

(19)



(11)

EP 3 371 355 B1

(12)

EUROPEAN PATENT SPECIFICATION

(45) Date of publication and mention
of the grant of the patent:

04.12.2019 Bulletin 2019/49

(51) Int Cl.:

D02G 1/12 (2006.01)

(86) International application number:

PCT/IB2016/056210

(21) Application number: **16801575.8**

(22) Date of filing: **17.10.2016**

(87) International publication number:

WO 2017/077411 (11.05.2017 Gazette 2017/19)

(54) CRIMPING MACHINE FOR THE TREATMENT OF SYNTHETIC FIBRES

CRIMPMASCHINE ZUR BEHANDLUNG VON SYNTHETISCHEN FASERN

MACHINE DE TEXTURATION POUR LE TRAITEMENT DE FIBRES SYNTHÉTIQUES

(84) Designated Contracting States:

**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB
GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO
PL PT RO RS SE SI SK SM TR**

(72) Inventor: **ROVELLINI, Marco**

29122 Piacenza (IT)

(30) Priority: **02.11.2015 IT UB20155106**

(74) Representative: **Zermani, Umberto**

Bugnion S.p.A.

Viale Lancetti, 17

20158 Milano (IT)

(43) Date of publication of application:

12.09.2018 Bulletin 2018/37

(56) References cited:

EP-A1- 2 098 622 GB-A- 1 016 139

GB-A- 1 265 301 US-A- 3 766 726

US-A- 4 074 405 US-A- 5 564 174

(73) Proprietor: **M.A.E. S.p.A.**

29122 Piacenza (IT)

Note: Within nine months of the publication of the mention of the grant of the European patent in the European Patent Bulletin, any person may give notice to the European Patent Office of opposition to that patent, in accordance with the Implementing Regulations. Notice of opposition shall not be deemed to have been filed until the opposition fee has been paid. (Art. 99(1) European Patent Convention).

Description

[0001] The present invention relates to a crimping machine, namely an apparatus for processing chemical fibers intended to confer to these fibers, being smooth out-bound the forming units, a continuous corrugated configuration, called "crimp", which is essential to allow the subsequent spinning.

[0002] The present invention finds particular application in the processing of chemical fibers (e.g. textiles), both synthetic and man-made, such as cellulosic, polyolefin, aramid, polyamide, polyester, polyvinyl, polyacrylic fibers, etc.

[0003] Note that in the currently known technical description it will be made explicit reference to the polyester fibers, without however losing generality, because the object of the present invention can also be applied and used in the treatment and processing of other kinds of chemical fibers, including but not limited to those listed above.

[0004] As above mentioned, the crimping machines are devices placed along the spinning lines of the chemical fibers, in particular operatively placed downstream of the spinning stations (in cui the spinning rovings are produced at very high speed), in the second processing stage of fibers.

[0005] In this second stage, the fibers are generally treated both mechanically and chemically (oiling and ironing) before being sent in the form of a continuous "cable" of material to the crimping machine.

[0006] Nowadays it is mainly known a single solution, with more or less variations, to obtain an efficient crimping.

[0007] This solution provides the abutment of a pair of counterrotating drums, both motorized, to define a drive section of the fibers.

[0008] Such fibers are driven inside a crimping room, so defined because it constitutes the housing in which the fibers are subjected to the mechanical stress that leads them to a collapse by peak load.

[0009] In fact, the two drums drive the fibers inside the crimping chamber at a predetermined speed, such that the pressure generated at the contact with the boundaries of the room, or with the previously crimped fibers, involves a permanent "curling" of the fibers.

[0010] Disadvantageously, this type of crimping introduces several problems related both to reliability and productivity when the working speeds exceed certain values (from 500 to 1200 m/min according to the design of the apparatus). One prior art crimping machine of this type is known from document US 3 766 726.

[0011] With regard to reliability, the presence of a pair of metal rollers abutted and movable away and towards each other to vary the passage section based on the thickness of the fiber entails a considerable wear on the boundaries of said rollers.

[0012] In fact, at high-speed, given the low thickness of the fibers (tenths of a millimeter) and their high speed

of advance, the "movable" drum tends to oscillate and hop on the fixed one determining a hammering effect highly wearing and sometimes dangerous.

[0013] With regard to productivity, the high inertia of the rollers (due to the need to generate a sufficient friction to drive the fiber which involves a heavy dimensioning) imposes significant constraints to the advancement speed, or peripheral speed, of the same, which is hardly more than 400 m/min.

[0014] Such a speed is typical of a "2-step spinning process" like that of the spun polyester, where the crimping must be conducted at this limit speed (second step) corresponding to not more than a fraction of the optimum advancement speed of the fiber in the previous spinning step (first step, typically variable between 1200 and 2000 m/min and above).

[0015] In other words, in the known art the crimping machine is the "bottleneck" of the production process.

[0016] To resolve this problem, several years ago the same Applicant realized a high-speed crimping machine, published in patent document US 5564174, which replaced the two drums with a pair of metal belts having respective operating portions placed opposed to each other.

[0017] In that solution, the metal belts are maintained substantially adherent, in order to generate a sufficient friction, by means of pressurization action by suitable blowing means.

[0018] Despite this actually allows to fix the problems of inertia and wear of the traditional crimping machines, the poor grip of the belts on the fibers makes it difficult the application at industrial level, where the effect of push/drive on the fiber presented to the crimping chamber may be insufficient to ensure absolute reliability of the process.

[0019] The object of the present invention is to provide a crimping machine allowing to overcome the above-mentioned drawbacks of the known art.

[0020] In particular, it is an object of the present invention to provide a crimping machine with high performance both in terms of production speed and reliability.

[0021] Yet, another object of the present invention is to provide a crimping machine which is compact and easy to manufacture.

[0022] Said objects are achieved by a crimping machine having the features of one or more of the following claims from 1 to 17 and in particular by a crimping machine comprising a conduit extending along an advancement direction between an inlet opening, associable to means for feeding a bundle of fibre material, and an outlet opening, a drive unit arranged along said conduit in order to split it into a first and a second portion, comprising a first and a second drive member abutted to each other in correspondence of at least a maximum proximity area, in cui they exert a driving action on said bundle of fibre material, and a crimping chamber arranged immediately downstream of the drive unit, and configured to receive said bundle of fibre material contributing to the mechan-

ical deformation of the same by peak load.

[0023] Note that "immediately downstream" indicates that the crimping chamber is preferably abutted to and facing a discharge outlet of the drive unit.

[0024] Therefore, the crimping machine according to the present invention is a compact machine, wherein all the components are identifiable between them in a single device.

[0025] According to one aspect of the present invention, the first and the second drive member are shaped so as to define a deviation along said conduit such that said first portion of the conduit has a different orientation with respect to said second portion.

