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54 **Process and device for coupling and re-joining the thread with the roving in a ring-spinning frame.**

57 The present invention relates to a process for automatically coupling and re-joining the thread (7), which may possibly break on a determined spinning bobbin (14) of a ring spinning frame, with the roving (6), or bundle of textile fibres, exiting the last pair of drawing rolls (24,26), as well as to a device for carrying out such a process.

The process according to the present invention essentially consists of approaching the end of the thread (7), coming from the spinning bobbin (14), to the bundle of textile fibres (6), exiting the last pair of drawing rolls (24,26), by means of the sucking action performed by a sucking "air race" (2a) inside which said thread and said fibre bundle get coupled and joined with each other, with the spinning process being resumed.

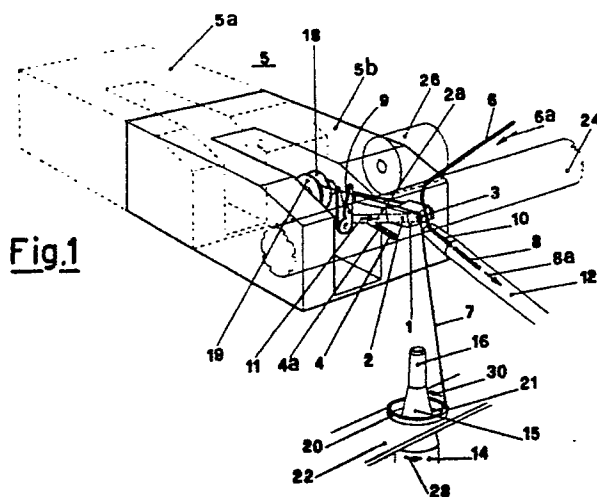


Fig.1

EP 0 321 017 A1

PROCESS AND DEVICE FOR COUPLING AND RE-JOINING THE THREAD WITH THE ROVING IN A RING-SPINNING FRAME

The present invention relates to a device for coupling and re-joining the thread with the roving in a ring spinning frame, a device to be used in combination with devices and means known from the prior art, in order to detect the presence of a broken thread, stop the spinning bobbin on which the breakage occurred, carry out the research of the free broken end of the thread on the same spinning bobbin, and catch said free end by means of suitable means, as disclosed in other patents to the same Applicant.

Said roving can be of any compositions or structures, and in the present disclosure and in the appended claims, it will be simply referred to as the "roving" or "textile fibre bundle", with both said terms being used in an interchangeable way.

It is known that, owing to various reasons, during the spinning process the thread which is being wound on the spinning bobbins can break once or several times, and, in order to go ahead with the spinning process, the free end of the broken thread has to be found out and re-joined to the textile fibre bundle, or roving, which continues to exit the last pair of drawing rolls of the spinning frame. Said breakage, owing to the same nature of the continuous spinning frames, takes always place along the section running from the outlet from the drawing rolls, and the upper layer of threads wound on the corresponding spinning bobbin.

The joining of the broken threads, before the application of saddle-devices for re-joining the broken threads on the continuous ring spinning frames, was always done by hand by the operators attending the spinning frames, entrusted with this precise task. The labour costs for the attendance of the continuous spinning frames installed in the spinning factories represented a considerable factor in the computation of the thread production costs. Therefore, completely automatic devices were installed, which, by running along the working fronts of the monitored frames, ascertain whether the thread is present or not, stop when they discover a missing thread, in which case they join the free end of the broken thread with the textile fibre bundle exiting the drawing rolls.

After carrying out all the above, they continue their monitoring movement along one or more spinning frames.

Said devices have worked to date with satisfactory results, but they resulted to be susceptible of improvement as regards some of their operating units. It also resulted suitable to simplify them from the viewpoint of their executive methodology by resorting to new operating principles, destined to

give greater guarantees of reliability and versatility in the application of the device, as a function or the large variety of types of textile materials and of their different manufacturing speeds.

