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(54) Roving joining method and device applicable to spinning machines

(57) To automate the roving joining operation, the device (1) comprises a tubular guide element (3) of open cross-section and two nozzles (4, 5) positioned at its ends. The nozzles (4, 5) selectively and alternately feed compressed air into the interior of said tubular guide element (3). The first nozzle (4) is inclined such as to also generate a component in the direction of advancement of the depleting roving. The second nozzle (5) is inclined such as to also generate a component in the opposite direction to the direction of advancement of the new roving.

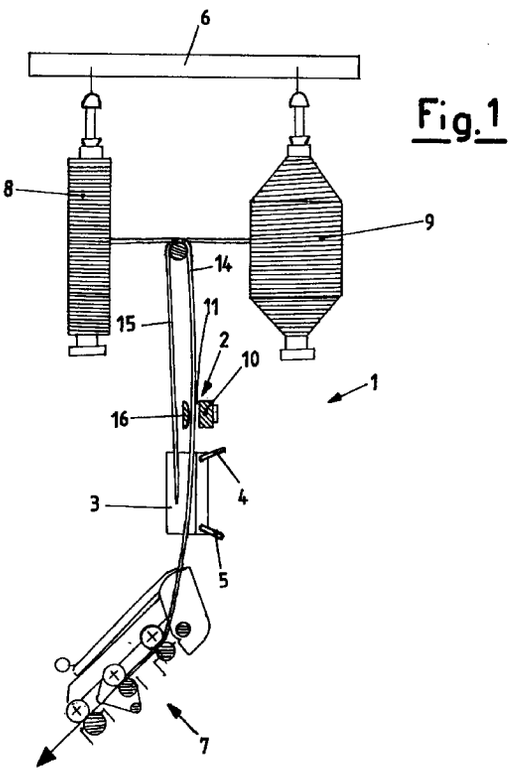

Fig.1

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Description

This invention relates to a roving joining method and device, applicable to spinning machines.

In spinning machines, usually ring spinning machines, to avoid operational interruption it is periodically necessary to join the roving from a depleting bobbin (old roving) to the roving from a full bobbin (new roving).

This operation could currently be effected by appropriate devices, however their reliability and cost are not such as to allow them to be advantageously used on a wide scale, mainly for the following reasons:

- The end of the new roving encounters considerable difficulty in entering the appropriate parts of the drafting device and the guides (condensers) properly to the side of the depleting (old) roving, and hence does not advance uniformly from the drafting device.
- When it abandons the first roller of the drafting device, the end of the old roving, which is now associated with the new, tends to be transported into the drafting region at the velocity of the exit roller, and hence does not undergo drafting.

The reason why it is particularly difficult to join the roving together by known mechanical devices lies mainly in the fact that to overcome said drawbacks the achieved joint must simultaneously possess the following contrasting characteristics:

- it must be sufficiently strong to enable the operating roving to drag the new roving into operation;
- it must be sufficiently weak to allow those fibres of the joined rovings which are still free to slide under the effect of the drafting force. If not, then drafting could not be achieved and the yarn size would be such as to interrupt production due to breakage.

For the aforesaid reasons the roving joining operation is still preferably carried out by an operator by halting the spinning unit of the machine and manually inserting the two rovings, the old and the new, simultaneously into the drafting unit and checking that the aforesaid conditions are verified.

The use of an operator, and in particular the halting of the spinning unit to allow him to operate, substantially affect costs. The object of the present invention is to obviate the aforesaid drawbacks by providing a roving joining device which essentially:

- achieves a joint which is sufficiently strong to enable the operating roving to drag the new roving into operation, while at the same time being sufficiently weak to allow those fibres of the joined rovings which are still free to slide under the effect of the drafting force;
- Is able to make the joint while substantially reducing operator commitment;
- joins the rovings without requiring stoppage of the spinning unit;
- is of simple and reliable structure leading to particularly low constructional and operating costs.

This object is attained by a device in accordance with claim 1.

