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(71) Applicant and
(72) Inventor: **FABRIS, Gianluca** [IT/IT]; Via del Geniere, 4, I-33170 PORDENONE (IT).

(74) Agents: **PETRAZ, Davide, Luigi** et al.; GLP SRL, Piazzale Cavedalis, 6/2, I-33100 UDINE (IT).

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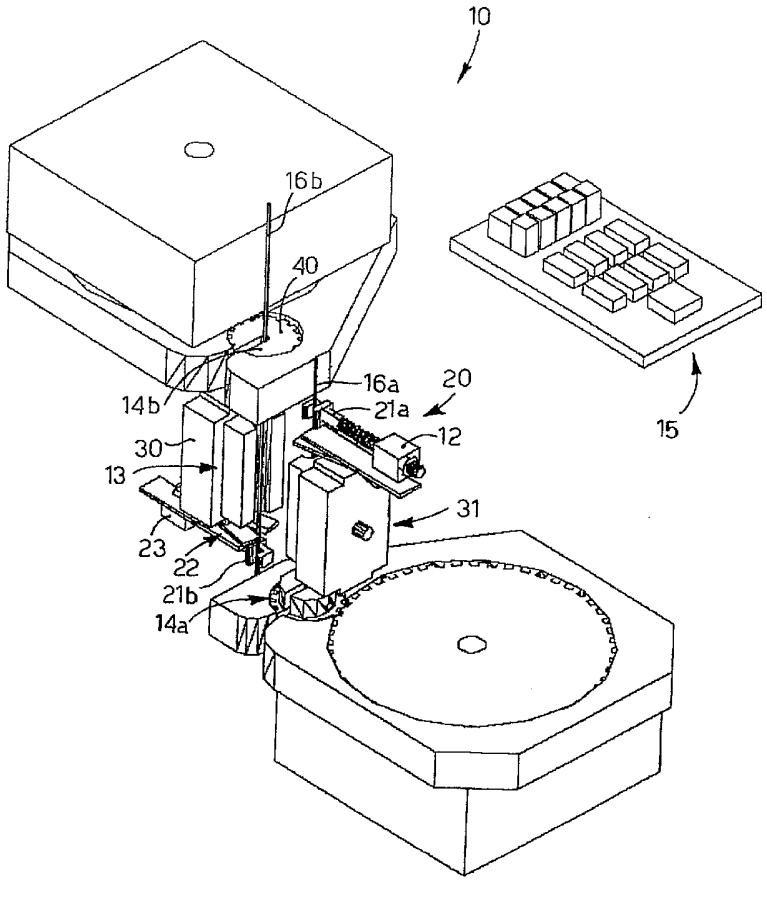

(57) Abstract: Device (10) and method for joining textile yarns (16a, 16b). The device (10) includes a joining chamber (13) inside which the ends of the two yarns (16a, 16b) to be joined are introduced. The joining chamber (13) can be closed and defines, in its closed position, a joining compartment which is hit by a fluid. The device (10) comprises, for each of the yarns (16a, 16b), first clamping members (21a, 21b) to clamp the ends of the yarn (16a, 16b), second gripping members (14a, 14b) rotating substantially around the axis of the relative yarn (16a, 16b) in order to perform the de-twisting and re-twisting of the yarn (16a, 16b), and cutting members (22). The joining chamber (13), the clamping members (21a, 21b) clamping the ends of the yarns (16a, 16b), and the de-twisting and twisting rotating members (14a, 14b) are driven by respective and independent drive elements governed by the commands of an electronic control unit (15).

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"DEVICE AND METHOD FOR JOINING TEXTILE YARNS"

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FIELD OF THE INVENTION

The present invention concerns a device, and the relative method, for joining textile yarns, formed by a set of fibers twisted together.

In the device according to the invention the various devices for clamping the ends, cutting the tails, stretching, the de-twisting and re-twisting of the parts of the yarn to be joined, and also the elements of the pneumatic joining chamber, are individually driven by their own, distinct actuation means, able to be commanded independently and individually regulated, by an electronic unit, according to pre-set and pre-settable parameters and values.

The electronic unit, according to the characteristics of the yarn, the type of use of the yarn, the environmental conditions and the signals arriving from appropriate sensors, is suitable to send command signals to each of the actuation means so as to perform the sequence of various operations to join the yarns.

BACKGROUND OF THE INVENTION

When joining textile yarns, it is possible to distinguish strictly technological steps, wherein operations are performed directly on the fibers that make up the yarn, and auxiliary steps that serve mainly to correctly position the yarns so that the various operations are correct.

A first type of joining device consists of pneumatic devices which uses the action of a fluid, normally air, on the fibers which make up the ends of the yarns to be joined. Normally, in the initial steps such devices act on two yarns so as to obtain, by means of scissors or

pincers, two ends of a defined length and conformation, called tails. Subsequently, the two ends of the yarns to be joined are hit by a jet of compressed air so as to eliminate the residual twists, trying to make the fibers parallel and to reduce the quantity of the fibers affected by the join.

The techniques used to achieve this action are various, such as jets inclined with respect to the yarn, rotary jets, pulsating jets and other. When the preparation step is finished, the tails are inserted in a proper joining chamber, wherein a second jet of air penetrates the fibers giving mechanical resistance and, thanks to the geometric conformation of the chamber, closes the fibers together so as to give the join a good aesthetic appearance. With such devices it is extremely difficult to obtain joins which have both good mechanical characteristics and also good aesthetic characteristics; in fact, these characteristics depend on the geometric configuration of the pneumatic chamber and therefore it is often necessary to use a chamber which covers a sufficient range of yarns and guarantees a good compromise between the two requirements.