[0026] Furthermore, preferably the first member, at least in correspondence of said maximum proximity area, is flexible in order to move towards or away from the second member according to the thickness of said bundle.

[0027] Advantageously, the presence of a deviation in the conduit allows to increase the frictional force on the fiber, pushed by its own inertia against the deviation (i.e. against the conduit walls), with no need to increase the contact pressure between the two drive members, thus allowing to obtain maximum performance in terms of production speed.

[0028] Preferably, the first drive member comprises at least one belt in part lying on said second member so that the second member contacts the belt at the maximum proximity area and keeps it in tension.

[0029] More preferably, the first drive member comprises at least one pair of rollers and a belt wound around said rollers movable along said advancement direction, in cui the belt, at least at said maximum proximity area, has a concave conformation defining at least in part the above-mentioned deviation of the conduit.

[0030] More preferably, the second drive member comprises at least one drum around which, in correspondence of said maximum proximity area, the belt of the first member is partially wrapped.

[0031] Advantageously, therefore, the maximum proximity area (or contact area) is defined between the belt of the first member and the drum of the second member, ensuring on one hand the maximum reduction of inertia (the drum has no other movement than rotation on its own axis, the belt instead follows the variation of the bundle thickness but has very low inertia) and on the other the maximum drive effect (concave portion and drum).

[0032] To maximize the yield of the machine, also, the first member of the drive unit includes blowing means placed inside the belt (i.e. inside the ring path defined by the belt) and configured to keep it adherent to the drum and in tension during operation.

[0033] So, thanks to the coupling between the curved belt and the drum, interposed between the two rollers driving the belt, the crimping machine is very compact and easy to transport and install.

[0034] These and other features and advantages will become more apparent from the following exemplary,

therefore non-limiting, description of a preferred, therefore not exclusive, embodiment of a crimping machine according to what is shown in the appended drawing tables, in which:

- Figure 1 shows a schematic side view of a crimping machine according to the present invention, in an operative condition;
- Figure 2 shows a schematic side view of the crimping machine of Figure 1 in a rest condition;
- Figure 3 shows a detail of Figure 1.

[0035] With reference to the appended figures, number 1 indicates a crimping machine according to the present invention.

[0036] The expression crimping machine 1 defines a device for the treatment of fiber material, mainly synthetic fibers, configured to perform a continuous sequence of corrugations or pleats of linear filaments coming from previous processing stations.

[0037] The treated fibers are typically chemical, such as cellulosic, polyolefin, aramid, polyamide, polyester, polyvinyl, polyacrylic fibers, etc.

[0038] The crimping machine 1 is therefore to be used in a spinning system of such fibers, both intended for the textile industry and for another industry.

[0039] The crimping machine 1 therefore includes a conduit 2 extending along an advancement direction "A" between an inlet opening 2a, associable to means for feeding (not shown) a bundle "F" of fibre material, and an outlet opening 2b.

[0040] It is also provided a drive unit 3 arranged along the conduit 2.

[0041] The drive unit 3 splits the conduit into a first (inlet) portion T1 and a second (output) portion T2.

[0042] The drive unit 3 comprising a first drive member 4 and a second drive member 5, reciprocally abutting at least at a maximum proximity area "Z", in cui they exert a driving action on said bundle "F" of fibre material.

[0043] Preferably, the maximum proximity area "Z" is a contact area between the two drive members 4, 5, wherein the reduced or preferably absent passage section along with the movement of the members in the advance direction "A" generates a drive effect on the fibers.

[0044] In the preferred embodiment, the first 4 and the second member 5 are substantially in contact, with the possibility to move (elastically) away and towards each other based on the thickness of the bundle "F" of fiber material.

[0045] Therefore, the first member 4, at least in correspondence of the maximum proximity area "Z", is flexible in order to move towards or away from the second member 5 according to the thickness of said bundle "F".

[0046] Furthermore, note that the first 4 and the second drive member 5 are (rigidly) movable towards and away from each other between a withdrawn position, rest, and an approached position, operational.

[0047] All the considerations related to the distances

and gaps that are created along the conduit 2 are made in this text with reference to the approached position of the two members, being the main purpose of the withdrawn position that of cleaning and maintenance, but not operational.

[0048] The first 4 and the second drive member 5 are shaped so as to define a deviation "D" along said conduit 2, such that the inlet opening of the conduit 2 (thus the first portion T1) has a different orientation with respect to the outlet opening (thus to the second portion T2).

[0049] Therefore, the conduit 2 has a first T1 and a second portion T2 having respectively a first and a second orientation, out of phase between them by an angle defined by said deviation "D".

[0050] The first 4 and the second drive member 5 therefore delimit in part the conduit 2 and determine a curve or a deviation "D" of it in correspondence of which there is an increase of the frictional force, namely the drive effect, in the bundle "F" of material.

[0051] Preferably, the first drive member 4 comprises at least one belt 7 in part lying on said second member 5 so that said second member 5 contacts the belt 7 at the maximum proximity area "Z" and keeps it in tension.

[0052] Preferably, the first drive member 4 comprises at least a pair of rollers 6 and a belt 7 wrapped around them.

[0053] The rollers 6 (at least one of them) are motorized to impart to the belt 7 a movement along the advance direction "A".

[0054] Therefore, the belt 7 has an operative portion 7a and a return portion 7b between the two rollers 6.

[0055] The operative portion 7a is proximal to the second drive member 5, while return portion 7b is distal from it.

[0056] The belt 7, at least in correspondence of said maximum proximity area "Z", has a concave shape defining at least partially the deviation "D" of the conduit 2.

[0057] Therefore, the operating portion 7a has a concave shape defining the deviation "D".

[0058] Preferably, however, the return portion 7b has a convex shape.

[0059] In particular, in the belt 7 is made of flexible material; preferably the belt is made of metal, more preferably of stainless steel, but also of synthetic composite material with textile core made of carbon fiber or glass fiber.

[0060] In the preferred embodiment, in the approached position the first portion 7a has a convex shape, while in the withdrawn position the first portion 7a has a substantially linear shape.

[0061] Dimensionally, this belt 7 has a thickness lower than 1 mm, preferably lower than 0.5 mm, more preferably of about 0.2 mm.

[0062] The second drive member 5 comprises at least one drum 8 around which, in correspondence of said maximum proximity area "Z", the belt 7 of the first member 4 is partially wrapped.

[0063] The conduit 2 is then at least partially delimited

between the belt 7 and the drum 8; more precisely, the maximum proximity area "Z" is defined between said belt 7 and said drum 8.

[0064] The drum 8 is therefore in part interposed between the rollers 6 of the first member 4 of entrainment; thereby the operating portion 7a of the belt 7 is wound on the drum 8.

[0065] In other words, a line "L" connecting the rotation centres of the rollers 6 of the first drive member 4 is placed at a distance from a rotation centre of the drum 8, which is less than the sum of the diameters of said drum 8 and one of said rollers 6.

