in particular also for each squeezing cylinder 12, 14 an independent device 20, 21, 22 for its translation in the radial direction with respect to the oscillating axis 16 of the frame 15 (the translation direction of the cylinders 11, 12, 14 is indicated in the figure by a corresponding bi-directional arrow.

[0029] The impregnating cylinders 11, 12 are opposed in such a way to delimit a recess 23 for the accumulation of the reinforcing product 13, which is supplied from suitable spraying nozzles 24.

[0030] The configuration of the recess 23 can be suitably modified by actuating the regulating means in such a way to regulate the level of impregnation also according to the application.

[0031] Preferably the angle α between the ray linking the axis 17 of the first cylinder 11 and the oscillation axis 16 of the frame 15 and the ray linking the axis 19 of the third cylinder 14 to the oscillation axis 16 of the frame 15 is equal to 90° and the axis 18 of the second cylinder 12 is positioned on the bisecting line of the angle α.

[0032] Preferably the frame 15 supports the second cylinder by impregnating and squeezing 12 substantially in tangential contact with the first cylinder 11 and the third cylinder for the squeezing 14 substantially with a tangential contact with the second cylinder 12.

[0033] Such a configuration is naturally modifiable by actuating in a selective translation of at least one of the cylinders 11, 12, 14.

[0034] Preferably each impregnating cylinder 11, 12 and in particular also each squeezing cylinder 12, 14 has an independent engine for a rotary actuation.

[0035] The independent regulation of the rotary speed of the cylinders 11, 12, 14 permits to optimize both the stresses on the warp 3 and the level of impregnation and squeeze. The drying and/or reticulating station 8 comprises drying and/or reticulating means of the reinforcing product applied to the warp 3, for example a plurality of cylinders 25, coated in a non sticking material, and heated by an internal circulation of a flow of steam, which guarantee a rapid and uniform drying, eventually, as shown, in cooperation with a room 26 in which hot air at constant temperature has been circulated. Advantageously it is provided to control the rotation of the heating cylinders 25 with peripheral speeds which can be singularly regulated in order to subject the warp 3 to stresses permitting to keep parallel their wires.

[0036] The reinforcing product used in the sizing station 4 can be of various kind, for example PVA (polyvynil acid).

[0037] Reinforcing products 3 particularly suitable are acethyl-glucosammine chitine (C8H13N05)n and/or chitosan, which are materials of animal origin, derived from

the processing of crustaceans.

[0038] Such materials are widely available at a low cost, they are non toxic, bio-compatible and completely biodegradable.

[0039] The chitosan is soluble in diluted acid solutions, for example in acetic acid and is adapted to form a web by means of ultraviolet rays.

[0040] The polymer of the chitosan also in low concentrations provides the warp 3 with the required washing and adhesion properties and it can be eliminated by hot washing, producing return flows easily biodegradable, with a consistent advantage in terms of ambiance impact with respect to the use of PVA.

[0041] Furthermore other possible traces of residual chitosan on the final fabric do not create a barrier to the paint, which on the other hand is facilitated, whereas its anti-bacterial action enriches the product.

[0042] The heating and/or sizing means can therefore also comprise infrared devices, ultraviolet devices, radio-frequence devices, which make easier the sizing of the web component of the reinforcing product 13.

[0043] Upstream of the charging beam 9 in a known way suitable inserting shafts (not shown) are obviously provided, able to separate the warp 3 in a lot of sections to avoid that the warp wires 3 attach one with the other, and a reducing comb, able to maintain mutually parallel the warp wires 3.

[0044] Another important aspect of the invention is that it is provided in the waxing station 7, a system with double tangential waxing, comprising at least a first waxing cylinder partially soaked in a first waxing bath 28, at least a second waxing cylinder 29, partially soaked in a second waxing bath 30, which can be equal or different from the first waxing bath 28 and at least one return cylinder 31, having a parallel axis with respect to the cylinders 27 and 29 between which it is interposed.

[0045] The waxing cylinders 27, 29 are rotary actuated in order to catch the lubricant solution from the waxing baths 28, 30 and to deposit it by contact on the warp wires 2.

[0046] The return cylinder 31 is advantageously supported in an orthogonal way and in translation with respect its own axis 32, for regulating the tangential waxing angles $\beta 1$, $\beta 2$ which generate on the first waxing cylinder 27 and on the second waxing cylinder 29.

[0047] The regulation of the position of the return cylinder 31 permits in particular to modify the friction pressure on the warp 3 and therefore the waxing level on the two sides A and B of the warp 3, by changing it at ease.

[0048] The machine 1 processes the warp 3 in the following way.

[0049] The warp 3 is unrolled from the discharging beam 2 and in sequence it passes through the opposed cylinders 11, 12 for the impregnation with the reinforcing product 13, between the opposed cylinders 12, 14 for squeezing the reinforcing product 13 in excess on the cylinder 27 for waxing one of its side, on the cylinder 29 for waxing its other side, through the drying and/or sizing station and finally it is rolled on the charging beam 9.