Mainly mechanical devices are also known, which directly use the mechanical action on the fibers that make up the ends of the yarns to be joined. By means of a first mechanical action, called de-twisting, on the two ends of the yarns to be joined, a central zone is obtained wherein the fibers are practically parallel and hence without mechanical resistance. At this point the excess parts are torn off or cut, so as to obtain two tails of the desired length with parallel fibers. The tails are superimposed and then, by means of a second mechanical action, or twist, opposite the first, the

structure of the original yarn is reconstructed. With such devices joins are obtained with optimum aesthetic characteristics, but the absence of the penetration step leads to a lack of mechanical resistance, especially to abrasion.

Another type of devices are the mixed pneumatic-mechanical devices, such as for example as described in DE-A1-3131986 and in EP-A-0 227 370, wherein first of all the mechanical action is used to de-twist the yarns and obtain segments of yarn with parallel fibers, then the fibers are penetrated by means of a jet of fluid, and finally a mechanical action is again performed in order to re-twist the fibers and regenerate the structure of the yarn. Such devices have not had a wide diffusion, despite the excellent results from both the point of view of aesthetics and of mechanical resistance, due to the great mechanical complexity in the industrial production. In fact, to have the possibility of adapting to the different types of yarns, it would be necessary to be able to vary the number of mechanical de-twistings and/or re-twistings and the step and/or duration of blowing in the pneumatic chamber. Given the configuration of the components and the relative drive systems, this known device requires an at least partial replacement of the components and/or their mechanical re-adaptation every time the type and/or number of yarns is changed, which makes the device uneconomical.

The purpose of the invention is therefore to achieve a device and a method for joining textile yarns which allow to obtain the desired technological results for a wide range of yarns, both in type and count, without increasing the complexity of the device and obviating

the limits of known devices as mentioned above.

The Applicant has devised and embodied this invention to overcome the shortcomings of the state of the art and to obtain other advantages.

SUMMARY OF THE INVENTION

The present invention is set forth and characterized in the main claims, while the dependent claims describe other innovative characteristics of the invention and variants to the main inventive idea.

A joining device for textile yarns according to the invention is of the mixed, pneumatic-mechanical type and comprises, as its main components, a pneumatic chamber, or joining chamber, means to grip the ends of the yarns, de-twisting means and re-twisting means cooperating with said gripping means, stretching means and cutting means.

According to a characteristic feature of the invention, the components of the device indicated above are mechanically independent with respect to each other, at least from the functional and operational point of view, and can be activated independently, both in entity of movement and in step, by means of relative and distinct actuation means, on the commands of an electronic control unit, according to the program, the work parameters and the signals arriving from the sensors used.

This independence of action allows to obtain a substantially universal joining device for yarns without needing to modify it mechanically or to apply particular accessories.

In fact, by setting the electronic unit, it is possible to modify on each occasion the actuation parameters of the individual components, adapting them specifically to the requirements of the operating cycle

in progress, so as to be able to regulate the operations of the device according to the characteristics of the yarn to be joined.

In this way we obtain an extremely versatile and flexible device, economical and able to operate substantially on any type of yarn without entailing the problems of modifications and reconfiguration.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other characteristics of the present invention will become apparent from the following description of a preferential form of embodiment, given as a non-restrictive example with reference to the attached drawings wherein:

- fig. 1 is a schematic overall view of the joining device for textile yarns according to the invention;
- fig. 2 shows an enlarged detail of the device in fig. 1;
- figs. 3a, 3b and 3c show an operating sequence of the joining cycle performed by the device in fig. 1;
- figs. 4a, 4b and 4c show three embodiments of the rotary pincers which perform the de-twisting and re-twisting of the yarn;
- fig. 5 shows an enlarged detail of fig. 4b;
- fig. 6 is a block diagram of the method for joining textile yarns according to the invention.

DETAILED DESCRIPTION OF A PREFERENTIAL EMBODIMENT

With reference to the attached drawings, the reference number 10 denotes generally a joining device for textile yarns, indicated by 16a and 16b in figs. 3a, 3b, 3c, according to a preferential embodiment of the present invention.

The device 10 comprises a pneumatic joining chamber 13, able to be selectively opened and closed, inside which the ends of the yarns 16a, 16b to be joined are introduced. The pneumatic joining chamber 13 cooperates with respective gripping means 20 to grip the ends of the yarns 16a, 16b, suitable to perform at least some of the following functions:

- twist-stopper;
- clamping the relative yarn 16a or 16b so that, during the de-twisting step before the join is made, and the re-twisting step after the join is made, the twists are concentrated in the segment of yarn involved in the join;
- stretching;
- reducing the quantity of fibers that will form the join;
- tearing the tails;
- super extension of the parts of the yarn in excess, so as to obtain two segments of yarn with a length and quantity of controlled fibers, called tails.

The gripping means 20 are located immediately outside the pneumatic chamber 13 and comprise a first and a second pincer arranged on opposite sides of the chamber 13, one (21a) above and the other (21b) below said joining chamber 13. Each of the pincers 21a, 21b acts on one of the two ends of the yarns 16a, 16b to be joined and particularly on the relative segments of free yarn.

Each pincer 21a, 21b is mounted on a relative screw 11 made to rotate by an electric motor 12. Taking the screw 11 in correspondence with a first position of rear end-of-travel, indicated by A in fig. 3, the pincers 21a, 21b open and are ready to receive the relative yarn 16a, 16b.

Commanding a suitable number of revolutions to the relative electric motor 12, the pincers 21a, 21b close, clamping inside them the relative yarn 16a, 16b. In this step, (position B, fig. 3b) the pincers 21a, 21b perform a stretching action on the relative yarn 16a, 16b of a quantity proportional to the number of revolutions imparted to the relative motors 12. The entity of the stretching can be equal in the two yarns 16a, 16b, or also reciprocally different.