[0066] Note that the term "distance" in this text refers to a measurement assessed orthogonally to the connecting line "L".

[0067] Therefore, the drum 8 defines the concavity of the operating portion 7a of the belt 7.

[0068] In this way, since the boundaries of the drum 8 interposed between the two points of attachment in the belt 7 on the rollers 6, the belt 7 itself, i.e. its operating portion 7a, is constrained to wrap the drum 8 by determining the deviation "D".

[0069] So, at least in an operating configuration, the maximum proximity area "Z" extends curved between an inlet area Z_{in} and an outlet area Z_{out} , each defined between the periphery of the drum 8 and the periphery of a respective roller 6 of the first drive member 4.

[0070] In certain compact embodiments, the inlet opening and the inlet area Z_{in} are substantially coincident.

[0071] Alternatively, it is expected the presence of the first portion T1 of feeding of material to the drive unit 3, and therefore to the inlet area Z_{in} .

[0072] Preferably, in the inlet areas Z_{in} and output areas Z_{out} the boundaries of the drum 8 is placed at a distance lower than 1 mm from the respective roller 6, more preferably lower than 0.5 mm, even more preferably of about 0.2 mm, increased by the expected thickness of the belt of fiber to be crimped, typically less than 0.5 mm.

[0073] Note that the drum 8 and the belt 7 works substantially at the same speed along the advance direction, as well as to the same speed of the bundle "F" of material coming from a plant for the production of the fiber.

[0074] Advantageously, in this way the speed of realization of the crimping is kept high, comparable to that of a production/spinning plant, considerably increasing the productivity of the line.

[0075] In order to maintain the maximum adhesion between the belt 7 and the drum 8 (i.e. the maximum pressure on the bundle "F"), the first drive member 4 comprises blowing means 9 placed inside said belt 7 and configured to keep it adherent to the drum 8 and in tension during the operation.

[0076] Preferably, the blowing means 9 are operatively active on the return portion 7a of the belt 7, in order to tension said portion away from the drum 8, generating the required tension to drive the fiber while ensuring the possibility to adapt the position of the operating portion

7a (thus the amplitude of the maximum proximity area "Z") to the thickness of the bundle "F".

[0077] Therefore, the blowing means 9 generate substantially a "balloon effect" in correspondence of the return portion of the belt 7.

[0078] Therefore, the tension of the belt 7 is determined by a synergistic effect of the blowing means 9 and of the position of the drum 8.

[0079] The blowing means 9 are preferably defined by at least one distributing member 9a configured to dispense a pressurized fluid (for example air or water vapor) on an inner face of the strip 7 in order to advance it toward the second drive member 5.

[0080] In this way, the belt 7 abuts on the bundle "F" of fibers as a flexible membrane under the effect of the fluid pressure, remaining adherent to the fiber.

[0081] On the contrary, the drum 8 remains rigid and defines an abutment for the fibers, increasing the friction and therefore the drive effect.

[0082] Furthermore, in order to limit the elastic movement away from the second member 5, the first drive member 4 includes an abutment member 15 distal from the second member 5 with respect to the belt 7 and placed at a predetermined distance from said belt 7.

[0083] Advantageously, it is possible in this way to provide the belt 7 with a mechanical abutment that cooperates with the tension to prevent the accumulation of fiber between the belt 7 itself and the drum 8.

[0084] Preferably, the abutment member 15 is defined by a skid 15a made of anti-friction material.

[0085] "Anti-friction" material in this text defines materials having very low friction coefficient and, preferably, a high resistance to wear and crushing.

[0086] Preferably, the dynamic friction coefficient of the skid 15a with the steel of the belt 7 is less than 0.2, more preferably less than 0.1.

[0087] In the preferred embodiment, the abutment member 15 (i.e. the skid 15a) is made of graphite or the like.

[0088] Preferably, said abutment member has a concave surface contacting with the belt 7, preferably substantially matching the curvature of the operating portion 7a of the belt 7.

[0089] In the preferred embodiment, the abutment member 15 is placed at a distance from the belt 7 (in the operating condition) from 0.5 and 2 mm (preferably equal to about 1 mm) exceeding the expected thickness of the bundle "F".

[0090] Immediately downstream of the drive unit 3, the machine 1 includes a crimping chamber 10 configured to receive the bundle "F" of fibre material contributing to the mechanical deformation of the same by peak load.

[0091] Note that the crimping chamber 10 has an orientation corresponding to said second portion T2 of the conduit.

[0092] In other words, the crimping chamber 10 is part of said second portion T2 defines an extension of it.

[0093] Note that, preferably, the crimping is made part-

ly inside the drive unit 3 before entering the crimping chamber 10, in which it will complete.

[0094] Therefore, the crimping preferably begins as a result of the combined action of the drum 8 and the belt 7 in the maximum proximity area "Z".

[0095] The crimping chamber 10 is a chamber with a confined volume, in which, when used, is driven the bundle "F" of high-speed material by means of the drive unit 3.

[0096] Preferably the crimping chamber 10 faces directly to the outlet area Z_{out} of the drive unit; in other words, the output area of the drive unit substantially corresponds to an inlet portion of the crimping chamber 10.

[0097] Therefore, there are no other operating means between the drive unit 3 and the crimping chamber 10.

[0098] The sudden stop of the advancement due to the confinement in the chamber involves a mechanical deformation of the fibers, which assume a characteristic corrugated shape on the plane (two-dimensional crimping).

[0099] The crimping chamber 10 thus includes an inlet portion 10a, placed in correspondence of the outlet area Z_{out} of the drive unit 3, and an operating portion 10b shaped to determine said load peak deformation of the fibers.

[0100] The inlet portion 10a is preferably shaped as a blade engaged in proximity of the drum 8 and of a roller 6 of the first member 4.

[0101] The inlet portion 10a therefore defines a wedge which engages in the proximity of the outlet area Z_{out} , fully limiting the gap between the drive unit 3 and the crimping chamber 10.

[0102] However, not being able to adhere the inlet portion to the rotatable members, between the output area Z_{out} and the inlet portion 10 it is provided a detachment zone 11.

[0103] In this detachment zone 11 it is provided at least one blowing nozzle 12 for guiding the bundle "F" of fiber material within the inlet portion 10a. The blown fluid, depending on the treated fiber type, may be gaseous such as steam or air, but also liquid such as water.

[0104] In the most common case of use of steam, this nozzle 12 is associated with means for generation of steam 13 and is configured to dispense pressurized steam from the nozzle 12 itself in order to constrain the movement of the guiding fibers towards the crimping chamber 10.

[0105] Alternatively, the means for steam generation are replaced with an air compressor configured to dispense, through a heater, hot air (up to 350°) or, with a dispensing circuit, pressurized heated water.