The present Applicant has now conceived, and is an object of the present invention, an improvement in the device for automatically joining the broken threads, supplying it with a new process and a new device for coupling and re-joining the free end of the broken thread to the roving. The processes and the devices already known from the prior art for joining the thread with the roving perform said operation in a mechanical way, with a poor reliability being obtained, in that sometimes the joining operation is not successful. In fact, an error can occur in the transversal positioning of the joining device, which does not come into contact with the drawing roll, with the consequence that the textile fibre bundle and the thread are not capable of coupling with each other, owing to the missed contact.

The above mentioned error in positioning can also be of longitudinal type, i.e., the joining member can regularly come into contact with the drawing roll, but it may happen that the roving and the thread are not aligned to each other, but are offset relatively to each other. This may happen both owing to an error in positioning of the joining device relatively to the drawing roll, and owing to a right and necessary position of the roving caused by the weft shifter action. Incidentally, the weft shifter action is a reciprocating shifting rightwards and leftwards of the trajectory, of the fibre bundle, in order not to generate a localized wear on the belts and on the rolls of the drawing unit.

The process and the relevant device for practicing the present invention overcome said drawbacks by means of an original solution, which eliminates any possibilities of missed junction between the thread and the fibre bundle exiting the drawing rolls. Another advantage of the device as compared to the prior art, is its extreme structural simpleness, from which considerably reliable operating steps arise.

These, and still other, advantages are all achieved by means of the process according to the present invention, which makes it possible the textile fibre bundle to be shifted, in case of a thread breakage, from the direction according to which it runs, towards the inlet port of a fixed sucking nozzle, known from the prior art, by means of a first, low-suction, air stream, the suction of which is anyway sufficient to secure the suction of said fibres into the interior of the conduit downstream

the same sucking nozzle; and which makes it possible as well, the free end of the thread, picked up from the spinning bobbin, to be brought into frontal adhesion with, and in a diametrical position relatively to, the inlet port of an ejector nozzle, temporarily inactive, with said thread being put under tension by means of downstream nipping elements known from the prior art.

Said process makes it furthermore possible the ejector nozzle to be activated, and the cutting, or the tearing, of the thread, in a region close to the inlet port of the same nozzle, to be simultaneously carried out; and the resumption of the revolutionary movement of the spindle to be activated substantially simultaneously, or slightly in advance, after that the textile fibre bundle, by being sucked entrained by the second air stream, with a greater sucking force, generated by said second ejector nozzle, get coupled and twisted with the end length of the cut thread, with the spindle spinning process being therefore resumed.

The process for coupling and re-joining the thread with the roving according to the present invention is accomplished therefore by joining inside the sucking "air race" generated by the ejector nozzle, the end of the thread coming from the spinning bobbin, and the textile fibre bundle exiting the last pair of drawing rolls.

The device used for practicing the process according to the present invention is provided with a mobile unit, or saddle, associated, as one single body, with a traveling unit, equipped with:

- an ejector nozzle destined to generate a sucking "air race" capable of sucking, at a precise time point, the textile fibre bundle from the fixed sucking nozzle provided at the outlet from the drawing rolls;
- scissors element for removing the excess thread upstream the region of the sucking "air race" generated by said ejector nozzle;
- nipping elements for holding the thread, downstream the scissors, under a proper tension.

The mobile saddle unit of the device used for practicing the present invention is mounted on a frame associated with motor means, or actuator lever systems, so that it can reciprocate (move forwards and backwards) between two limit positions relatively to the last pair of drawing rolls. In its forwards-moved position, said mobile unit makes it possible the suction port of the ejector nozzle to be frontally predisposed in the nearby of the inlet of the fixed sucking nozzle, in order to make it possible the operating steps of coupling and re-joining of the thread with the textile fibre bundle to start.

According to a form of practical embodiment, the sucking "air race", inside which the free end of the thread coming from the spinning bobbin, and the textile fibre bundle are joined with each other, is obtained by means of a suction source.

According to a further form of practical embodiment, the sucking "air race", inside which the thread and the textile thread bundle are joined with each other, is obtained by simultaneously using a sucking source, and a compressed-air injector provided in the nearby of the sucking nozzle.