By activating the motors 12 again until the relative screw 11 is taken to a second, front end-of-travel position (position C, fig. 3c), the function of tearing the tails is performed.

The device 10 also comprises cutting means consisting of scissors 22 to cut the yarn, which can be sued, for particularly resistant yarns or yarns with an elastic core, so as to guarantee the interruption of the yarn.

The scissors 22 are activated by feeding a pneumatic piston by means of a control electro-valve 23.

The pneumatic joining chamber 13 is a device in which the function of penetration of the fibers is performed. The chamber 13 is formed by two separate movable shells, respectively 30 and 31 (figs. 2, 3a), at least one of which, in this case the shell 30, is equipped with a series of holes 32, advantageously with an axis perpendicular to the axis of the yarns 16a, 16b, from which pressurized fluid is made to exit, on the command of an electro-valve.

The two shells 30, 31 are moved apart/closer from/to each other, advantageously by means of a pneumatic piston. They can thus assume a first, reciprocally distanced position (position D, fig. 3a) wherein the joining chamber 13 is open and the yarns 16a, 16b can be

introduced inside it, the ends of the yarns being retained by the respective pincers 21a, 21b.

Once the yarns 16a, 16b are located inside the joining chamber 13, the two shells 30, 31 are taken into contact with each other (position E, fig. 3b) and the joining chamber 13 is closed in sealed manner.

After having suitably prepared the two ends of the yarns 16a, 16b, the joining chamber 13 is closed and then, for a pre-set time, a command electro-valve is activated so that the fluid is introduced into the chamber 13 through the hole 32, and hits the fibers. The shape of the joining chamber 13 is advantageously such that the jet of fluid creates a vortex such that the fibers are bound together, creating a joining point between the two ends.

The duration of the delivery of the jet of air to the yarns is defined by an electronic control unit 15 according to the characteristics of the yarn, the type of use of the yarn and the environmental conditions. The electronic control unit 15 is also suitable to drive the motors 12 of the pincers 21a, 21b according to the steps of the cycle and the entity of stretching to be imparted to the relative yarns 16a, 16b, the pneumatic piston that opens and closes the shells 30, 31 of the joining chamber 13, and, as we shall see hereafter, the members that drive the rotary pincers 14a, 14b of the scissors 22 and the members involved in the joining cycle.

The joining chamber 13, in one and/or the other of the shells 30, 31, can be equipped with devices to clamp the yarns, which are particularly useful in the case of elasticized yarns. In this case, one or more pins 33, commanded pneumatically, can be selectively driven, on the command of the electronic control unit 15, to clamp

the yarns 16a, 16b in the joining zone, preventing the elastic core of the yarn from retracting excessively and from escaping from the join.

The device 10, according to a first variant, can be equipped with auxiliary components, selectively driven, to vary the delivery, pressure and temperature of the fluid injected. The auxiliary components are piloted by the control unit 15 according to the characteristics of the yarn, the type of use of the yarn and the environmental conditions.

According to another variant, the device 10 is equipped with auxiliary components able to allow to inject into the joining chamber 13 a mixture of air and water, to a percentage modifiable by the control unit 15, according to the characteristics of the yarn, the type of use of the yarn and the environmental conditions.

The device 10 also comprises, as said above, a first 14a and a second 14b rotary pincers, suitable for the de-twisting and re-twisting of the respective yarns 16a, 16b.

The rotary pincers 14a, 14b allow to impart to the relative yarns 16a, 16b a controllable number of rotations around their own axis. They are located immediately outside the pneumatic joining chamber 13, on opposite sides thereof, and each of them cooperates with a relative yarn-clamping pincer 21a, 21b. Each rotary pincer 14a, 14b acts on one of the two ends of the yarns 16a, 16b to be joined, and particularly on the segment of integral yarn.

Figs. 4a, 4b, 4c show three embodiments of the rotary pincers 14a, 14b.

In fig. 4a, the rotary pincer 14a, 14b is of the type

with an eyelet 50 housing the relative yarn 16a, 16b and is made on a first gear 40 drawn by a second gear 140 solid with the shaft of an electric motor.

In fig. 4b too, the rotary pincer 14a, 14b has an eyelet 50 housing the relative yarn 16a, 16b and is mounted on a disk wherein magnets 41 are incorporated, whereas on the fixed outer part electric coils 42 are housed. By suitably feeding the coils 42 the controlled rotation of the pincer is commanded, according to commands imparted by the electronic control unit 15.

In the embodiment shown in 4c, the pincer 14a, 14b again has the eyelet 50 housing the relative yarn and is mounted on a small pneumatic turbine 43. The clockwise/anti-clockwise rotation of the rotary pincer 14a, 14b occurs by activating suitable jets of air, for example 44 for clockwise rotation and 45 for anti-clockwise rotation.

The angular position of each of the rotary pincers 14a, 14b is controlled by a sensor 46 (fig. 5) which provides a suitable electric signal when a clamping pin 47, associated with a movement coil 48, has been taken to a position such as to allow the introduction of the yarns 16a, 16b.

Once the rotary pincer 14a, 14b has been clamped in the desired position, the pincer is opened by feeding the coil 48 which attracts the pin 47.

The electric signal supplied by the sensor 46 allows the electronic control unit 15 to measure the number of revolutions performed by the pincer 14a, 14b.

The electronic control unit 15 advantageously consists of an electronic card with a microprocessor in which the functions of processing, piloting the electric motors, commanding the electro-valves and reading the various

sensors are integrated.