[0106] The operating portion 10b of the crimping chamber 10 comprises at least two pairs 14 of walls longitudinal to each other, facing two by two to delimit it laterally.

[0107] More precisely, at least the walls of a pair 14 are movable towards and away from each other between an active position, in which they are proximal, and an inactive position, in which they are distal.

[0108] In the active position, therefore, the side walls

14 are approached until the contact to determine the deformation of the fiber.

[0109] Preferably, these walls 14 are pivoted to a frame in the proximal area to the drive unit 3 and are configured to reciprocally rotate away and towards each other.

[0110] The movement is preferably obtained by means of hydraulic/pneumatic actuators, but it may also include other types of activations.

[0111] The invention achieves the intended objects and achieves important advantages.

[0112] In fact, the presence of a deviation in the drive conduit allows to maintain a high friction with the fibers, i.e. the drive effect, even without the need to increase the operating pressure of the active members in the drive.

[0113] Furthermore, by coupling a drum with a belt it has been possible matching the lightness of the latter with the robustness of the abutment provided by the drum, allowing to increase considerably the operating stability.

Claims

1. Crimping machine for the treatment of synthetic fibres, comprising:

- a conduit (2) extending along an advancement direction (A) between an inlet opening (2a), associable to means for feeding a bundle (F) of fibre material, and an outlet opening (2b);
- a drive unit (3) arranged along said conduit (2) and comprising a first drive member (4) and a second drive member (5), reciprocally abutting at least at a maximum proximity area (Z) in which they exert a driving action on said bundle (F) of fibre material;
- a crimping chamber (10) arranged immediately downstream of the drive unit (3), and configured to receive said bundle (F) of fibre material contributing to the mechanical deformation of the same by peak load;

characterized in that the first drive member (4) and the second drive member (5) are configured so as to define a deviation (D) along said conduit (2) such that said inlet opening (2a) of the conduit (2) has different orientation with respect to said outlet opening (2b), wherein the first member (4), at least at said maximum proximity area (Z), is flexible to move closer or further away from the second member (5) as a function of the thickness of said bundle (F), wherein the conduit (2) has a first (T1) and a second portion (T2) having respectively a first and a second orientation, out of phase between them by an angle defined by said deviation (D); said crimping chamber (10) being a part of said second portion (T2) defining an extension of it.

2. Crimping machine according to claim 1, **characterized in that** said first drive member (4) comprises at least one belt (7) in part lying on said second member (5) so that said second member (5) contacts the belt (7) at said maximum proximity area (Z) and keeps it in tension.

3. Crimping machine according to claim 1 or 2, **characterized in that** said first drive member (4) comprises at least one pair of rollers (6) and a belt (7) wound around said rollers (6) movable along said advancement direction (A); said belt (7), at least at said maximum proximity area (Z), having a concave conformation defining at least in part said deviation (D) of the conduit (2).

4. Crimping machine according to claim 2 or 3, **characterized in that** said second drive member (5) comprises at least one drum (8) around which, in correspondence of said maximum proximity area (Z), said belt (7) is partially wound.

5. Crimping machine according to claim 4, **characterized in that** said belt (7) has an operating portion (7a) and a return portion (7b), wherein the operating portion (7a) has a concave conformation to define said deviation (D) and the return portion (7b) has a convex conformation.

6. Crimping machine according to claim 4 or 5, **characterized in that** said drum (8) is partly interposed between said rollers (6) of the first drive member (4) so that an operating portion (7a) of the belt (7) appears wrapped around and stretched upon said drum (8).

7. Crimping machine according to any one of claims 4 to 6, **characterized in that** a line (L) connecting the rotation centres of the rollers (6) of the first drive member (4) is placed at a distance from a rotation centre of the drum (8), which is less than the sum of the diameters of said drum (8) and one of said rollers (6).

8. Crimping machine according to any one of claims 4 to 7, **characterized in that**, in an operating configuration, said maximum proximity area (Z) extends curved between an inlet area (Z_{in}) and an outlet area (Z_{out}), each defined between the periphery of the drum (8) and the periphery of a respective roller (6) of the first drive member (4).

9. Crimping machine according to claim 8, **characterized in that** in said inlet area (Z_{in}) and said outlet area (Z_{out}), the periphery of the drum (8) is placed at a distance of less than 1 mm from the respective roller (6), preferably less than 0.5 mm.

10. Crimping machine according to any of claims from 2 to 9, **characterized in that** the first drive member (4) comprises blowing means (9) placed inside said belt (7) and configured to keep it adherent to the drum (8) and in tension during the operation.
11. Crimping machine according to any of claims from 2 to 10, **characterized in that** the first drive member (4) comprises an abutment body (15) distal from the second drive member (5) with respect to the belt (7) and placed at a predetermined distance from said belt (7) to limit its movement away from the second member (5).
12. Crimping machine according to claim 11, **characterized in that** said abutment body (15) is defined by a shoe (15a) made of anti-friction material.
13. Crimping machine according to any of claims from 2 to 12, **characterized in that** said belt (7) is made of metal, preferably stainless steel, with a thickness less than 1 mm, preferably less than 0.5 mm.
14. Crimping machine according to any one of the preceding claims, **characterized in that** said first (4) and/or said second drive member (5) are movable closer or further away from each other between a spaced rest position and an approached operating position.
15. Crimping machine according to any one of the preceding claims, **characterized in that** said crimping chamber (10) comprises an entry portion (10a) located in correspondence of an output area of the drive unit (3) and an operating portion configured to determine said peak load deformation of the fibres; said machine also comprising at least one blowing nozzle (12) interposed between said outlet area (Z_{out}) and said entry portion (10a), and configured to guide the bundle (F) of fibre material within said entry portion (10a).
16. Crimping machine according to claim 15, **characterized in that** said nozzle (12) is associated with means for generation of steam (13) and configured to supply steam under pressure, or to a compressor for delivering heated air or to a dispensing circuit of pressurized hot water.
17. Crimping machine according to any one of the preceding claims, **characterized in that** said crimping chamber (10) comprises an entry portion (10a) placed in correspondence of an output area of the drive unit (3) and an operating portion (10b) configured to determine said peak load deformation of the fibres; said operating portion (10b) comprising at least a pair of walls (14) facing each other and movable closer or further away from each other between

an active position, in which they are proximal, and an inactive position, in which they are distal.