The operation initially of the first nozzle and then of the second nozzle and hence selectively and alternately generates within the guide a first and a second swirl which cause the initial end of the new roving to be wound as helical turns on the old roving and the tail end of the old roving to be wound as helical turns on the new roving respectively.

Tests have shown that in both cases the joint obtained is substantially a connection between the rovings such that the operating roving is able to drag the new roving into operation, while simultaneously allowing the subsequent drafting of the rovings even if joined. In other words the connection made has the merit of still allowing relative sliding between the roving fibres even at the point of joining, and which must necessarily occur to be able to effect the subsequent drafting of the roving without defects at the joint.

To make the joint the operator has merely to insert the initial end of the new roving into the first tubular guide element so that it lies beside the old roving which at that moment is in operation. Inserting the roving into a tubular guide element of open cross-section requires no particular ability. The intervention of the operator is hence particularly limited both in terms of time and in terms of ability and hence specialization.

It follows therefore that, for equal available times, a non-specialized operator is able to operate correctly on more than one spinning unit of the same machine to hence effect several times an operation which currently still requires specialist labour.

After operating the first nozzle 4 the joint is only semi-effective because, even if the new roving is sufficiently wound on the old roving to be dragged into operation, to prevent further yarn defects the tail end of the old roving must also be joined.

Whether said tail end is formed as a result of the emptying of the bobbin on which said old roving is wound (a very rare case) or by breaking said roving is indifferent.

The operation of the second nozzle within the tubular guide element of open cross-section generates a second stream which also winds the tail end of the old roving as helical turns onto the new roving, which is substantially taut as it is in operation.

The device for joining the tail end of the old roving onto the new roving can also be used separately from the first device if it is required only to join the roving tail end, for example because the joint between the rovings has already been previously made manually or by a device. In either case the device for joining the tail end can operate either in collaboration with a gripper device or not. The gripper device is synchronized with the operation of the two nozzles 4 and 5 such that the tail end of

the old roving has a length suitable for winding by the second nozzle 5.

As it can also cooperate with a roving joining device having a structure different from that of the described first joining device, the tail end joining device is particularly versatile.

To make the roving joining device less bulky, the first device for joining the initial end of the new roving and the second device for joining the tail end of the old roving can use one and the same tubular guide element. In this case the first and second nozzle are positioned at the two ends of said guide element respectively and must be operated selectively and sequentially to prevent the jet from one interfering negatively with that from the other.

The tubular guide element has an open cross-section mainly to allow the roving or rovings to be joined to be rapidly and easily inserted through the relative slit. Hence it is not to be excluded that a closed guide element without the said slit can equally operate satisfactorily.

The invention is described by way of non-limiting example in terms of an embodiment which has been improved such as to comprise a single guide serving both the the joining devices. In this respect it is assumed that such an embodiment is more suitable for current requirements.

Figure 1 shows the device mounted on a unit of the spinning machine.

Figure 2 is a perspective view of the device.

Figure 3 is a plan view of the device.

Figures 4A-4E are schematic illustrations showing the device during the various stages of operation.

With reference to said figures, the roving joining device 1 comprises a gripper device 2, a guide element 3, a first nozzle 4 and a second nozzle 5. The device 1 is housed on each unit (or position) of the spinning machine between the creel 6 and the drafting unit 7, which are conventional. Consequently the spinning machine comprises a number of devices equal to the number of units. The creel 6 is able to contain at least one depleting bobbin 8 and at least one full bobbin 9.

The gripper device 2 comprises a movable abutment 10 and a fixed abutment 16 separated by a gap 11 between which the roving to be broken can slide.

The guide element 3 is of tubular form with its axis 13 parallel to the axis of movement of the roving in operation. The element 3 is of open cross-section because of the presence of a longitudinal slit 12 through which the roving or rovings can be inserted. The cross-section of the element 3 is such that an air jet directed towards its interior is able to form a swirl essentially about and along the axis 13. To satisfy this condition, the guide 3 can have any of the following shapes: a portion of a circle, a portion of an ellipse, a portion of a circumferential involute, a portion of an Archimedes spiral, or similar and/or intermediate shapes.