According to a further form of practical embodiment, the inner surface of the nozzle and of the relevant conduit of the sucking "air race" is provided with variously shaped enlargements and narrowings.

According to a further form of practical embodiment, the device according to the present invention is equipped with tearing elements in order to carry out a gradual breakage of the fibres when the excess thread upstream the region of the sucking "air race" and downstream the nipping elements is removed.

The device used for practicing the present invention is associated with scheduling means in order to coordinate the sequence of entering into action of the various operating members, and is associated as well with regulator means, in order to regulate the values of depressure inside both above said sucking nozzles.

The invention is now disclosed in detail on the basis of the example of practical embodiment which is schematically shown in the figures of the hereto attached drawing tables, and further peculiarities and features will be clarified, it having to be well understood that the invention can be anyway accomplished according to many further structural forms of practical embodiment.

In the hereto attached drawings:

Figure 1 shows a schematic, axonometric perspective view of the device which carries out the coupling and the re-joining of the thread with the roving, with the presence of the spinning bobbin under way of formation and illustrates as well the time point at which the mobile saddle unit is in its forwards-moved position, close to the pair of drawing rolls, in order to enable the suction port of the ejector nozzle to be frontally predisposed in the nearby of the intake port of the fixed sucking nozzle.

All this represents the time point preceding the beginning of the operating steps of coupling and re-joining of the thread to the textile fibre bundle;

Figure 2 shows a schematic, axonometric perspective view of the device which carries out the coupling and re-joining of the thread with the roving, at the time point at which the free end of the cut thread, and the textile fibre bundle have got coupled with each other, and are being twisted with each other, resuming the spinning process by the relevant spindle.

All this represents the time point subsequent to the activation of the ejector nozzle, carried out together

with the cutting of the thread, and the resumption of the revolutionary movement of the spindle.

In the figures, same elements are indicated by the same reference numerals. Moreover, in the figures, for the sake of clarity of the overall structure, the parts not necessary for the understanding of the invention are omitted, or are presented in a general way, in that they are per se known.

In said hereto attached figures we have that:

1 is a prismatic block inside which the ejector nozzle 2 is provided, and on its upper surface, is provided with a "V"-shaped, or similarly shaped, groove in order to put and constrain the taut thread 7 in a diametrical and frontal position relatively to the inlet port 3 of the same ejector nozzle 2;

4 is the pipe for the primary pressurized fluid, with this latter being injected according to the direction as shown by the arrow 4a. Said pressurized fluid generates the sucking "air race" 2a;

5a and 5b are the two positions, the one moved backwards, and the other moved forwards, relatively to the drawing rolls, of the mobile saddle unit. The position 5a, shown in dashed lines, corresponds to the position of the mobile saddles during the non-splicing-operating step; the position 5b, depicted in solid line, corresponds to the position in which the mobile saddle is during the splicing operating step. Said positions are obtained by means of known motor means not depicted in that they do not constitute an object of the present invention;

6a is the arrow showing the direction of simple roving 6 feed;

7 is the thread which is generated when the textile fibre bundle exiting the drawing rolls 24 and 26 is twisted, and is wound around the underlying spinning bobbin 14 by means of a technology and means which are per se known;

8 is a length of the textile fibre bundle, approximately equivalent to the length of the individual fibres, which get detached and are removed from the roving 6 owing to the action by the sucking depressure acting in the direction 8a. Said textile fibres are continuously conveyed to a waste storage;

9 are the scissors elements for removing the excess thread immediately before the free end of the same thread gets coupled to the roving;

10 is the fixed sucking nozzle positioned under the pair of drawing rolls 26 and 24, in order to be capable of intaking and removing the textile fibre bundle 8 after the breakage of the thread 7, until the re-joining has taken place;

11 is the prolonging pipe for the ejector nozzle 2;