5 Patentansprüche

1. Crimpmaschine zur Behandlung von synthetischen Fasern, umfassend:

- eine Leitung (2), die sich entlang einer Vorschubrichtung (A) zwischen einer Einlassöffnung (2a), die mit Mitteln zum Zuführen eines Bündels (F) aus Fasermaterial assoziierbar ist, und einer Auslassöffnung (2b) erstreckt;
- eine Antriebseinheit (3), die entlang der Leitung (2) angeordnet ist und ein erstes Antriebselement (4) und ein zweites Antriebselement (5) umfasst, die gegenseitig mindestens an einen maximalen Näherungsbereich (Z) anschlagen, in dem sie eine Antriebswirkung auf das Bündel (F) aus Fasermaterial ausüben;
- eine Crimpkammer (10), die unmittelbar nach der Antriebseinheit (3) angeordnet und ausgelegt ist, um das Bündel (F) aus Fasermaterial aufzunehmen, und die zu dessen mechanischer Verformung durch Höchstbelastung beiträgt, **dadurch gekennzeichnet, dass** das erste Antriebselement (4) und das zweite Antriebselement (5) ausgelegt sind, um eine Abzweigung (D) entlang der Leitung (2) zu definieren, sodass die Einlassöffnung (2a) der Leitung (2) eine andere Ausrichtung als die Auslassöffnung (2b) aufweist, wobei das erste Element (4) zumindest am maximalen Näherungsbereich (Z) flexibel ist, um sich hinführend zum oder wegführend vom zweiten Element (5) je nach der Dicke des Bündels (F) zu bewegen,

wobei die Leitung (2) einen ersten (T1) und einen zweiten Abschnitt (T2) aufweist, aufweisend jeweils eine erste und eine zweite Ausrichtung, die um einen Winkel voneinander versetzt sind, definiert durch die Umlenkung (D), wobei die Crimpkammer (10) ein Teil des zweiten Abschnitts (T2) ist und eine Ausdehnung von diesem definiert.

2. Crimpmaschine nach Anspruch 1, **dadurch gekennzeichnet, dass** das erste Antriebselement (4) mindestens ein Band (7) umfasst, das teils auf dem zweiten Element (5) aufliegt, sodass das zweite Element (5) das Band (7) am maximalen Näherungsbereich (Z) berührt und dieses gespannt hält.
3. Crimpmaschine nach Anspruch 1 oder 2, **dadurch gekennzeichnet, dass** das erste Antriebselement (4) mindestens ein Paar Walzen (6) und ein Band (7) umfasst, das um diese Walzen (6) gewunden ist, bewegbar entlang der Vorschubrichtung (A), wobei

das Band (7) mindestens am maximalen Näherungsbereich (Z) eine konkave Beschaffenheit aufweist, definierend mindestens teilweise die Umlenkung (D) der Leitung (2).

4. Crimpmaschine nach Anspruch 2 oder 3, **dadurch gekennzeichnet, dass** das zweite Antriebselement (5) mindestens eine Trommel (8) umfasst, um die das Band (7) am maximalen Näherungsbereich (Z) teilweise gewunden ist. 5
5. Crimpmaschine nach Anspruch 4, **dadurch gekennzeichnet, dass** das Band (7) einen Betriebsabschnitt (7a) und einen Rückkehrabschnitt (7b) aufweist, wobei der Betriebsabschnitt (7a) eine konkave Beschaffenheit aufweist, um die Umlenkung (D) zu definieren, und der Rückkehrabschnitt (7b) eine konvexe Beschaffenheit aufweist. 10
6. Crimpmaschine nach Anspruch 4 oder 5, **dadurch gekennzeichnet, dass** die Trommel (8) teilweise zwischen den Walzen (6) des ersten Antriebselements (4) eingesetzt ist, sodass ein Betriebsabschnitt (7a) des Bands (7) rund um die Trommel (8) gewickelt und auf dieser gestreckt ist. 15
7. Crimpmaschine nach einem der Ansprüche 4 bis 6, **dadurch gekennzeichnet, dass** eine Leitung (L), die die Rotationszentren der Walzen (6) des ersten Antriebselements (4) verbindet, in einem Abstand vom Rotationszentrum der Trommel (8) angeordnet ist, der geringer ist als die Summe der Durchmesser der Trommel (8) und einer der Walzen (6). 20
8. Crimpmaschine nach einem der Ansprüche 4 bis 7, **dadurch gekennzeichnet, dass** der maximale Näherungsbereich (Z) sich in einer Betriebskonfiguration gekrümmt zwischen einem Einlassbereich (Z_{in}) und einem Auslassbereich (Z_{out}) erstreckt, wobei ein jeder zwischen dem Umfang der Trommel (8) und dem Umfang einer jeweiligen Walze (6) des ersten Antriebselements (4) definiert ist. 25
9. Crimpmaschine nach Anspruch 8, **dadurch gekennzeichnet, dass** der Umfang der Trommel (8) im Einlassbereich (Z_{in}) und im Auslassbereich (Z_{out}) in einem Abstand von weniger als 1 mm von der jeweiligen Walze (6) angeordnet ist, vorzugsweise von weniger als 0,5 mm. 30
10. Crimpmaschine nach einem der Ansprüche 2 bis 9, **dadurch gekennzeichnet, dass** das erste Antriebselement (4) Blasmittel (9) umfasst, die im Band (7) angeordnet und ausgelegt sind, um dessen Haftung an der Trommel (8) und dessen Spannung während des Betriebs aufrechtzuerhalten. 35
11. Crimpmaschine nach einem der Ansprüche 2 bis 10, 40

dadurch gekennzeichnet, dass das erste Antriebselement (4) einen Anschlagkörper (15) umfasst, der vom zweiten Antriebselement (5) gegenüber dem Band (7) entfernt und in einem bestimmten Abstand vom Band (7) angeordnet ist, um dessen Bewegung wegführend vom zweiten Element (5) zu begrenzen. 45

12. Crimpmaschine nach Anspruch 11, **dadurch gekennzeichnet, dass** der Anschlagkörper (15) durch einen Schuh (15a) aus Gleitmaterial definiert ist. 50
13. Crimpmaschine nach einem der Ansprüche 2 bis 12, **dadurch gekennzeichnet, dass** das Band (7) aus Metall, vorzugsweise aus rostfreiem Stahl, mit einer Dicke von weniger als 1 mm, vorzugsweise von weniger als 0,5 mm, besteht. 55
14. Crimpmaschine nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** das erste (4) und/oder das zweite Antriebselement (5) hinführend zueinander oder wegführend voneinander zwischen einer beabstandeten Ruheposition und einer angenäherten Betriebsposition bewegbar sind.
15. Crimpmaschine nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** die Crimpkammer (10) einen Eingangsabschnitt (10a) umfasst, der an einem Ausgangsbereich der Antriebseinheit (3) angeordnet ist, und einen Betriebsabschnitt, der ausgelegt ist, um die Höchstbelastungsverformung der Fasern zu bestimmen, wobei die Maschine auch mindestens eine Blasdüse (12) umfasst, die zwischen dem Auslassbereich (Z_{out}) und dem Eingangsabschnitt (10a) angeordnet und ausgelegt ist, um das Bündel (F) aus Fasermaterial innerhalb dieses Eingangsabschnitts (10a) zu führen.
16. Crimpmaschine nach Anspruch 15, **dadurch gekennzeichnet, dass** die Düse (12) mit Mitteln zur Erzeugung von Dampf (13) assoziiert und ausgelegt ist, um Dampf unter Druck entweder einem Kompressor zuzuführen, um erhitzte Luft zuzuführen, oder einem Kreislauf zur Ausgabe von mit Druck beaufschlagtem Warmwasser.
17. Crimpmaschine nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** die Crimpkammer (10) einen Eingangsabschnitt (10a) umfasst, der an einem Ausgangsbereich der Antriebseinheit (3) angeordnet ist, und einen Betriebsabschnitt (10b), der ausgelegt ist, um die Höchstbelastungsverformung der Fasern zu bestimmen, wobei der Betriebsabschnitt (10b) mindestens ein Paar Wände (14) umfasst, die einander zugewandt und hinführend zueinander oder wegführend voneinander zwischen einer aktiven Position, in der