[0050] After the weaving of the warp 3, it is necessary to dissolve the reinforcing product 13. In the case where the reinforcing product 13 is PVA-based, a starting bath with water is prepared, to which acetic acid is added, to bring pH between 4 and 5. The bath relationship (the relationship between the weight of the fabric and the quantity of the solution) is fixed at 1:5. The bath is heated up to a temperature comprised between 40°C and 70°C. The fabric is treated for a treatment time of 45 minutes and then it is rinsed for 15 minutes with water, at a temperature comprised between 45°C and 55°C. Then the following steps are performed: the drying, the dyeing of patch of fabric and the chemical, physical, mechanical or combined finishing in function of the desired effect.

[0051] The machine for providing suitability for weaving a thin yarn and/or warp of animal and/or vegetal and/or artificial and/or synthetic natural fibers in pure state or in a mixture of the same so conceived is subjected to various changes and variants, all within the scope of the inventive concept; furthermore all the details can be substituted by technically equivalent elements.

[0052] In practice, the used materials, and also their size, can be of any kind, according to the needs and the state of the art.

Claims

1. A machine (1) for providing suitability for weaving a thin yarn and/or warp (3) of natural, animal and/or vegetal and/or artificial and/or synthetic fibers in a pure state or in a mixture of the same, **characterized in that** it comprises impregnating cylinders (11, 12) of the yarn and/or the warp (3), with a reinforcing product (13) able to provide to the yarn and/or warp (3) mechanical properties which make it suitable for weaving, squeezing cylinders (12, 14) of the yarn and/or warp (3) which is impregnated for eliminating the quantity in excess of said reinforcing product (13), drying and/or sizing means of the reinforcing product (13), applied to the yarn and/or warp (3), and regulating means of the position of the axis of at least the impregnating cylinders (11, 12).

2. The machine (1) for providing suitability for weaving to a thin yarn and/or a warp of fibers according to previous claim, **characterized in that** said regulating means comprise at least a support frame (15), which is common at least for impregnating cylinders (11, 12), said frame (15) having an oscillating axis (16) parallel and distanced from the axis (17, 18) at least of the impregnating cylinders (11, 12) such that at least the impregnating cylinders (11, 12) by effect of the oscillating frame (15) can be subjected to flushing movement along an arched trajectory.

3. The machine (1) for providing suitability for weaving

a thin yarn and/or a warp of fibers, according to the preceding claim, **characterized in that** said regulating means comprise for each impregnating cylinder (11, 12) an independent device (20, 21) for its translation in a radial direction with respect to the oscillating axis (16) of the frame (15).

4. The machine (1) for providing suitability for weaving a thin yarn and/or warp of fibers according to any of preceding claims, **characterized in that** it has a first and at least a second impregnating cylinder (11, 12) which are opposed in such a way to delimit a recess (23) for the accumulation of the reinforcing product (13), supplied by suitable spraying nozzles (24).

5. The machine (1) for providing suitability for weaving a thin yarn and/or warp of fibers according to the preceding claim, **characterized in that** said second cylinder (12) cooperates with a third cylinder (14) , opposed for squeezing said yarn and/or warp (3).

6. The machine (1) for providing suitability for weaving a thin yarn and/or warp of fibers according to the preceding claim, **characterized in that** said second cylinder (12) is substantially in tangential contact with both the first (11) and the third (14) cylinder.

7. The machine (1) for providing suitability for weaving a thin yarn and/or warp of fibers according to any of claims 5 and 6, **characterized in that** also said third cylinder (14) has a device (22) for its translation in a radial direction with respect to the oscillating axis of the frame (15).

8. The machine (1) for providing suitability for weaving a thin yarn and/or warp of fibers according to any of claims 5 to 7, **characterized in that** the angle (α) between the ray of conjunction of the axis (17) of the first cylinder (11) and the oscillating axis (16) of the frame (15) and the ray of conjunction of the axis (19) of the third cylinder (14) to the oscillating axis (16) of the frame (15) is equal to 90° and the axis (18) of the second cylinder (12) is positioned on the bisecting line of said angle (α).

9. The machine (1) for providing suitability for weaving a thin yarn and/or warp of fibers according to any claim 5 to 8, **characterized in that** each of said first, second and third cylinder (11, 12, 14) has an independent engine for its rotary actuation.

10. The machine (1) for providing suitability for weaving a thin yarn and/or warp of fibers according to any of preceding claims, **characterized in that** it comprises a system with double tangential waxing, comprising at least a first waxing cylinder (27), partially soaked in a first waxing bath (28), at least a second waxing cylinder (29), partially soaked in a second waxing bath (30) and at least a return cylinder (31), interposed between the first and second waxing cylinders (27, 29), said return cylinder (31) being translatable in an orthogonal direction with respect to its axis (32) for the regulation of the tangential waxing angles (β1, β2) which generate on the first and second waxing cylinders (27, 29).