12 is a suction pipe connected to means destined to generate inside it, and, consequently, inside the nozzle 10, a depressure which is entrusted with the task of collecting from the working area, after the brakage of the thread, the fibres which continue to come out from the rolls 24 and 26, in order to prevent useless and dangerous deposits of wastes from forming along the spinning spindles;

16 is the tube which constitutes the support for the thread, for forming the spinning bobbin 14;

21 is the spinning ring, whose revolutions, according to arrow 30, are the true twist given to the thread 7 being formed;

20 is the spinning spindle ring;

22 is the ring rail. It is provided with a reciprocating vertical movement, so as to reel the thread according to concentric, mutually overlapping thread layers of cone-frustum shape 15 around the tube 16;

24 and 26 are the last pair of drawing rolls, with these latter being positioned at the end side of the per se traditional drawing system; 28 is the arrow which shows the direction of revolution of the spinning spindle, and consequently of the spinning bobbin 14 which can be engaged on it;

18 and 19 are two plates frontally opposite to each other, and urged against each other by elastic elements, or similar elements, and operating substantially in parallel in order to nip the free end of the thread 7. The tension to the thread 7 is supplied owing to the effect of the nipping pressure between said two plates, between which the end portion of the same thread 7 is wedged in, after being picked up from the stationary spinning bobbin 14 after the thread brakage.

The following disclosure of the operating way, carried out by referring to the cited figures, is mainly referred to all of the novel elements and, therefore, it only concerns the device according to the present invention, which carries out the coupling and the re-joining of the thread with the roving, it being understood that, in order to operate, it requires complementary devices, which do not constitute an object of the disclosure.

It is known to associate the ring spinning frame with a saddle device in order to automatically re-join the broken threads during the spinning spindles operation. Said saddle is caused to run along the spinning front(s), along running ways comprising one or more rail(s), of any shapes, cooperating with suitable rolling means such as wheels, or rollers, or equivalent means. During the operation of the spinning frame, the saddle unit for the re-joining of the threads is continuously frontally reciprocated along the spindle bed, performing a reciprocating patrolling function.

During said patrolling monitoring, the traveling device detects, by using detecting means known from the prior art, whether the thread is present or not, on each spinning spindle. When it detects the absence of one of the threads under way of formation, the device stops the saddle in front of the spindle wherein the broken thread is, and actuates the re-joining starting mechanisms.

At the mean time, and at the time point at which the thread 7 breaks, the textile fibre bundle 6, when exiting the drawing rolls 26 and 24, is intaken and removed by the sucking nozzle 10 until the re-joining is ended. Then, by means of an automatic method, the end of the broken thread is looked for on the upper layers wound on the spinning bobbin 14, and a long enough length of it is unwound, as disclosed in other patents to the present Applicant's name.

Said thread end will be picked up by means of a mobile pincers, which will move upwards along a preestablished path, in order to insert it between the plates 18 and 19. The thread 7 results hence to be locked, wedged and tensioned along a well defined length, as it clearly results from Figure 1. The above said pincers means is not shown in the drawings, because in practice it could have a whatever shape as suitable for its intended task, and, furthermore, it is not an object of the present invention. During the operating steps of thread search, picking up and transfer, the spindle on which the spinning bobbin 14 under way of formation is slid, is not under operating revolving conditions, and is kept stationary by suitable means. Before the wedging of the end of the thread 7 between the plates 18 and 19, operations preliminary to the threading of the same thread through the various element existing between the spinning bobbin and the device of the present invention are carried out, by using known means and operating methods which are per se traditional, and well-known to those skilled in the art.

Before the end of the thread 7 is wedged between said plates 18 and 19, the mobile saddle unit 5 is moved towards the area under the drawing rolls 24 and 26 and is stopped in the 5b position, as shown in the hereto attached drawings. To the above steps, the operation of coupling and re-joining of the end of the broken thread 7 with the roving, or textile fibre bundle 6, starts. The true splicing of the present invention is carried out simply, with the aid of a sucking "air race" 2a, which performs the function of re-joining the textile fibre bundle 6 with the end of the thread 7, amalgamating them with each other, for resuming the spinning process.