sie angenähert sind, und einer nicht aktiven Position, in der sie voneinander entfernt sind, bewegbar sind.

Revendications

1. Machine de texturation pour le traitement de fibres synthétiques, comprenant :

- un conduit (2) se prolongeant le long d'une direction de progression (A) entre une ouverture d'admission (2a), pouvant être associée à des moyens servant à alimenter un faisceau (F) de matériau fibreux, et une ouverture de sortie (2b) ;
 - une unité d'entraînement (3) disposée le long dudit conduit (2) et comprenant un premier organe d'entraînement (4) et un second organe d'entraînement (5) venant se mettre en butée réciproquement au moins en correspondance d'une zone de proximité (Z) maximale dans laquelle ils exercent une action d'entraînement sur ledit faisceau (F) de matériau fibreux ;
 - une chambre de texturation (10) disposée immédiatement en aval de l'unité d'entraînement (3) et configurée pour recevoir ledit faisceau (F) de matériau fibreux contribuant à la déformation mécanique de ce dernier par charge de pointe ;
- caractérisée en ce que** le premier organe d'entraînement (4) et le second organe d'entraînement (5) sont configurés de manière à définir une déviation (D) le long dudit conduit (2) de sorte que ladite ouverture d'admission (2a) du conduit (2) comporte une orientation différente par rapport à ladite ouverture de sortie (2b), dans laquelle le premier organe (4), au moins en correspondance de ladite zone de proximité (Z) maximale, est flexible pour se rapprocher ou s'éloigner du second organe (5) en fonction de l'épaisseur dudit faisceau (F),

dans laquelle le conduit (2) comporte une première (T1) et une seconde partie (T2) comportant, respectivement, une première et une seconde orientation déphasées entre elles par un angle défini par ladite déviation (D) ; ladite chambre de texturation (10) faisant partie de ladite seconde partie (T2) définissant son extension.

2. Machine de texturation selon la revendication 1, **caractérisée en ce que** ledit premier organe d'entraînement (4) comprend au moins une courroie (7) reposant en partie sur ledit second organe (5) de sorte que ledit second organe (5) se met en contact avec la courroie (7) en correspondance de ladite zone de proximité (Z) maximale et la maintient en tension.

3. Machine de texturation selon la revendication 1 ou

2, **caractérisée en ce que** ledit premier organe d'entraînement (4) comprend au moins une paire de rouleaux (6) et une courroie (7) enroulée autour desdits rouleaux (6) mobile le long de ladite direction de progression (A) ; ladite courroie (7), au moins en correspondance de ladite zone de proximité (Z) maximale, ayant une forme concave définissant au moins en partie ladite déviation (D) du conduit (2).

4. Machine de texturation selon la revendication 2 ou 3, **caractérisée en ce que** ledit second organe d'entraînement (5) comprend au moins un tambour (8) autour duquel, en correspondance de ladite zone de proximité (Z) maximale, ladite courroie (7) est partiellement enroulée.

5. Machine de texturation selon la revendication 4, **caractérisée en ce que** ladite courroie (7) comporte une partie de fonctionnement (7a) et une partie de rappel (7b), dans laquelle la partie de fonctionnement (7a) a une forme concave pour définir ladite déviation (D) et la partie de rappel (7b) a une forme convexe.

6. Machine de texturation selon la revendication 4 ou 5, **caractérisée en ce que** ledit tambour (8) est partiellement interposé entre lesdits rouleaux (6) du premier organe d'entraînement (4) de sorte qu'une partie de fonctionnement (7a) de la courroie (7) apparaît enroulée autour et étirée sur ledit tambour (8).

7. Machine de texturation selon l'une quelconque des revendications de 4 à 6, **caractérisée en ce qu'une** ligne (L), reliant les centres de rotation des rouleaux (6) du premier organe d'entraînement (4), est placée à une distance d'un centre de rotation du tambour (8) qui est inférieure à la somme des diamètres dudit tambour (8) et d'un desdits rouleaux (6).

8. Machine de texturation selon l'une quelconque des revendications de 4 à 7, **caractérisée en ce que**, dans une configuration de fonctionnement, ladite zone de proximité (Z) maximale se prolonge sous forme incurvée entre une zone d'admission (Z_{in}) et une zone de sortie (Z_{out}), chacune définie entre la périphérie du tambour (8) et la périphérie d'un rouleau (6) respectif du premier organe d'entraînement (4).

9. Machine de texturation selon la revendication 8, **caractérisée en ce que** dans ladite zone d'admission (Z_{in}) et ladite zone de sortie (Z_{out}), la périphérie du tambour (8) est placée à une distance inférieure à 1 mm du rouleau (6) respectif, de préférence inférieur à 0,5 mm.

10. Machine de texturation selon l'une quelconque des revendications de 2 à 9, **caractérisée en ce que** le premier organe d'entraînement (4) comprend des

moyens de soufflage (9) placés à l'intérieur de ladite courroie (7) et configurés pour qu'elle adhère en permanence au tambour (8) et reste en tension pendant le fonctionnement.