The first nozzle 4 is connected to a compressed air generator (not shown) and is positioned at a first end of the tubular guide element 3 and orientated towards the interior of said guide element 3 so as to generate an air swirl extending along the entire extension of the element 3, and having a component in the direction of advancement of the roving in operation. The second nozzle 5 is also connected to a compressed air generator, preferably that to which the first nozzle 4 is connected, and is positioned at a second end of the tubular guide element 3 and orientated towards the interior of said guide element 3 to generate an air swirl rotating about the axis 13 and extending along the entire extension of the element 3, but with a component directed in the opposite direction to the direction of advancement of the roving in operation.

With particular reference to Figures 4A-4E, the operation of the device is as follows.

When the (old) bobbin 8 supplying the roving in operation (which is also defined as old for convenience and is indicated by 14) is nearly depleted, the operator takes from a full bobbin the end 15A of the new roving 15 and inserts it into the tubular guide element 3 through the slit 12 (Figure 4A). The air stream leaving the nozzle 4 generates a swirl causing the end 15A of the new roving 15 to wind for a number of helical turns onto the old roving 14 which at that moment is in operation and is moving substantially taut within said guide element 3 (Figure 4B). The new roving 15, being hence secured to the old roving 14 by friction, is dragged into operation (Figure 4C).

At the same time the gripper device 2 operates to nullify the gap 11. The traction to which the old roving 14 is subjected is sufficient to break its component fibres by creep (Figure 4D).

This breakage of the old roving 14 determines the formation of the relative tail end 14A.

The jet generated by the first nozzle 4 is interrupted. The jet generated by the second nozzle 5 generates a swirl causing the tail end 14A of the old roving 14 to wind for a number of helical turns onto the new roving 15 which at that moment is moving substantially taut within said guide element 3 (Figure 4E). The tail end 14A is hence secured by friction to the new roving 15 and is wound thereon, to be hence drafted together with the new roving 15.

This connection of the tail end of the old roving to the new has the merit of still allowing relative sliding between the roving fibres at the joining point. This sliding must necessarily occur in order to be able to effect the subsequent drafting of the roving and hence produce a yarn as free of defects as possible, particularly at the joint. Consequently the tail end of the old roving also undergoes the drafting essential for forming the yarn.

Hence neither the joining of the initial end 15A nor the joining of the tail end 14A effected in this manner prejudices the execution of the subsequent drafting or of the further twisting, these being essential for forming the yarn.

In practice the device of the invention joins the rovings together by a method comprising the following steps:

- a first step in which the initial end of the new roving is positioned to the side of the old roving which at that moment is in operation and is hence taut along a rectilinear axis parallel to or coincident with the axis 13;
- a second step in which the initial end of the new roving is wound about the old roving in operation by an air swirl which rotates about the rovings and also has a component in the direction of advancement of the roving in operation so as to form a number of helical turns sufficient to generate a level of friction such as to overcome the dragging force;
- possible breakage of the old roving;
- a third step in which the joined rovings are inserted into the drafting device.

To avoid subsequent defects in the yarn being produced, the tail end of the old roving is also wound about the (new) roving in operation, which is taut along a rectilinear axis. Again in this case, the winding is achieved by a further air swirl rotating about the rovings and having a component in the opposite direction to the direction of advancement of the rovings in operation so as to form further helical turns.

The tail end of the old roving can be formed either by programmed breakage of the roving or by natural depletion of the bobbin.

The first case is however preferred because it reduces to a minimum a region which is critical as it can easily become a source of imperfection in the yarn being produced.