According to the memorized program of a series of parameters connected to the characteristics of the yarn, the join to be obtained and the environmental conditions, the electronic control unit 15 performs a sequence of operations on the yarn. This sequence can be modified according to the signals arriving from some sensors so as to adapt to the new working conditions.

We shall now describe a complete joining cycle performed by the device 10 as described heretofore, as shown in the block diagram in fig. 6.

First step – Introduction and clamping of the yarns: each yarn 16a, 16b is introduced inside the device 10 and clamped at the two ends by the corresponding end-clamping pincer 21a, 21b and the corresponding rotary pincer 14a, 14b.

At the end of this operation the four pincers, two fixed 21a, 21b and two rotary 14a, 14b, isolate the segments of yarn outside the device 10 from those inside it, on which the subsequent operations will act.

Second step – De-twisting of the yarns: the electronic control unit 15 commands the rotary pincers 14a, 14b to rotate. The number of revolutions and the direction of rotation are connected to the characteristics of the yarn and are such as to obtain the annulment of the twists in proximity with the end-clamping pincer 21a, 21b.

Third step – Closure of the joining chamber: the control unit 15 commands the pneumatic joining chamber 13 to close, by activating the appropriate electro-valve.

Fourth step – Stretching of the yarns: the control unit 15 commands the end-clamping pincers 21a, 21b to move by means of a controlled drive of the relative motors 12.

The entity of the linear movement of the pincers 21a, 21b is connected to the characteristics of the yarn: the greater the entity of the stretching, the smaller the quantity of fibers involved in the join.

Fifth step – Clamping of the central part of the yarns: the control unit 15 activates the electro-valve that commands the outlet of the central block, so as to prevent the possible elastic core of the yarn from retracting excessively in the subsequent tearing step.

Sixth step – Tearing: the control unit 15 commands the end-clamping pincers 21a, 21b to move, until the travel is complete. The two ends of the yarn to be eliminated are thus caused to tear by means of suction.

Seventh step – Scissor cut: to guarantee the discharge of the two segments of yarn to be eliminated, the control unit 15 activates the two scissors 22.

Eighth step – Joining blow: the control unit 15 commands the jet of fluid inside the joining chamber 13. The duration of the jet depends on the characteristics of the yarn and the parameters set. The direction of blowing is such that the fluid not only acts on the fibers of the yarn, making them penetrate each other, but also takes the pistons of the central block into the inactive position.

Ninth step – Re-twisting of the yarns: the control unit 15 commands the rotary pincers 14a, 14b to rotate in the opposite direction with respect to the direction of the second step: The number of revolutions depends on the characteristics of the yarn and the parameters set.

Tenth step – Cycle completed: the control unit 15 commands the shells 30, 31 of the pneumatic joining chamber 13 to open, then the rotary pincers 14a, 14b are released and finally the end-clamping pincers 21a, 21b

return to their position.

As an auxiliary step, the control unit 15, according to the parameters set, can activate a function to control the join.

This step can provide the activation of various control algorithms: a test every N cycles, random distribution, upon specific request of the operator.

According to another variant, a force sensor can be provided, located on at least one of the pincers 21a, 21b that clamp one end of the join, in order to measure the tension of the yarn. If the function to test resistance and stretching is active, the control unit 15 reads the value supplied by the force sensor and processes it to determine the breaking load of the join.

According to another variant, a movable pincer can be provided which clamps the other end of the join if the function to test resistance and stretching is active. The control unit 15, in this case, is therefore suitable to command the movement of the movable pincer so as to put the join in traction until it breaks.

In this variant form, when the join cycle is complete, a pincer equipped with the load cell and the end-clamping pincer are activated, and in this way the join remains clamped inside the two pincers.

The control unit 15 then commands the movable pincer to move, so as to put the join in traction, and at the same time memorizes the values supplied by the load cell. At the moment the join breaks, the value read by the load cell is practically zeroed.

The control unit 15 processes the data memorized and supplies the values of the breaking load and stretching of the join. Should these values not satisfy the required levels, the control unit 15 signals a

malfunction of the device 10. The operator can set the device 10 so that this event causes it to stop, to avoid producing joins not in conformity with the required standards. Or, if the values obtained, while not optimum, are considered sufficient to continue functioning, the condition is only signaled, so that a maintenance and/or cleaning operation can be programmed.

CLAIMS

1. Device for joining textile yarns (16a, 16b), including a joining chamber (13) inside which the ends of two yarns (16a, 16b) to be joined are able to be introduced, said joining chamber (13) being able to be closed and defining, in its closed position, a joining compartment able to be hit by a jet of fluid in order to obtain the join, said device comprising, for each of the yarns (16a, 16b), first clamping means (21a, 21b) to clamp the ends of the yarn (16a, 16b), second gripping means (14a, 14b) rotating substantially around the axis of the relative yarn (16a, 16b) in order to perform the de-twisting and re-twisting of the yarn (16a, 16b), and cutting means (22), characterized in that said joining chamber (13), said clamping means (21a, 21b) to clamp the ends of the yarns (16a, 16b) and said rotating gripping means (14a, 14b), de-twisting and twisting, are able to be driven by respective and independent drive means governed by the commands of an electronic control unit (15), wherein said electronic control unit (15) is able to regulate at least the starting moment, the flow rate and/or the duration of delivery of the jet of said fluid on the yarns according to at least one between the characteristics of the yarn, the type of use of the yarn and the environmental conditions.

2. Device as in claim 1, wherein said means to grip the ends of the yarn comprise pincer means (21a, 21b) commanded by respective motors (12), characterized in that said electronic control unit (15) is able to command the drive of said motors (12) in order to move said pincer means (21a, 21b) from a first position (A) wherein said pincer means open and are ready to receive the relative yarn (16a, 16b), a second position (B)

wherein the pincer means (21a, 21b) close, clamping inside them the relative yarn (16a, 16b), and a third position (C), wherein the function of tearing the tails is obtained.