11. Machine de texturation selon l'une quelconque des revendications de 2 à 10, **caractérisée en ce que** le premier organe d'entraînement (4) comprend un corps de butée (15) distal du second organe d'entraînement (5) par rapport à la courroie (7) et placé à une distance prédéterminée de ladite courroie (7) pour limiter son mouvement d'éloignement du second organe (5). 5 10
12. Machine de texturation selon la revendication 11, **caractérisée en ce que** ledit corps de butée (15) est défini par un sabot (15a) constitué d'un matériau anti-friction. 15
13. Machine de texturation selon l'une quelconque des revendications de 2 à 12, **caractérisée en ce que** ladite courroie (7) est en métal, de préférence en acier inoxydable et d'une épaisseur inférieure à 1 mm, de préférence inférieure à 0,5 mm. 20 25
14. Machine de texturation selon l'une quelconque des revendications précédentes, **caractérisée en ce que** ledit premier (4) et/ou ledit second organe d'entraînement (5) sont mobiles en se rapprochant ou en s'éloignent l'un de l'autre entre une position éloignée de repos et une position rapprochée de fonctionnement. 30
15. Machine de texturation selon l'une quelconque des revendications précédentes, **caractérisée en ce que** ladite chambre de texturation (10) comprend une partie d'entrée (10a) située en correspondance d'une zone de sortie de l'unité d'entraînement (3) et une partie de fonctionnement configurée pour déterminer ladite déformation de charge de pointe des fibres ; ladite machine comprenant aussi au moins une buse de soufflage (12) interposée entre ladite zone de sortie (Z_{out}) et ladite partie d'entrée (10a) et configurée pour guider le faisceau (F) de matériau fibreux à l'intérieur de ladite partie d'entrée (10a). 35 40 45
16. Machine de texturation selon la revendication 15, **caractérisée en ce que** ladite buse (12) est associée à des moyens de génération de vapeur (13) et configurée pour fournir de la vapeur sous pression, ou à un compresseur pour distribuer de l'air chauffé ou à un circuit de distribution d'eau chaude sous pression. 50
17. Machine de texturation selon l'une quelconque des revendications précédentes, **caractérisée en ce que** ladite chambre de texturation (10) comprend une partie d'entrée (10a) placée en correspondance 55

d'une zone de sortie de l'unité d'entraînement (3) et une partie de fonctionnement (10b) configurée pour déterminer ladite déformation de charge de pointe des fibres ; ladite partie de fonctionnement (10b) comprenant au moins une paire de cloisons (14) se faisant face et mobiles en se rapprochant ou en s'éloignant l'une de l'autre entre une position active, dans laquelle elles sont proximales, et une position inactive, dans laquelle elles sont distales.