Claims

1. A roving joining device (1) applicable in particular to spinning machines, characterised by comprising a first device (3, 4) for joining the initial end of the (new) roving originating from a full bobbin (9) to the (old) roving originating from a depleting bobbin (8), and a second device (3, 5) for joining the tail end of the old roving to the new roving already in operation, said first device(3, 4) comprising:

- a first essentially tubular guide element (3) the axis (13) of which is positioned parallel to the axis of movement of the roving in operation;
- a nozzle (4) feeding compressed air into the interior of said tubular guide element (3) and inclined such that the generated jet (4) also has a component in the same direction as the direction of advancement of the roving in operation;

said second device comprising:

- a second essentially tubular guide element (3) the axis (13) of which is positioned parallel to the axis of movement of the roving in operation;
- a second nozzle (5) feeding compressed air into the interior of said tubular guide element (3) and inclined in the opposite direction to the direction of advancement of the new roving in operation.

2. A device as claimed in claim 1, characterised in that the first and second tubular guide element are of open cross-section because of the presence of a longitudinal slit (12) and are connected together to form a single element (3).

3. A device as claimed in claims 1 and/or 2, characterised in that the shape of the open cross-section of the tubular guide element (3) is round.

4. A device as claimed in claims 1 and/or 2, characterised in that the shape of the open cross-section of the tubular guide element (3) is elliptical.

5. A device as claimed in claims 1 and/or 2, characterised in that the shape of the open cross-section of the tubular guide element (3) is a circumferential involute.

6. A device as claimed in claims 1 and/or 2, characterised in that the shape of the open cross-section of the tubular guide element (3) is an Archimedes spiral.

7. A device as claimed in claim 1, characterised by comprising, for locking the depleting roving, a device (2) positioned upstream of the tubular guide element (3).

8. A roving joining device applicable in particular to spinning machines, comprising a first device for joining the initial end of the (new) roving originating from a full bobbin (9) to the (old) roving originating from a depleting bobbin (8), and a second device for joining the tail end of the old roving to the new roving, characterised in that said second device comprises:

- a tubular guide element (3) the axis (13) of which is positioned parallel to the axis of movement of the roving in operation;
- a nozzle (5) feeding compressed air into the interior of said guide element (3) and inclined in the opposite direction to the direction of advancement of the new roving in operation.

9. A method for joining together at least two rovings in a spinning machine, characterised by comprising:

- a first step in which the initial end of the new roving is positioned to the side of roving in operation which is taut along a rectilinear axis;
- a second step in which the initial end of the new roving is wound about the roving in operation by an air swirl which rotates about the rovings and also has a component in the direction of advancement of the roving in operation so as to

form a number of helical turns sufficient to generate a level of friction such as to ensure dragging;

- a third step in which the joined rovings are inserted into the drafting device.

10. A method as claimed in claim 9, characterised in that the tail end of the old roving is also wound about the (new) roving in operation, and hence taut along a rectilinear axis, by a further air swirl rotating about the rovings and having a component in the opposite direction to the direction of advancement of the rovings in operation, so as to form further helical turns.

11. A method as claimed in claim 9 or 10, characterised in that the tail end of the old roving is formed by the programmed breakage of the roving.

12. A method as claimed in claim 9 or 10, characterised in that the tail end of the old roving is formed by natural emptying of the bobbin.

13. A method for joining together at least two rovings in a spinning machine, characterised in that the tail end of the old roving is wound about the (new) roving in operation and hence taut along a rectilinear axis, by an air swirl rotating about the rovings and having a component in the opposite direction to the direction of advancement of the rovings in operation so as to form further helical turns.