In order to begin the splicing operation, the arm of the above said mobile pincers can advantageously cooperate. Said arm, in fact, at the end of

its movement, which enables the pincers to wedge the end of the thread 7 between the plates 18 and 19, actuates a microswitch, or a similar element, which enables the releasing of the brake which is keeping stopped the spindle of the spinning bobbin 14. This latter starts to revolve, while the scissors 9 are simultaneously, or substantially simultaneously, actuated, and at the same time the ejector nozzle 2 is activated by delivering compressed air into the pipe 4, according to the direction 4a. This latter actuation is such as to immediately cause the textile fibre bundle 6 to be intaken and conveyed from the sucking nozzle 10 towards the inlet port of, and into the interior of the ejector nozzle 2.

At the same time, through this latter inlet port 3, the cut end of the thread 7 is captured; said thread 7 cut end is already subject to a twisting, due to the effect of the already started revolutions, in the direction 30, of the ring 21, which is driven in its turn by the revolutions of the spindle on which the spinning bobbin 14 is slid. At this time, the thread and the roving inside the inlet port 3 of the ejector nozzle 2 approach each other, and interfere and get constrained with each other, in that the fibres of the roving are captured and wrapped by the fibres of the end of the thread 7, with this latter being strongly twisted by the revolutions of the ring 21. In order to prevent the splice from resulting too long, the scissors 9 must cut the thread at a point rather close to the inlet port 3, and with a slight delay after the resumption of the revolutions of the ring 21, in order to give the twists the necessary time for them to rise up to the end of the thread nipped between the plates 18 and 19. Incidentally, the above mentioned operating steps can at least partially overlap each other over time.

Instead of the scissors 9, which cut the thread 7 with a substantially sharp cut, also the use can be envisaged of a tearing device, of a traditional structure, in order to carry out a gradual breakage of the fibres, in order to improve the appearance of the splice. It should be stressed that the roving 6 does not need to be cut, or torn, in that at the time at which it is intaken into the interior of the ejector nozzle 2, its length is never excessive.

In fact, the roving, inside the suction duct 12 does maintain its fibrous structure along an initial length only, which is approximately equal to the length of the fibres. After this length, inasmuch as it does not have any consistency, the roving gets dissolved owing to the effect of the suction. Therefore, for the purposes of the splice, no need exists for the excess of roving length to be removed. At the time point subsequent to the cutting by the scissors 9, suitably timed by an adjustable scheduling apparatus, known from the prior art, the ejector nozzle 2 is disabled, or partially disabled, with the action of the sucking "air race" 2a being dis-

continued, or limited.

In fact, it is of essential importance that the suction by the "air race" 2a does not retain the coupled thread or roving after that the joining is carried out, in order to prevent the thread 7 from remaining stuck, in correspondence of its upper section, to the inlet port 3 of the ejector nozzle 2, being thus hindered in its running towards the spindle, on which it has started to wind on the spinning bobbin 14. In such a way, the continuity of the roving/thread is reliably resumed, thus the continuity of the spinning process being resumed as well.

From tests carried out by the present Applicant, the perfect repeatability and the extreme reliability was observed of the joining process, conceived and disclosed in the present invention, on the whole range of discontinuous-fibre threads.

In fact, the advantage of the herein proposed device, by means of an original solution, is that the free end of the thread 7 meets always the fibres of the roving 6, whichever the position of these latter may be when exiting the drawing rolls 24 and 26. Therefore, the possibilities are nullified, that the thread 7 and the fibres of the roving 6 may not meet each other inside the interior of the sucking "air race" 2a of the ejector nozzle 2, in that both of them are attracted and piloted by suction. It is obvious that the sucking "air race" inside the tube 11, instead of being generated by compressed air delivered through the tube 4, could be obtained by connecting said pipe 11 with a vacuum pump, or with a similar device. The "air race" inside the pipe 11 can be possibly obtained by combining the suction with the blowing of compressed air by means of one or more nozzles. Also the air intake points may be more than one.