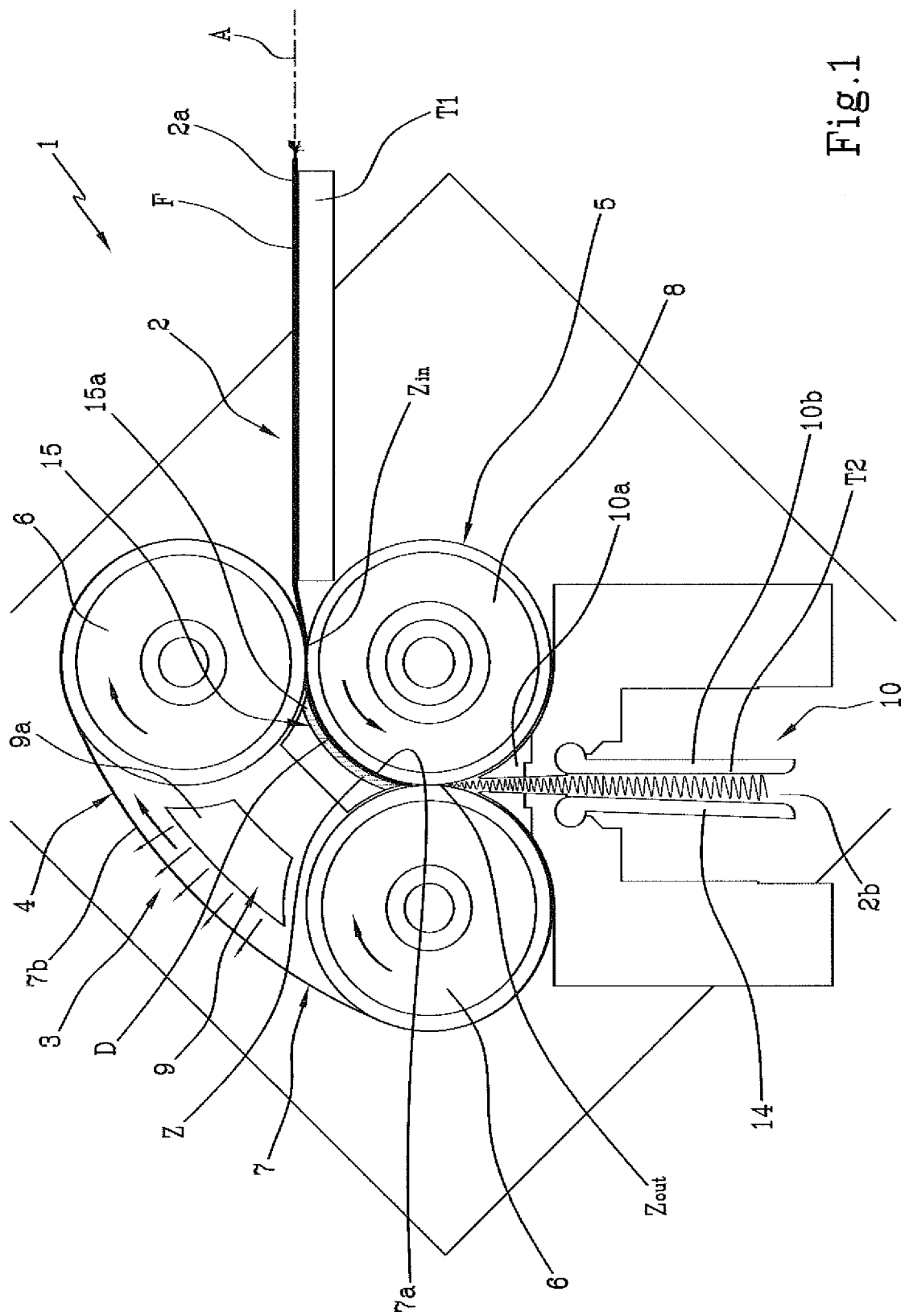


Fig.1

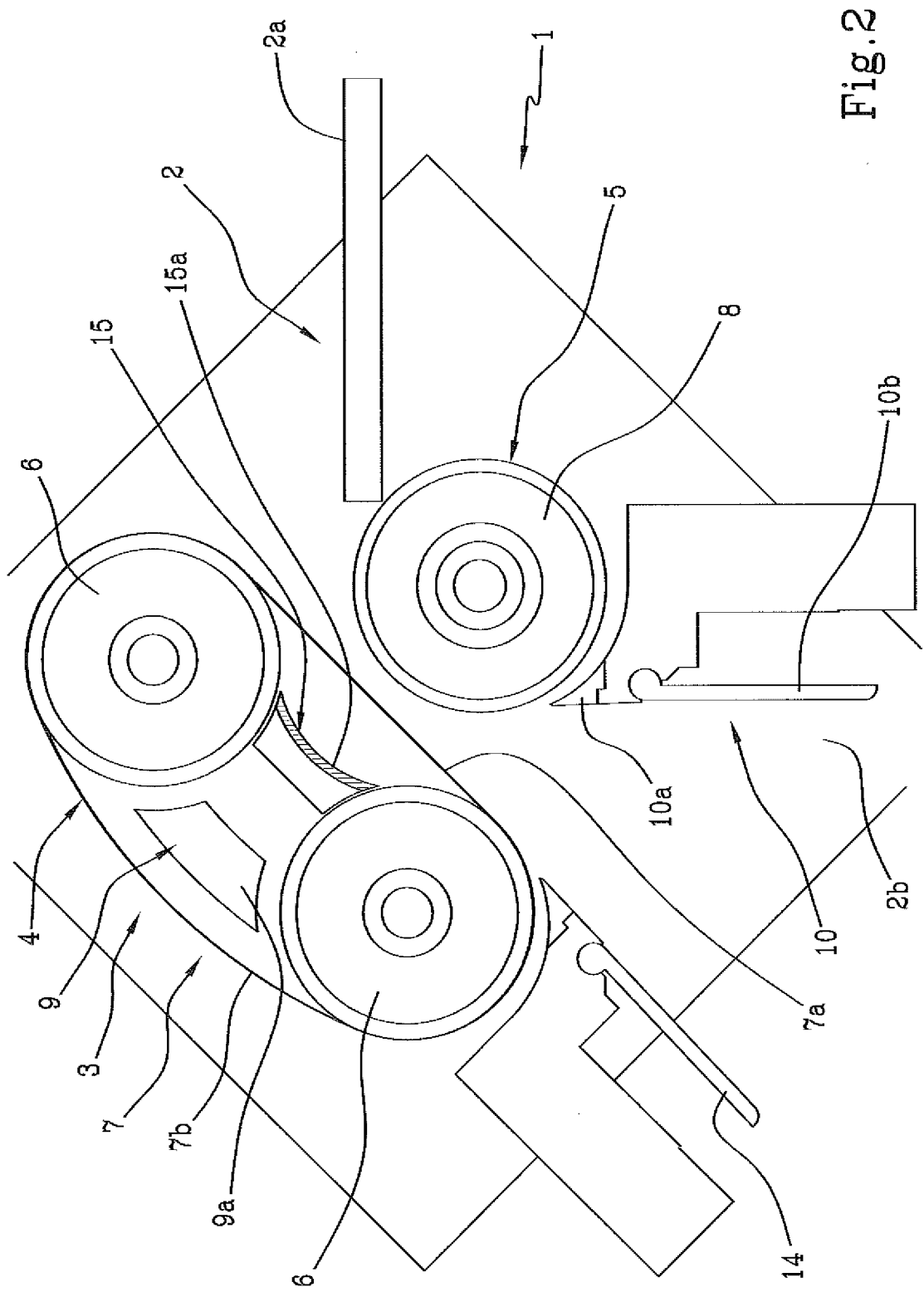
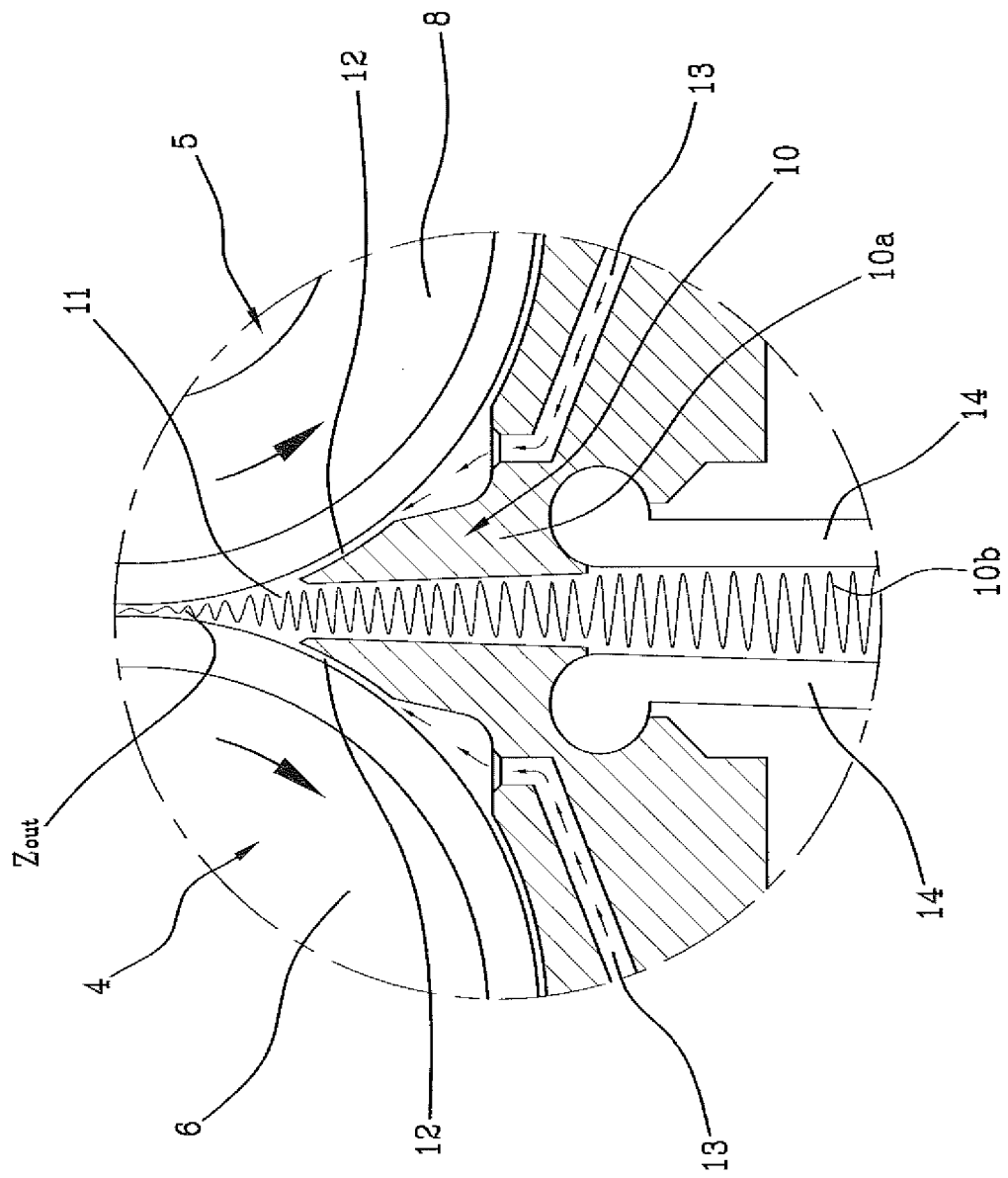


Fig.2

Fig.3



REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- US 3766726 A [0010]
- US 5564174 A [0016]