11. The machine (1) for providing suitability for weaving a thin yarn and/or warp of fibers according to any preceding claim, **characterized in that** said heating and/or sizing means comprise at least one infrared device and/or at least an ultraviolet ray device and/or a radiofrequency device.

12. The machine (1) for providing suitability for weaving a thin yarn and/or warp of fibers according to any preceding claim, **characterized in that** said reinforcing product (13) comprises chitin and/or chitosan.

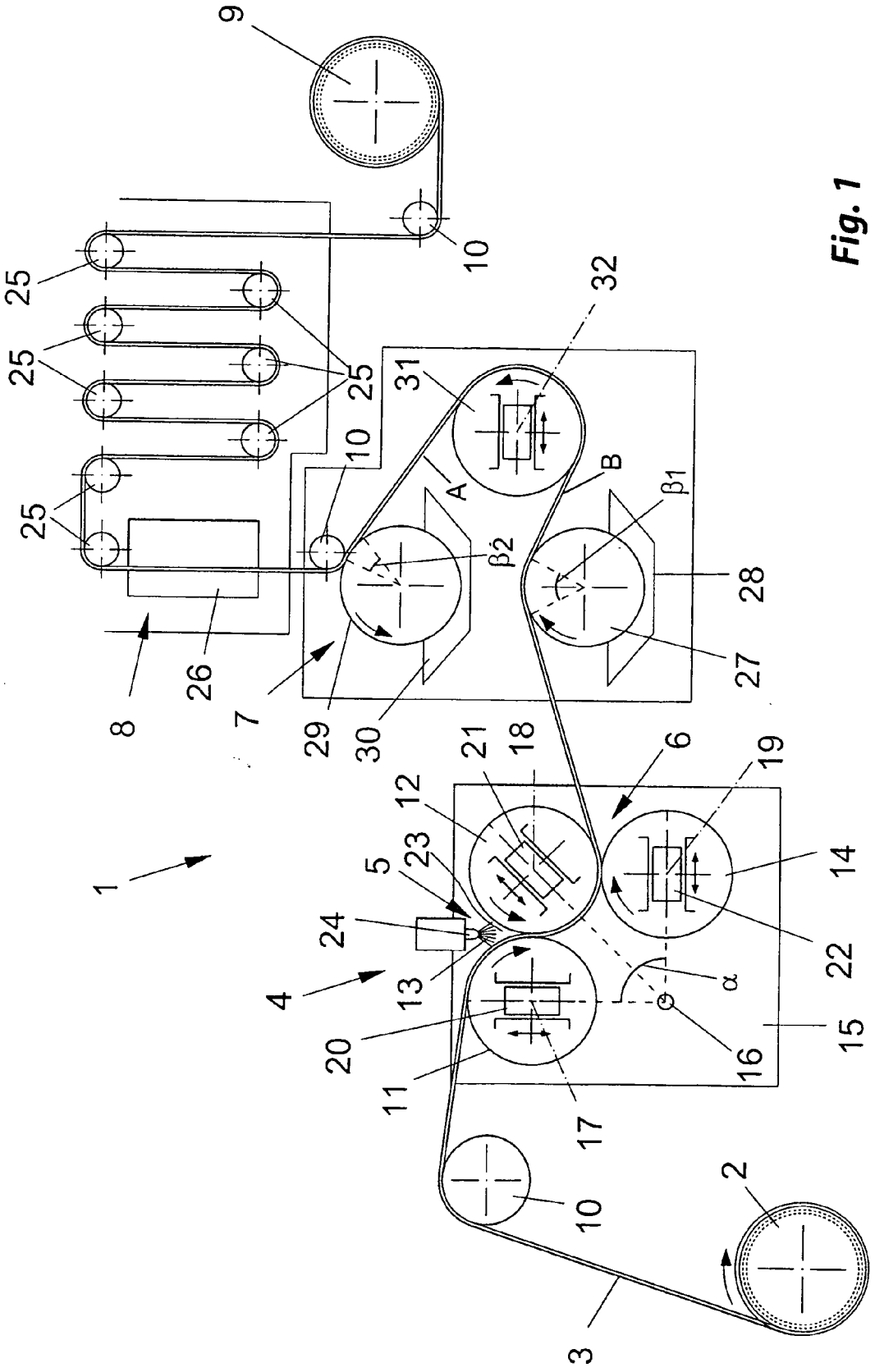
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Fig. 1

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EUROPEAN SEARCH REPORT

Application Number
EP 11 42 5217

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	17 February 2012	Bichi, Marco

CATEGORY OF CITED DOCUMENTS

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EUROPEAN SEARCH REPORT

Application Number
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