3. Device as in claim 2, characterized in that in said second position (B) said pincer means (21a, 21b) are able to perform a stretching action on the relative yarn (16a, 16b) with an adjustable entity proportional to the number of revolutions imparted by said control unit (15) to the relative motors (12).

4. Device as in any claim hereinbefore, characterized in that said joining chamber (13) is formed by two movable shells (30, 31), at least one of which is equipped with holes (32) from which pressurized fluid is made to emerge, upon the command of an electro-valve.

5. Device as in claim 4, characterized in that said shells (30, 31) are able to be moved away from/towards each other, in order to assume a first reciprocally distanced position, wherein said joining chamber (13) is open and the ends of said yarns (16a, 16b), held by the respective pincer means (21a, 21b), are able to be introduced inside, and a second position of reciprocal contact, wherein the joining chamber (13) is closed in sealed manner for the introduction of said fluid inside, through said holes (32), so as to hit the fibers and achieve the join.

6. Device as in claim 5, characterized in that said joining chamber (13) is shaped so that the jet of fluid creates a vortex such that the fibers are bound together, creating a joining point between the two ends.

7. Device as in claim 4, characterized in that said joining chamber (13), in one and/or the other of said shells (30, 31) includes means (33) able to be

selectively activated in order to clamp the yarns (16a, 16b) inside said joining compartment, particularly in the case of elasticized yarns.

8. Device as in any claim hereinbefore, characterized in that said electronic control unit (15) is able to regulate the direction of rotation and the number of rotations of said rotary pincers (14a, 14b) which perform the de-twisting and re-twisting of the yarns (16a, 16b) according to the characteristics of the yarn, the type of use of the yarn and the environmental conditions.

9. Device as in any claim hereinbefore, characterized in that it comprises means, able to be driven by said electronic control unit (15), to selectively vary the flow rate, the pressure and the temperature of the fluid injected inside said joining chamber (13).

10. Device as in any claim hereinbefore, characterized in that it comprises means, able to be driven by said electronic control unit (15), to inject into said joining chamber (13) a mixture of air and water in an adjustable percentage according to the characteristics of the yarn, the type of use of the yarn and the environmental conditions.

11. Device as in claim 2, characterized in that said control unit (15) is able to determine the selective activation of said pincer means (21a, 21b) in order to regulate the starting moment when the stretching of the two segments of yarn (16a, 16b) is performed, according to the characteristics of the yarn, the type of use of the yarn and the environmental conditions.

12. Device as in claim 2, characterized in that said control unit (15) is able to determine the selective activation of said pincer means (21a, 21b) in order to

regulate the moment when the tearing of the two free ends of yarn is commanded according to the characteristics of the yarn, the type of use of the yarn and the environmental conditions.

13. Device as in any claim hereinbefore, characterized in that said control unit (15) is able to determine the selective activation of cutting means (22) in temporal correlation at least with the pincer means (21a, 21b) that grip the ends of the yarns and with the rotary pincer means (14a, 14b) according to the characteristics of the yarn, the type of use of the yarn and the environmental conditions.

14. Device as in claim 1, characterized in that said rotary pincer means (14a, 14b) are able to be driven by an electric motor (12) governed by the commands of said control unit (15).

15. Device as in claim 1, characterized in that said rotary pincer means (14a, 14b) are able to be driven by pneumatic turbine means (43) governed by the commands of said control unit (15).

16. Device as in claim 1, characterized in that said rotary pincer means (14a, 14b) are able to be driven by electric coil means (42) cooperating with magnets (41) and whose drive is governed by the commands of said control unit (15).

17. Device as in claim 1, characterized in that on at least one of said clamping means (21a, 21b) that grip the ends of the yarns (16a, 16b) there are sensor means present able to perform a test of resistance and stretching on the join just made.

18. Device as in claim 17, characterized in that said sensor means comprise at least a load cell.

19. Method for joining textile yarns (16a, 16b), in a

joining device (10) as in any claim hereinbefore, characterized in that it comprises, in sequence, at least the following steps:

- a step of introducing the yarns (16a, 16b) inside the device (10) and clamping their ends by the corresponding pincer means (21a, 21b) and the corresponding rotary pincer means (14a, 14b);
- a step of de-twisting the yarns, wherein the electronic control unit (15) commands the rotary pincer means (14a, 14b) to rotate, with a number of revolutions and a direction of rotation correlated to the characteristics of the yarn;
- a step of closing said joining chamber (13);
- a step wherein said control unit (15) commands said pincers means (21a, 21b) to move, by means of a controlled drive of the relative motors (12), in order to stretch the yarns (16a, 16b) clamped by the rotary pincers (14a, 14b), wherein the entity of the linear movement of the pincers means (21a, 21b) is connected to the characteristics of the yarn in order to regulate in a corresponding manner the entity of the stretching imparted;
- a step wherein said control unit (15) commands the pincers means (21a, 21b) to move until the travel is complete so that the two ends of the yarn (16a, 16b) to be eliminated are caused to tear by means of suction;
- a step wherein said control unit (15) activates the cutting means (22) to guarantee the discharge of the two segments of yarn to be eliminated;
- a step wherein said control unit (15) commands the jet of fluid inside the joining chamber (13), wherein the starting moment, the flow rate and the duration of the

jet are a function of the characteristics of the yarn and the parameters set;

- a step of re-twisting of the yarns (16a, 16b), wherein said control unit (15) commands the rotary pincers (14a, 14b) to rotate in the opposite direction with respect to the direction adopted during de-twisting, wherein the number of revolutions of said rotary pincers (14a, 14b) is a function of the characteristics of the yarn and the parameters set;
- a cycle completion step, wherein said control unit (15) commands the shells (30, 31) of said joining chamber (13) to open, then said rotary pincers (14a, 14b) are released and finally the end-clamping pincers (21a, 21b) return to their position.