The inner wall of the nozzle 2 and/or of the pipe 11, besides being of the simple conical or cylindrical walls, may be given a different shape, suitable for giving the fibres and the thread a centrifugal speed, or similar motions. Furthermore, the extensions of the above said pipes can be both rigid and flexible.

When the joining action is ended, the mobile saddle unit 5 is returned to its initial position 5a, thus making it possible the spinning to be regularly continued, and the reciprocating patrolling by the traveling unit, which is the supporting and moving unit for the device of the present invention, to be resumed.

The hereinabove disclosed forms of practical embodiment are reported for merely exemplifying purposes, and in no way do they limit the invention. It is evident that many variants, modifications and additions can be supplied by those skilled in

the art to the typical features of the device, without thereby departing from the general idea of the process according to the present invention.

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Claims

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1. Process for coupling and re-joining the thread with the roving in a ring spinning frame, in which for each spinning spindle a textile fibre bundle comes out from the last pair of drawing rolls, characterized in that:

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- in case of a thread breakage, the textile fibre bundle is shifted from the directions according to which it runs, towards the inlet port of a fixed sucking nozzle by means of a first, low-suction, air stream, the suction of which is anyway sufficient to secure the suction of said fibres into the interior of the conduit of the same sucking nozzle;

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- the free end of the thread, picked up from the spinning bobbin, is brought into frontal adhesion with, and in a diametrical position relatively to, the inlet port of an ejector nozzle, temporarily inactive, with said thread being put under tension by means of downstream nipping elements known from the prior art;

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- the ejector nozzle is activated, and the cutting, or the tearing, of the thread, in a region close to the inlet port of the same nozzle, is simultaneously activated; and the resumption of the revolutionary movement of the spindle is activated as well, substantially simultaneously, or slightly in advance, after that the textile fibre bundle, by being sucked entrained by the second air stream, having a greater sucking force, generated by said second ejector nozzle, get coupled, and twisted together, with the end length of the cut thread, with the spindle spinning process being therefore resumed.

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2. Process according to claim 1, characterized in that the free end of the thread coming from the spinning bobbin and the textile fibre bundle exiting the last pair of drawing rolls are joined with each other inside the sucking "air race" generated by the ejector nozzle.

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3. Device for practicing the process according to claims 1 and 2, characterized in that it comprises a mobile saddle unit, associated, as one single body, with a traveling unit, equipped with:

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- an ejector nozzle destined to generate a sucking "air race" capable of sucking, at a precise time point, the textile fibre bundle from the fixed sucking nozzle provided at the outlet from the drawing rolls;

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- scissors element for removing the excess thread upstream the region of the sucking "air race" generated by said ejector nozzle;

- nipping elements for holding the thread, downstream the scissors, under a proper tension.

4. Device according to claim 3, characterized in that the mobile saddle unit is mounted on a frame associated with means which enable it to reciprocate (move forwards and backwards) between two limit positions relatively to the last pair of drawing rolls; in its forwards-moved position, said mobile unit makes it possible the suction port of the ejector nozzle to be frontally predisposed in the nearby of the inlet of the fixed sucking nozzle, in order to make it possible the operating steps of coupling and re-joining of the thread with the textile fibre bundle to be started.

5. Device according to claim 3, characterized in that the sucking "air race", inside which the free end of thread coming from the spinning bobbin, and the textile fibre bundle are joined with each other, is obtained by means of a suction source.

6. Device according to claims 3 and 5, characterized in that the sucking "air race", inside which the thread and the textile thread bundle are joined with each other, is obtained by simultaneously using a sucking source, and a compressed-air injector provided in the nearby of the sucking nozzle.

7. Device according to claims 5 and 6, characterized in that the inner surface of the nozzle and of the relevant conduit of the sucking "air race" is provided with variously shaped enlargements and narrowings.

8. Device according to claim 3, characterized in that it is equipped with tearing elements in order to carry out a gradual breakage of the fibres when the excess thread upstream the region of the sucking "air race" and downstream the nipping elements is removed.