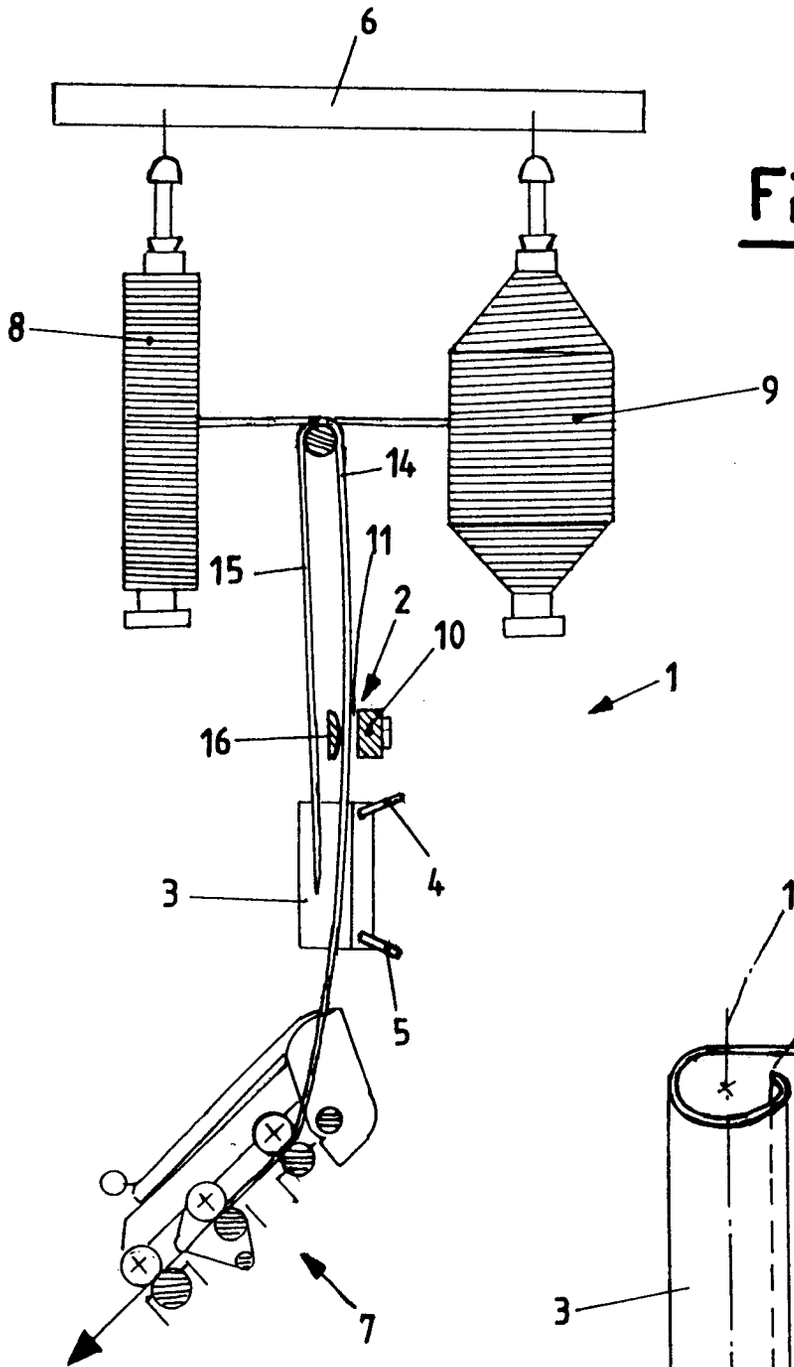


Fig.1

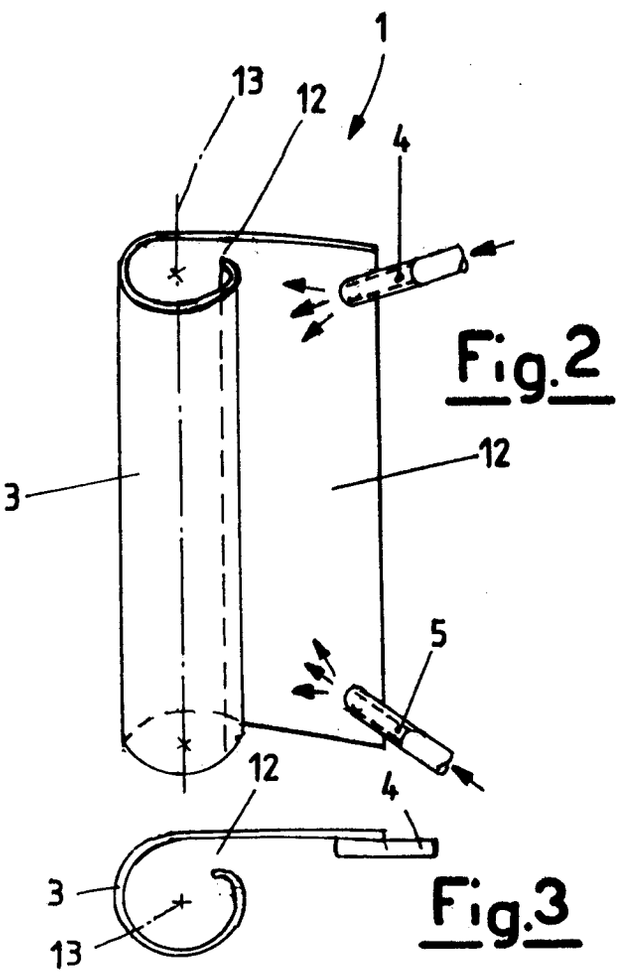


Fig.2

Fig.3

Fig.4E

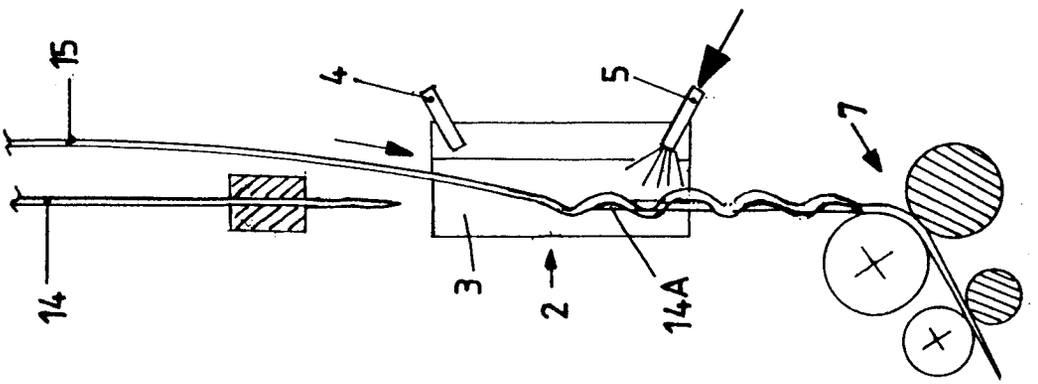


Fig.4D

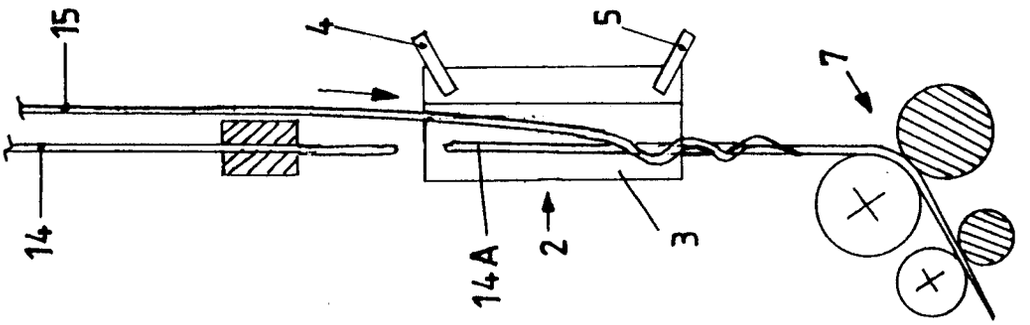


Fig.4C

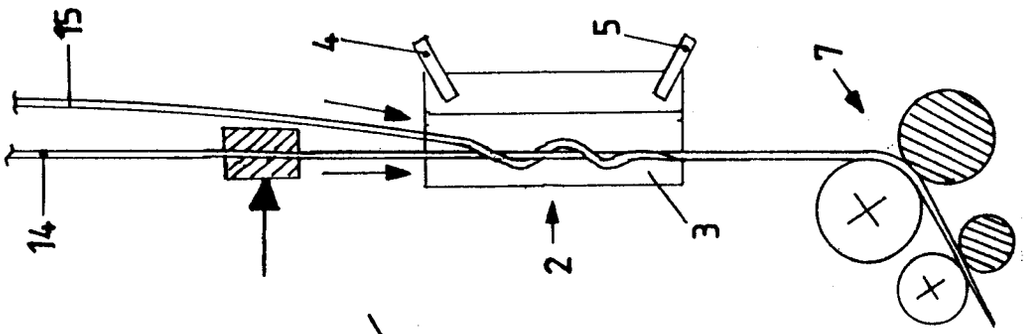


Fig.4B

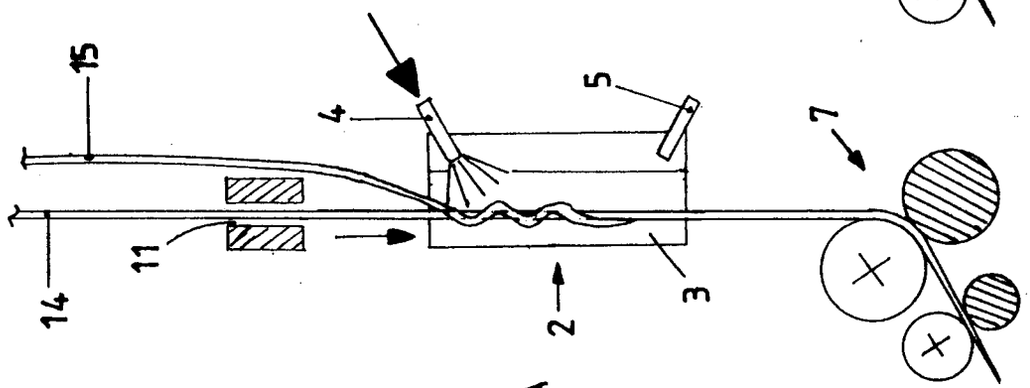
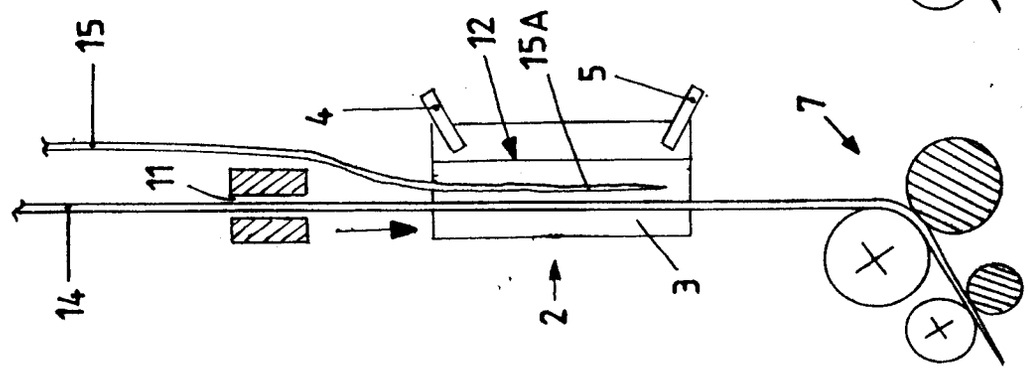


Fig.4A



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EUROPEAN SEARCH REPORT

Application Number
EP 95 20 2742

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.6)
X	DE-A-31 14 538 (W.SCHLAFHORST & CO) * figure 1 * ---	1-8	D01H9/00 B65H69/06
A	DE-A-36 12 229 (MURATA KIKAI K.K.) * page 13, line 27 - page 14, line 5; figures 1,8 * ---	1,9	
A	DE-A-39 39 881 (MASCHINENFABRIK RIETER AG) * the whole document * ---	1-13	
A	PATENT ABSTRACTS OF JAPAN vol. 4 no. 42 (C-005) ,3 April 1980 & JP-A-55 016981 (MURATA MACH LTD) * abstract * -----	1-13	

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

D01H
B65H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	21 February 1996	Tamme, H-M

CATEGORY OF CITED DOCUMENTS

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