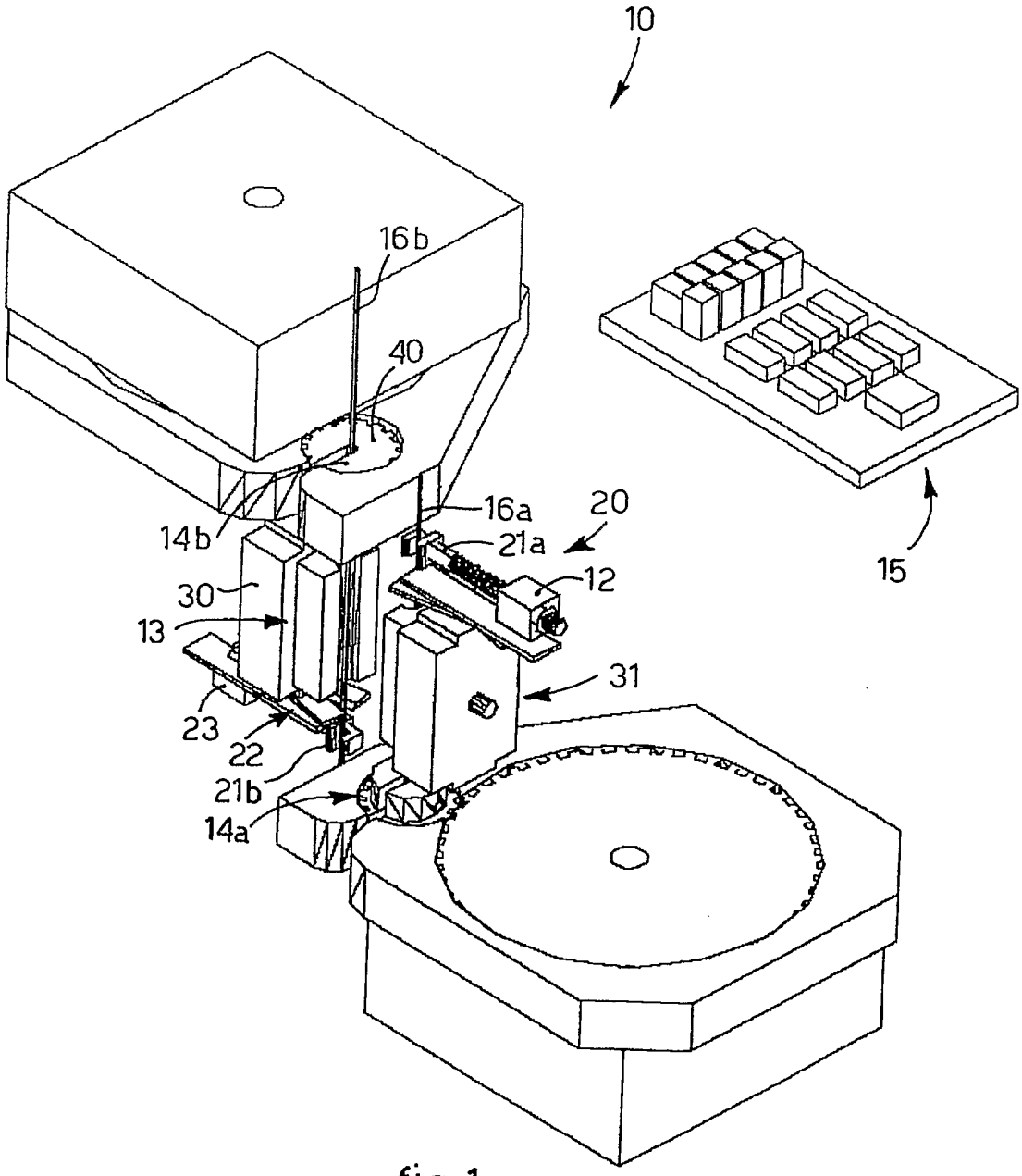

fig. 1

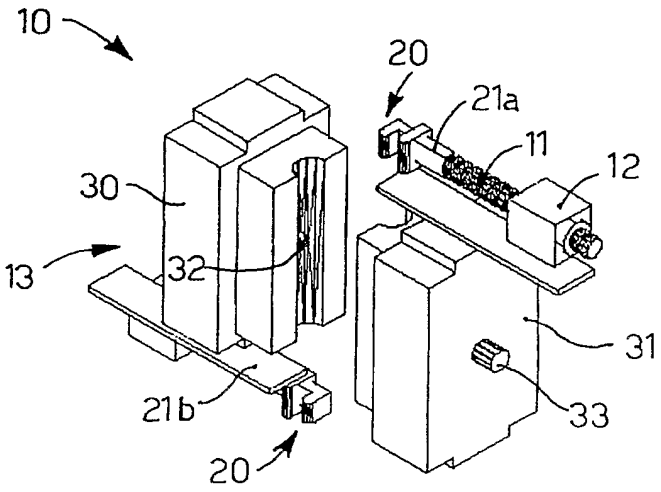
10
20
21a
11
12
30
13
32
31
21b
33
20

fig. 2

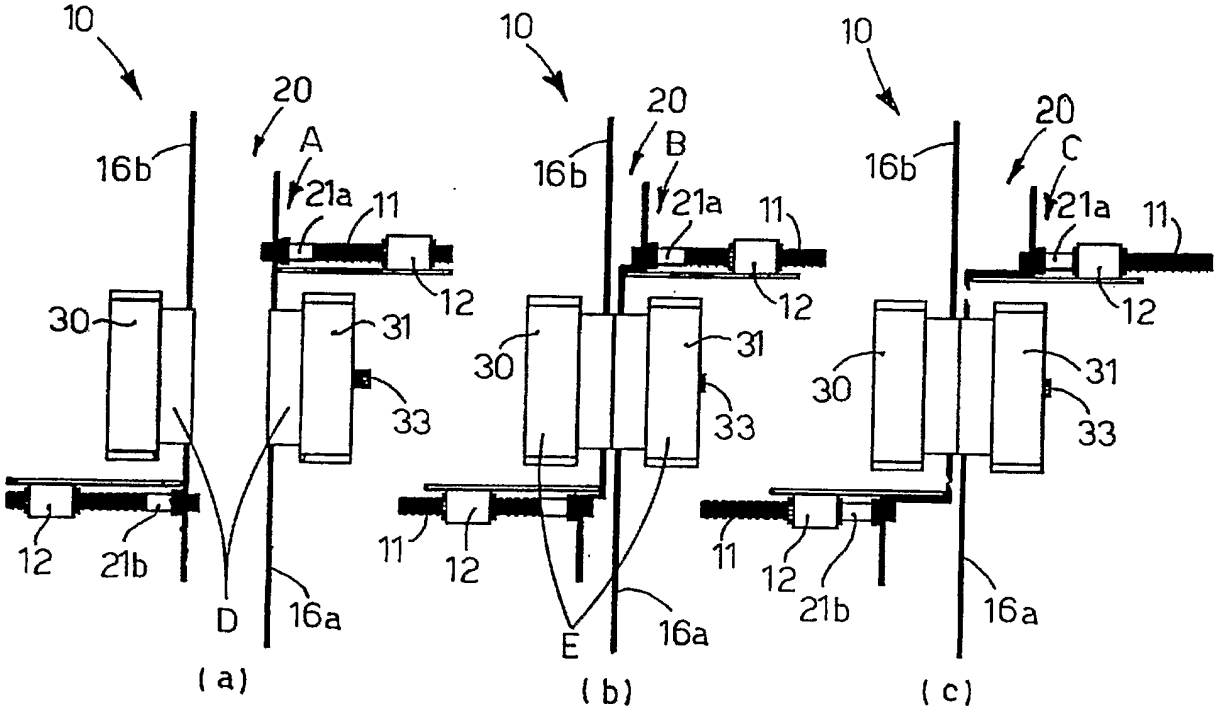
10
20
A
16b
21a
11
12
30
31
33
12
21b
D