9. Device according to claims from 3 to 7, characterized in that it is provided with scheduling means, in order to coordinate the sequence of entering into action of the various operating members, and is provided as well with regulator means, in order to regulate the values of depressure inside both above said sucking nozzles.

10. Device according to claim 3, characterized in that each spinning spindle is equipped with one device according to the present invention.

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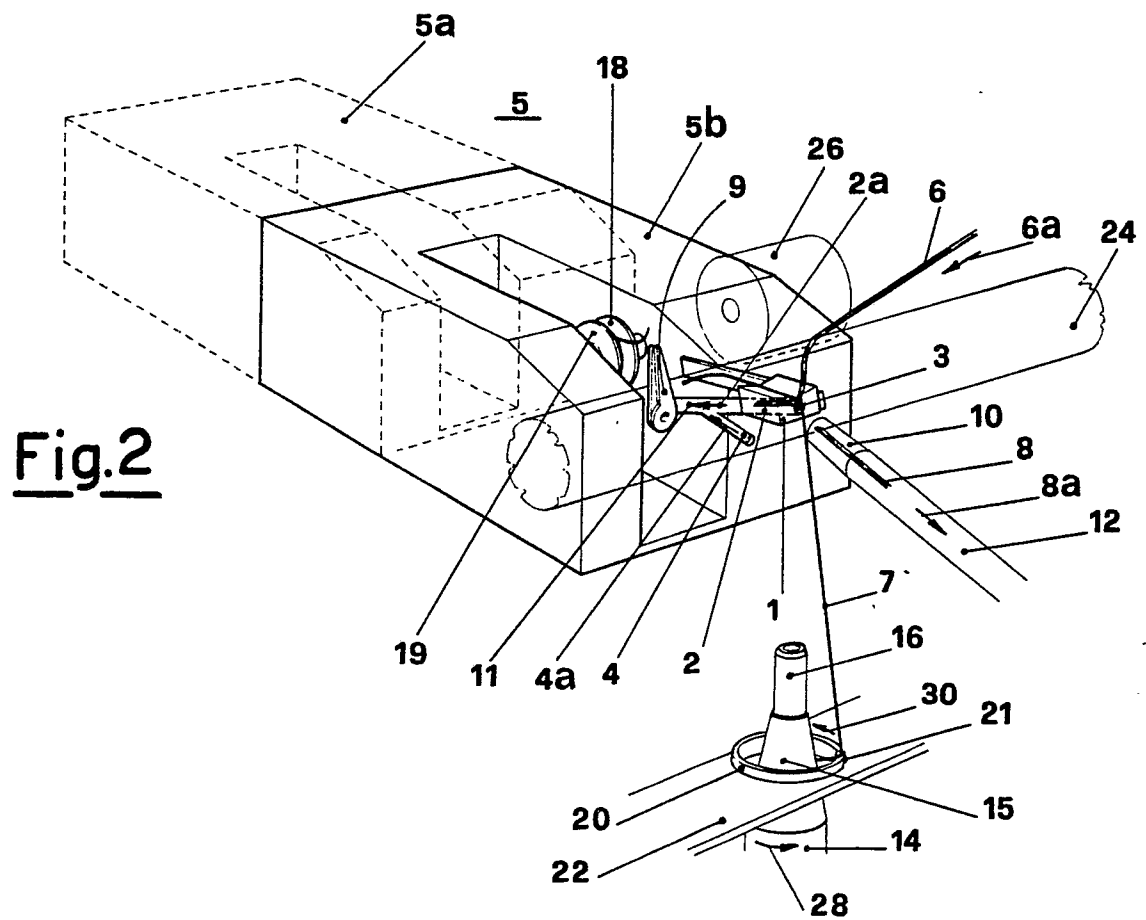
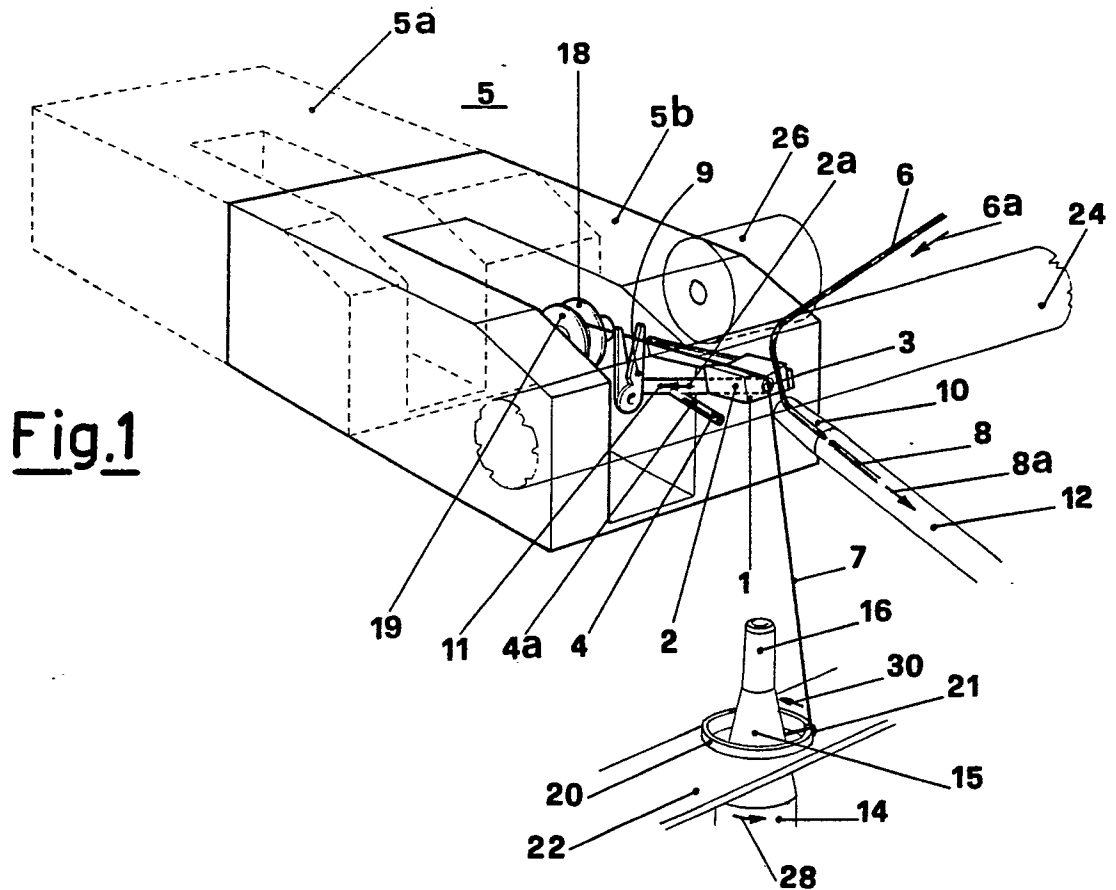
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European Patent
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EUROPEAN SEARCH REPORT

Application Number

EP 88 20 2729

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
A	PATENT ABSTRACTS OF JAPAN vol. 9, no. 324 (C-320) 2047 19 December 1985, & JP-A-60 155741 (MASAJIROU YAMASHIRO) * see the whole document *	1-3, 5	D01H15/00
A	US-A-3077312 (FÜRST) * column 3, line 3 - column 4, line 14 *	1, 3	
A	GB-A-2074199 (IVANOVSKY TEXTILNY INSTITUT) * figures 1-8 *	1-3, 5	
A	DE-A-3143263 (SCHLAFHORST) * claims 1-8; figures 1-5 *	1, 3, 7	
A	DE-A-3405304 (SCHLAFHORST) * figures 1-6 *	1, 3, 5	
A	GB-A-2060004 (SCHUBERT & SALZER) * figures 1-12 *	1, 3	
			TECHNICAL FIELDS SEARCHED (Int. Cl.4)
			D01H B65H
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 22 FEBRUARY 1989	Examiner RAYBOULD B.D.J.
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			