16a
(a)
10
20
B
16b
21a
11
12
30
31
33
11
12
E
16a
(b)
10
20
C
16b
21a
11
12
30
31
33
11
12
21b
16a
(c)

fig. 3

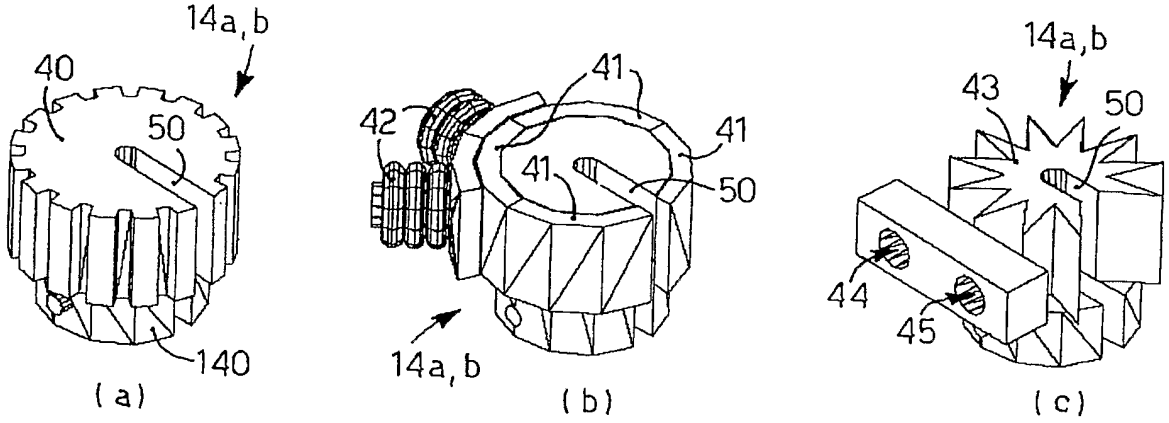
14a,b
40
50
140
(a)
42
41
41
41
50
14a,b
(b)
14a,b
43
50
44
45
(c)

fig. 4

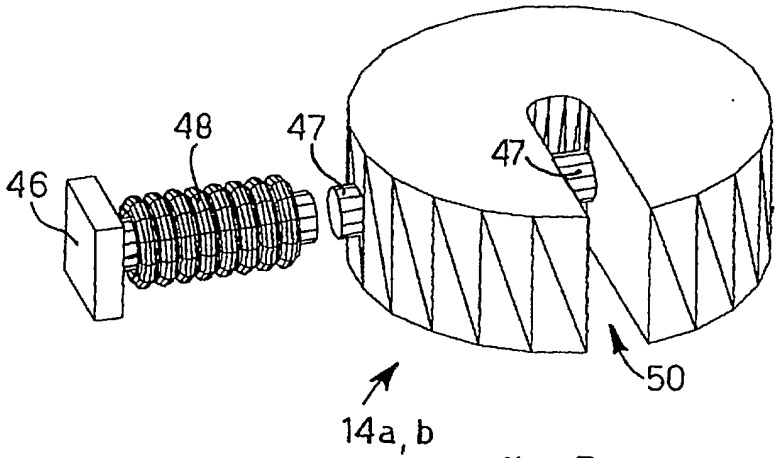
48
47
47
46
50
14a,b

fig. 5

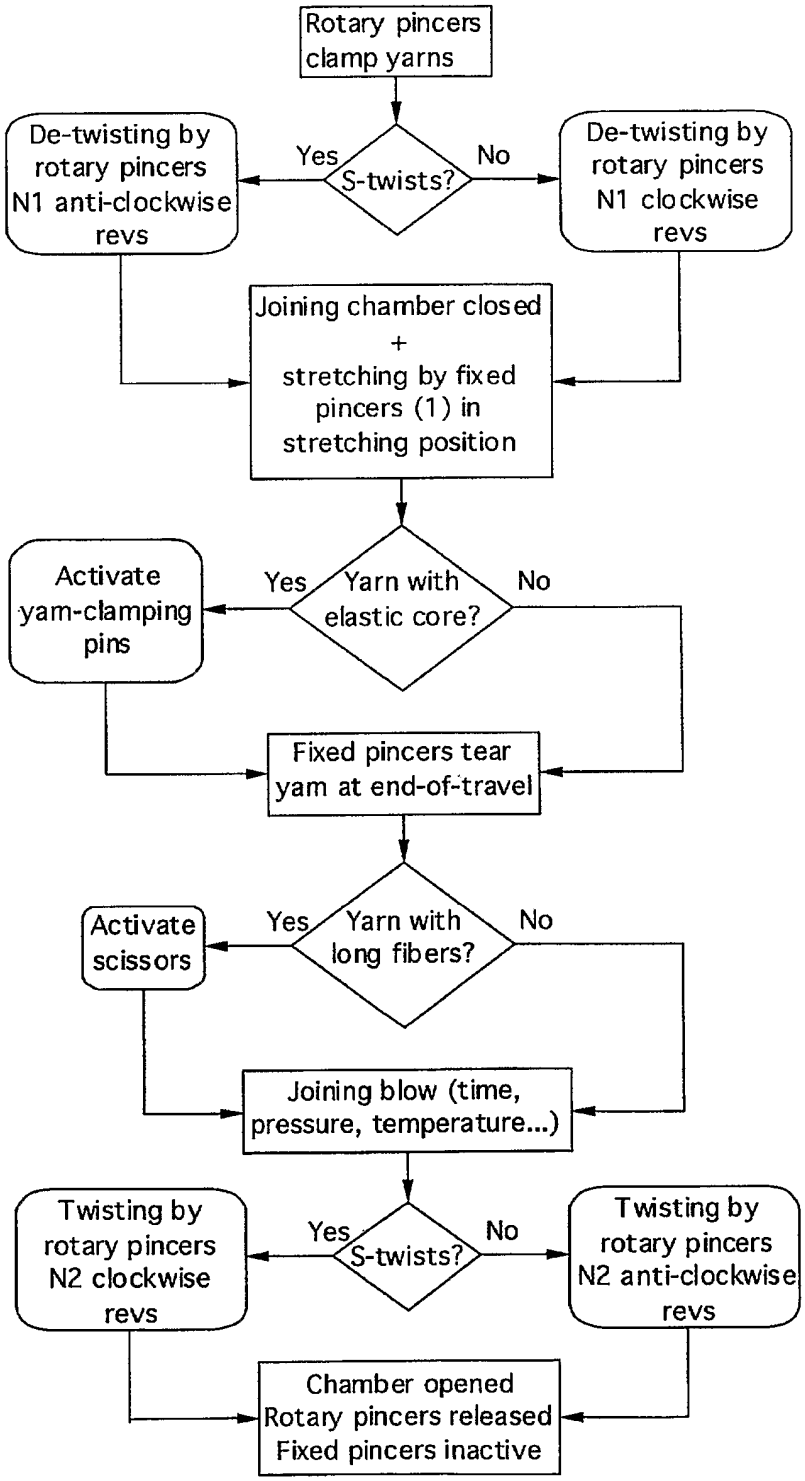
Rotary pincers clamp yarns
De-twisting by rotary pincers N1 anti-clockwise revs
Yes
S-twists?
No
De-twisting by rotary pincers N1 clockwise revs
Joining chamber closed + stretching by fixed pincers (1) in stretching position
Activate yarn-clamping pins
Yes
Yarn with elastic core?
No
Fixed pincers tear yarn at end-of-travel
Activate scissors
Yes
Yarn with long fibers?
No
Joining blow (time, pressure, temperature...)
Twisting by rotary pincers N2 clockwise revs
Yes
S-twists?
No
Twisting by rotary pincers N2 anti-clockwise revs
Chamber opened Rotary pincers released Fixed pincers inactive

fig.6

INTERNATIONAL SEARCH REPORT

International Application No
PCT/EP2005/052415

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 B65H69/06

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 B65H

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

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

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE 31 31 986 A (W. SCHLAFHORST & CO) 3 March 1983 (1983-03-03) page 12, line 10 - line 21 page 13, line 15 - page 15, line 4 page 22, line 17 - page 23, line 14 page 29, line 26 - page 30, line 24 page 31, line 4 - line 22 page 32, line 22 - page 34, line 8; claims 1-3,10,13,14,19,23,30-39,47,48	1,8-10, 14,15,19
A	US 4 397 138 A (J. ROHNER ET AL.) 9 August 1983 (1983-08-09) column 17, line 11 - line 56 column 21, line 43 - column 22, line 26 column 22, line 53 - column 24, line 34; figures 12-17	1,19

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
20 September 2005	28/09/2005

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Lemmen, R

INTERNATIONAL SEARCH REPORT

International Application No
PCT/EP2005/052415

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

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